AN EXPLORATORY STUDY OF THE FIVE-FACTOR PERSONALITY TRAITS MODEL AS PREDICTORS AMONG WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS FIELDS AT INDIANA STATE UNIVERSITY

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ABSTRACT

The purpose of this study is to identify any trends in personality traits of students at a mid-western university along with the influence of gender, choice of STEM or non-STEM academic major, and level of education on personality traits. The chosen mid-western university is Indiana State University (ISU) located in Terre Haute, Indiana. This study investigated the personality traits of student's through administering Goldberg's (1999) International Personality Item Pool of the Big Five Broad Domains of Personality. The personality profiles of students at ISU who have taken the questionnare are summarized. The personality profiles of female students were analyzed further with special focus to identify the role of level of education and choice of major among female students. Based on the responses of the study's subjects, there are significant relationships found between gender and all of the big five personality traits. Level of education, graduate or undergraduate, had significant impact on extraversion, agreeability, concientiousness, and emotional stability. Choice of STEM and non-STEM major impacted emotional stability for subjects in general but its influence is not significant among female subjects. Choice of STEM or non-STEM major had a significant influence on the intelligence/imagination trait for both male and female subjects. Level of education did not have any significant influence on intellegence/imagination. Overall, this study found a few significant relationships between Big-Five personality traits and identified categorizations.

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CHAPTER 1

INTRODUCTION

Today we live in a world that is interconnected through information and is in a continuous state of change. The United States has been one of the world's leading economies for many decades and strives to stay ahead by rapidly advancing its industries, new technologies, military, and education (Gwynne, 2011). However, in the present decade, there is evidence that the United States is losing its lead in technology and innovation (Etter, 2011). According to Etter (2011), this decline in technological advancement and innovation directly impacts the United States' global ranking. Wei and Chan (2014) from Bloomberg's research team measured innovation by seven factors, including research and development intensity, productivity, high-tech density, researcher concentration, manufacturing capability, tertiary efficiency, and patent activity in 2014, and found that the United States stands third next to South Korea and Sweden (Bloomberg, 2014; Wei & Chan, 2014).

Cady and Terrell (2008) found that an increasing number of patents are being awarded to non-American companies. In 2009, more than half of the patents awarded by the U.S. Patent Office went to non-American companies; only four of the top 10 patent recipients were U.S. corporations (Gwynne, 2011). By each passing year, it is observed that an increasing number of students from India, China, and other countries have chosen to pursue engineering through the U.S. educational system (Etter, 2011). This student population is significant because the same

students garner knowledge and training, but may not contribute to the future of the U.S. work force (Etter, 2011). Etter (2011) through his analysis indicated that the United States might be losing its technical edge, which could result in negative implications for the country's progress. As a result of fewer students pursuing engineering, sciences, and mathematics, the U.S. workforce is also facing a similar situation. "Technological fields, like engineering, are in desperate need of more qualified workers, yet not enough students are pursuing studies in science, technology, engineering, or mathematics (STEM) that would prepare them for technical careers" (Rockland et al., 2010, p. 53).

During February 2005, at their joint annual meeting, the councils of the National Academy of Sciences and the National Academy of Engineering discussed and examined the position of the United States in today's environment of global competition (Gwynne, 2011). These councils expressed their concerns that the weakening of science and technology in the United States would inevitably degrade the country's social and economic conditions (Gwynne, 2011). The urgency to address this concern was supported by the Institution of Medicine and by Policy and Global Affairs (National Academy of Science, 2005). As a result, the experts at the National Academy of Science generated a strong report with recommendations to reverse the possibility of losing to global competition in the areas of technology and innovation (National Science Board, 2010).

In response, the National Academy of Sciences and the National Academy of Engineering together initiated a study—using their own funds—to evaluate, analyze, and suggest a course of action with an intention to bolster the United States' competitiveness and pre-eminence in STEM areas so that the nation may consistently gain from the opportunities offered by rapid globalization (National Academy of Science, 2005). In pursuit of this interest in STEM,

the Committee on Science, Engineering, and Public Policy established the Committee on Prospering in the Global Economy of 21st Century: An Agenda for American Science and Technology with 20 subject matter experts. These 20 experts, chosen from national committees and organizations, included university presidents, CEOs, Nobel Prize winners, and former U.S. presidential appointees (National Academy of Science, 2005). The experts made four major recommendations along with suggesting 20 implementation actions that federal policymakers should create high-quality jobs and focus new science and technology efforts on meeting the U.S. workforce's contemporary needs (Augustine, 2005). The four recommendations were

1. To increase U.S.'s talent pool by vastly improving K-12 mathematics and science education;
2. To sustain and strengthen the nation's commitment to long-term basic research;
3. To develop, recruit, and retain top students, scientists and engineers from both the United States and abroad; and
4. To ensure that the United States is the premier place in the world for innovation (Augustine, 2005).

It was predicted by the U.S. Department of Labor that 90% of the fastest growing occupations that require bachelor's degrees or above will require significant scientific and mathematical training (as cited by National Science Board, 2010). The U.S. Department of Labor also predicted that science, engineering, and computer related occupations would grow substantially faster than the average rate of all occupations (as cited by National Science Board, 2010).

At a time when the nation is addressing the need and importance of STEM fields so aggressively, it is observed that there is substantial gender disparity in students pursuing these

fields. Cady and Terrell (2008) found clear evidence that there is gender inequity among computer professionals and stated, “The lack of women currently working in the field of computer science is problematic” (Cady & Terrell, 2008, p. 284). Not only in the computer field, but also as per the occupational employment projections, women currently hold one quarter or fewer positions in science, engineering, and computer related fields put together (Lacey & Wright, 2009).

It is possible to assume that the reason may be due to the lower number of female students in universities or even that females may be performing less proficiently than their male counterparts during school. But investigations into the assumption of lower enrollment of female students revealed some very interesting facts. Mathematics and sciences are the foundational subjects in school for entering into STEM fields. Though historically boys have outperformed girls in mathematics, in the past few decades this gender gap has narrowed and today girls are performing just as well as boys (Hyde, Lindberg, Linn, Ellis, & Williams, 2008). When considering mathematics and sciences together, girls seem to be earning slightly higher grades than boys in high school (National Center for Education Statistics, 2007). As such, the conclusion is that the gender disparity based on performance in sciences and mathematics in schools is not as evident in recent years as it was a decade ago.

As freshmen, there are more women entering college than men (Hill, Corbett , & St. Rose, 2010). However, many women turn away from STEM fields when they enter college. Only 15% of all female freshmen planned to major in STEM fields, while 29% of male freshman planned to major in STEM fields in 2006 (National Center of Educational Statistics, 2007). Hill, Corbett and St. Rose (2010) mentioned that the American Association of University Women (AAUW) was selected by the National Science Foundation to investigate the under-

representation of women in science, technology, engineering, and mathematics. As a result AAUW's report *Why So Few* focused on practical ways families, schools, and communities can create an environment of encouragement that can disrupt negative stereotypes about the capacity of women in the demanding fields of science, technology, engineering, and mathematics (Hill, Corbett, & St. Rose, 2010).

Statement of the Problem

According to the 2010 U.S. Census, women account for a little over 50% of the U.S population, with a birth ratio of 96.7%, which implies that for every 100 girls there are 97 boys born (Howden & Meyer, 2011). Evidently, women comprise a significant portion of the population and their numbers should not be ignored in terms of the country's overall progress. According to a 2007 survey of United States freshman, the majority of college freshmen are women (Hill et al., 2010). But at the same time women who choose STEM majors encompass less than 15.1% of the population (Hill et al., 2010). Based on this information, it can be implied that if women choose STEM majors proportionately, the nation's STEM workforce could increase substantially, generating gender balance and an overall growth in STEM fields. Science, technology, engineering, or mathematics positions tend to support higher income levels due to the specialization and advanced skills associated with them.

> Controlling for a variety of pre-college characteristics, results show sizable earnings advantages for majoring in a STEM field, as well as for majoring in biological sciences and professional fields. Students of these fields reported earnings from 26% to almost 40% more than their counterparts who concentrated their studies in humanities or education. (Melguizo & Wolniak, 2012, p. 400)

Hence, enlarging the STEM workforce can substantially demonstrate its impact on the country's economy.

Success in STEM fields today has become a concern, as it not only affects the economy, but also the progress of the nation as a whole. In today's technological world it is necessary to have successful STEM graduates who continue in these fields beyond high school graduation. "Implementation of successful models should lead to a future workforce that is more technologically literate, and that ultimately includes more engineers to meet the challenges of the coming years" (Rockland et al., 2010, p. 61). However it appears that women do not comprise a significant portion of that workforce. Students who are male and/or non-minority in STEM majors are about 74.6% more likely to graduate when compared to under-represented (female and/or minority) STEM students according to a study done by Whalen and Shelley on full time freshman in the fall of 2000 at a Midwestern Research University (Whalen & Shelley, 2010, p. 52). In his research Baker (2011) posited that female scientists continue to face greater barriers to success than their male counterparts, particularly because of issues related to childcare, work-life balance, and gender bias (p. 88). He continued that these STEM pressures are not only at the academic level, but are also seen among well-settled professionals in STEM areas. Even women with professional STEM degrees face difficulties persisting in STEM careers (Baker, 2011).

Research suggests that personality traits are enduring and remain largely constant across a person's lifetime (Myers & Myers, 2010; Vernon, 1966). More recent studies offered that personality traits could change in adulthood or old age depending on the life and social events for each individual (Robert, Walton, & Viechtbauer, 2006; Specht, Egloff, & Schmukle, 2011).

Studying the personality characteristics of women in STEM fields could provide information that might assist students in choosing their STEM major according to their

psychological characteristics. It could also help to build personality profiles, which could assist undecided students in choosing a STEM major and could assist decided ones in considering the value of their choice. Such a practice may increase the likelihood of successful student outcomes and eventually address the gender imbalance.

Purpose of the Study

The main intension of this study was to examine the personality types of students at Indiana State University. This study intends also to work from the notion that personality type is malleable (Robert et al., 2006; Specht et al., 2011), which is different from other studies where personality type is conceived as fixed. The Goldberg International Personality Item Pool (IPIP) of the five-factor model (FFM) of personality (Goldberg, 1999) was used to assess personality profiles. Students were categorized with respect to (a) STEM/non-STEM field, (b) gender, and (c) level of education (undergraduate and graduate). Investigations into the commonalities and/or differences among personality traits were to be observed based on the above criteria. According to this goal, the research objective was articulated into the following research questions.

Research Questions

Based on the research objective, this study addressed the following research questions:

1. What are the levels of personality traits among the students of Indiana State University?
2. What are the levels of personality traits among female students of Indiana State University?
3. Is there any influence of gender, academic majors (STEM or Non-STEM), and level of education (graduate and undergraduate) on personality traits?

   H_{01}: Gender will have no significant influence on the Big Five personality traits

   H_{02}: Choice of major (STEM or Non-STEM) will have no significant influence on the Big Five personality traits.

H_{03}: Level of education will have no significant influence on the Big Five personality traits.

4. Is there any influence of academic majors (STEM or Non-STEM) and level of education (graduate and undergraduate) on personality traits of female students at Indiana State University?

H_{01}: Choice of major (STEM or Non-STEM) will have no significant influence on the Big Five personality traits among female students at ISU.

H_{02}: Level of education will have no significant influence on the Big Five personality traits among female students at ISU

Significance of Study

This study provided information on students at Indiana State University by examining the personality traits and their relationship between: (a) STEM and non-STEM majors; (b) gender; (c) level of education (graduate/undergraduate); and in comparison between women and the total population at each level. Information on the influence of gender, STEM/non-STEM majors, and within levels of education can help to build personality profiles of students in each of the fields, if they exist. This revelation could provide several benefits for (a) young women entering college when making appropriate choices (b) universities in retention of women in STEM fields and (c) faculty who act as advisors in providing direction to the students based on the personality profiles.

Students might become more aware of their personality profile and possible associations with the field's successful profiles. Knowing one's personality profiles may help in making decisions when considering the value of one's career choice. Learning about their personality profile may lead students to identify and develop their strategic strengths and work on their

weaknesses as they correlate to personality traits identified in the fields of choice. Faculty in STEM fields might be able to utilize students' profiles to appropriately consult with the student on a choice of major and promote coping strategies that lead to ultimate academic success in their field of study (Lounsbury, Smith, Levy, Leong, & Gibson, 2009).

Assumptions

This study used a survey to gather data from all the students during one semester at Indiana State University. Student gender, level of education, and field of major allowed the researcher to categorize students for this survey. The survey was distributed to all students online and they were presumed to complete the survey in the allotted amount of time after reading the survey instructions. This survey was administered under the assumptions listed:

1. The participants thoroughly read and understood the directions of the questionnaires.
2. The particpants responded to the questionnaires honestly, accurately, and without influence or intension of defrauding the survey.
3. The students took the survey themselves and not delegate the task to their subordinates/confederates.
4. The IPIP measured the personality traits of the respondents accurately.

Limitations of the Study

This study was conducted with students at a single institution, not at multiple institutions. The survey was sent to all the students and was not mandatory. Hence the participants came from a limited pool of students and their participation was voluntary. The respondent pool is a reflection of Indiana State University's demographics, at least as those are related to the students who actually completed the survey, and consequently; the research results cannot be generalized to the entire population of students in the United States or the female profile of personality

characteristics. The data collected will not be used as representative data for STEM female personality characteristics at large, but surely may serve as a baseline for comparisons and could be generalized for peer institutions of similar demographics.

The five-point Likert-scale questionnaire for the IPIP was a self-reported survey. As a result, the survey results depended on the participants' perceptions of self and willingness to complete the survey with honesty. As this study was implemented based on a quantitative approach, there were no open-ended questions or interviews to capture any detailed descriptive information.

Delimitations

This survey was administered to students at only one institution—Indiana State University. It has only focused on (a) the influence of gender, (b) academic majors (STEM/non-STEM majors), and (c) level of education (undergraduate/advanced) on the Big Five personality traits.

Definition of Terms

Five factor model of personality (FFM): Costa and McCrae's (1992) five factor model of personality is composed of the traits of extraversion, neuroticism, conscientiousness, agreeability, and openness.

International Personality Item Pool (IPIP): This set of items includes three major types of information: (a) some psychometric characteristics of the current set of IPIP scales, which are continuously being supplemented by new scales; (b) keys for scoring the current set of scales; and (c) the current total set of IPIP items, which is continuously being supplemented with new items (Goldberg et al., 2006). For the purpose of this study, the Big Five broad domain short

form will be used. Throughout this research, IPIP was used to describe the IPIP Big Five broad domain short form instrument.

Science, technology, engineering and mathematics (STEM): These streams of study were identified as the most intellectual and demanding in moving the world into the future. Although once a pioneer for advancement in the world, the United States somehow stalled in its technological advances and leadership (Etter, 2011). This gave way for countries like Japan and India to take the lead (Etter, 2011). Economists and politicians, after thorough brain storming, identified that lack of proper technology will eventually eradicate all the progress made if the stalling is not addressed adequately and immediately. This informed assumption has given birth to the idea of identifying those fields of study that accommodate the technological workforce of a nation. Educators have determined that science and mathematics are the foundational subjects through which technology and engineering are built and sustained (Augustine, 1997).

Chapter Summary

The United States has been one of the forerunners in the global race of innovation and technological advancement. It is observed that the country has been losing its lead slowly and steadily. There is evidence that this downfall is caused due to lack of focus on STEM fields. The National Academy of Science along with other affiliations have come forward to put a plan into place to effectively address the issue and bring the country in pace with or ahead of the rest of the world technologically. Furthermore, it was found that there is a substantial gender disparity in STEM fields at universities and in career levels. The AAUW was selected by the National Academy of Science to investigate and address the gender disparity in STEM fields. AAUW in their *Why So Few* report (Hill et al., 2010) made recommendations to address the identified gender issue among STEM professionals.

Though there are more women entering college than men in United States, women do not choose STEM fields as extensively as men. There are numerous reasons for these choices. Sustaining female STEM professionals in their respective fields is important for addressing the gender disparity. To achieve this, understanding the personality traits of STEM professionals and that of female STEM professionals in particular could give a comprehensive picture. Evidence that personality traits once formed, endure through a lifetime, which may provide insights that contribute to recruitment and retention of women in STEM fields if logically applied to counseling and educational efforts.

This study looked into the personality types of students at Indiana State University to understand and identify any commonalities or differences among students in STEM and non-STEM fields, by gender and also by the level of education. Research questions were formulated based on this objective. As the study is restricted to one university and has reported based on the responses recorded only, it has its limitations. This study could be extremely useful to understand the personality profiles of a segment of ISU's students by their STEM affiliation, gender, and level of education. This in turn could help in retention, motivation, and successful completion of ISU students' academic commitments.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this study was to examine the personality traits of students in STEM fields and understand the influence of gender, level of education, and academic majors on personality traits as identified by the Big Five personality traits. This chapter presents a literature review on STEM origin and development, the Big Five personality traits and their implications, and the IPIP instrument and the rationale of its use for this study. The sections on STEM evolution and its importance focus on investigating the history of STEM, the issues involving the STEM idea, and how STEM developed over time. The sections on Women and STEM attempt to provide a holistic picture about women in STEM careers and their issues in the past and present. Finally, the section on the Big Five personality traits and IPIP delve into investigating the details about Big Five history, its classification, the instruments used to measure the Big Five traits, and the details about the IPIP itself. This research would be relevant to all who have interest in exploring and explaining the scope of personality traits on STEM careers, as well as the influence of gender, level of education, and academic majors in the STEM fields.

Evolution of STEM

Students report that science and mathematics are the subjects they find difficulty with and assume to be the most advanced of the subjects taught (Augustine, 1997). Science and mathematics held significant importance even before they were recognized as the soul for

technology and engineering. When the United States began to lose its competitive edge to Japan, China, and India in the field of technology, a concern over the United States' ability to maintain its position in the global economy began to surface. In fact, today's interest in STEM education comes from this concern. Three prominent U.S. scientific groups—the National Academy of Science, the National Academy of Engineering, and the Institute of Medicine—jointly issued a report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, which called for strengthening the STEM pipeline from primary through post-secondary U.S. education (National Academy of Science, 2005).

The inevitability of the use of technology in routine work and its integration in our day-to-day life makes technology awareness more of a need than a choice. Technology dependence renders people and nations handicapped as the world progresses at a faster pace than can be imagined due to technological innovation. "Technological fields like engineering are in desperate need of more qualified workers, yet not enough students are pursuing studies in science, technology, engineering, or mathematics (STEM) that would prepare them for technical careers" (Rockland et al., 2010, p. 54). Rockland et al. (2010) opined that most K-12 teachers lack the training to integrate relevant STEM topics into their classroom teaching and curriculum materials. They strongly insisted on introducing the best practices to integrate engineering into mathematics and science curriculum in secondary school classrooms. A blend of various STEM disciplines and innovative teaching in these areas should spur interest and enthusiasm among students for these fields, and provide them an opportunity to explore the possibilities they may have in these fields.

The origin of STEM has roots in the 1990s at the National Science Foundation. Since that time, STEM has been used as a generic label for any event, policy, program, or practice that

involves one or more of the STEM disciplines. Bybee (2010a) clearly defined STEM and identified what STEM could mean for contemporary education in an article he wrote for a journal called *Technology and Engineering Teacher*. He listed the following five major presumptions that contemporary education has on STEM education:

1. It may mean recognition that science education has been diminished during the No Child Left Behind era, which is ending.
2. Based on the assumption that STEM is often a term for science or mathematics, STEM should mean increased emphasis of technology in school programs.
3. STEM could mean increasing the recognition of engineering in K-12 education.
4. All STEM disciplines present opportunities for stressing 21st century skills.
5. STEM could mean an integrated curricular approach to studying grand challenges of our era.

Bybee (2010b) emphasized the importance of recognizing the value of STEM and insisted on taking it beyond a hollow slogan. “Now is the time to move beyond the slogan and make STEM literacy for all students an educational priority” (Bybee, 2010b, p. 33).

STEM Fields and Their Importance

With an increasing interest in STEM, the federal government seems to be more interested in encouraging students and schools that will strengthen the STEM backbone for the nation (Augustine, 1997). Specialized schools concentrating on science, mathematics, and technology are commonly presumed as the “crown jewels” in their school districts (Subotnik, Tai, Rickoff, & Almarode, 2009). The intention of these schools is to produce the best students and it is assumed these schools also draw the best teachers. They work with a purpose and strive to fulfill the same. There is not much evidence regarding the contributions of such schools, but in an

article by Subotnik et al. (2009), the authors report on variables shown to predict STEM career participation of adolescents in and out of these specialized high schools. In their research they found articles and resources that prove adolescents with interests and talents in mathematics and science to be more likely to pursue STEM fields in post-secondary environments when provided with challenging curricula, expert instruction, and peer stimulation in their secondary education experiences.

Many students enroll in these specialized schools, as they desire a challenging learning atmosphere with motivated classmates and teachers. A recent report, *Rising Above the Gathering Storm* made the claim that "an effective way to increase student achievement in science and mathematics is to provide an intensive learning experience for high performing students" (National Academy of Science, 2005, p. 14). In 1988, a consortium of 15 schools formed to exclusively address the importance of and focus on mathematics, science, and technology in U.S. education (Thomas & Williams, 2009). Over time 90 other schools joined these founding member schools in the National Consortium of Specialized Secondary Schools of Mathematics, Science, and Technology (NCSSSMST; Thomas & Williams, 2009). Clearly this expansion demonstrates the interest and urgency in addressing STEM development and advancement. When schools form at this pace, two pressing questions arise:

1. Are graduates from specialized STEM high schools more likely to enroll in STEM-related studies and career fields when compared with graduates from regular non-magnet, non-examination high schools with comparable academic and demographic backgrounds?
2. What were the school models employed by specialized STEM high schools that are most associated with entrance into STEM-related studies and career fields?

In response to these valid and pressing questions and to establish relevance to key reports such as *Rising Above the Gathering Storm* (National Academy of Science, 2005), President George W. Bush signed the America COMPETES Act into law on August 9, 2007 (Subotnik et al., 2009). The intent of this Act was to support additional initiatives that work to improve the nation's competitiveness, to include funding authorizations to states to seed additional specialized high schools (Subotnik et al., 2009). The America COMPETES Act focused on three critical areas to ensure United States' innovation in the 21st century (Thomas & Williams, 2009). Those three critical areas are increasing research investment; strengthening educational opportunities in science, technology, engineering, and mathematics from elementary through graduate school; and developing an innovation infrastructure (Thomas & Williams, 2009, p. 20).

Studies Related to STEM fields

STEM can be taught very early. Mrs. McGrew of Florida Elementary School started teaching her fourth graders STEM instruction to improve the overall performance (McGrew, 2012). After a review of current research on failing schools and poor curriculum, Mrs. McGrew wondered what her school could do to improve science, technology, engineering, and mathematics instruction at the elementary level. She began by piloting units for technological literacy and became interested in teaching engineering and technology at the elementary level. To begin, she was chosen to be one of six Invention, Innovation, and Inquiry (I3) curriculum specialists as a trainer throughout the nation. This project was funded in part by the National Science Foundation and NASA (McGrew, 2012). The cocoon of the regular classroom was comfortable, but Mrs. McGrew felt the urge to break free and make a difference. At that point the metamorphosis began.

There are other studies that investigated attitudes towards STEM subjects and how these can help if integrated into curricula. Many scholars claimed that the integration of STEM education through project-based learning (PjBL) is beneficial to national economy (Tseng, Chang, Lou, & Chen, 2013). One study in 2013 investigated 30 freshmen with engineering backgrounds from five institutes of technology in Taiwan. This study used survey questionnaires and semi-structured interview methods to examine student attitudes towards STEM before and after PjBL activity. The results of the survey showed that student attitudes towards STEM changed significantly (Tseng et al., 2013). They started to understand and recognize the importance of STEM in science and engineering disciplines. They explicitly mentioned in their interviews how STEM education and professional science knowledge can help their future career choices along with contributing to improve their lives, society, and the world by making it a more convenient and efficient place (Tseng et al., 2013).

The integration of STEM disciplines has been identified and is being implemented in some schools and colleges across the nation. However, the effects of integrative approaches among STEM subjects have not been researched well. A study conducted by Becker and Park (2011) analyzed the findings from previous research on the effects of integrative approaches among STEM subjects on students' learning. They selected 28 studies to conduct their meta-analysis and calculated 33 effect sizes to examine the effects of integrative approaches among STEM subjects. Barcelona (2014), while studying Becker and Park's research, mentioned,

> The effects of integrative approaches with respect to the grade levels showed the largest effect size at the elementary school level and the smallest effect size at the college level. Regarding the types of integration, STEM, the integration of four subjects, presented the largest effect size, and E-M and M-S-T showed the smallest effect size. In addition, concerning the achievement through integrative approaches, STEM achievement showed

> the highest effect size and mathematics achievement showed the smallest effect size. (p. 868)

The results from Becker and Parks's preliminary meta-analysis revealed that the integrative approaches among their STEM subjects had positive effects on those students learning in general (Becker & Park, 2011). They concluded by suggesting further empirical research on the effects of STEM education needs to be conducted to confirm the findings of their preliminary meta-analysis.

Scott (2012) examined the characteristics of 10 different STEM-focused high schools from various parts of United States. These 10 schools were considered somewhat representative of many such schools, some currently operational and others in planning phases, which have been designed to better prepare students for careers in STEM fields, Scott gathered extensive data from websites, national statistics databases, standardized test scores, interviews, and published articles for analysis and documentation in his report. He then used a comparative case design to identify key components of STEM high school designs. His analysis and subsequent results indicated that students from STEM-focused high schools were outperforming their peers at similar institutions, also were engaged in real-world problem solving, and completed internships and/or a capstone projects to fulfill graduation requirements. Most STEM-focused schools used a lottery-based admission process while two out of the 10 that Scott investigated admitted all the applicants on a first come-first serve basis. Another observation is that the STEM focused schools had a higher number of minority students compared to other schools in the United States. These findings are important as the admissions indicate that, given the opportunity and support, many are able to successfully complete rigorous STEM academic programs that are far advanced in comparison with basic graduation requirements.

Another major concern today is about retention of students in STEM fields. A recent study by Watkins and Majur (2013) compared the percentages of students who switch out of a STEM major after taking a physics course taught using traditional lectures only or one taught using Peer Instruction at a highly selective research institution. They found that nearly twice the percentage of students switched out of STEM fields after a lecture-based course. After conducting a thorough literature review on retention, they concluded that providing opportunities for students to think, respond, and interact in class might have substantial impact on retention of students in STEM disciplines (Watkins & Majur, 2013).

To address continually decreasing enrollment and rising attrition in post-secondary STEM degree programs, particularly for women, there was a study conducted by Simon, Aulls, Dedic, Hubbard, and Hall (2015). This study examined the utility of motivation and emotion variables to account for persistence and achievement in science among male and female students transitioning from high school to junior college. The structural equation modelling based on data from 1309 students from four English language *Collège d'enseignement général et professionnel,* also known as CEGEPs, showed students' achievement goals, self-efficacy, and perceived autonomy support to impact intrinsic motivation, emotions, and achievement that, in turn predicted persistence in the science domain (Simon et al., 2015). These findings were consistent with Deci and Ryan's (2011) self-determination theory and Senko, Hullerman, and Harackiewicz's (2011) achievement goal theory.

Under-representation of Women in STEM Fields

Attempts have been made to understand why there is under-representation of women in STEM fields. Studies indicate that women's enrollment into STEM majors have been alarmingly low and needs to be addressed as early as possible (Pitt, 2009). It is also noted that these dis-proportionality issues have been increasing. Though women are attending college at unprecedented rates and usually constitute more than near to half of the college population, they still are under-represented in STEM fields irrespective of their overall enrollment statistics (Planty, Hussar, & Snyder, 2009). Among the studies that tried to explain this gender gap, Morganson, Jones, and Major (2010) tried to address the role of social coping among these gender disparities. The researchers stated that "women undergraduates reported using significantly more social coping than did men" (Morganson et al., 2010, p 172) This study performed a multiple regression analysis, which revealed social coping to be a stronger predictor of commitment to a chosen major for women than for men. This study also concluded that women benefit more from social coping.

Among studies that examine how high school courses affect a student's career choices, one of the most compelling studies is one conducted by Tyson, Lee, Borman, and Hanson (2007). Their study showed that although women are competitive with their male counterparts in all aspects of STEM, their involvement and interest in STEM fields has been substantially lower than those of men. Their career choices seem to be unaffected by their high school courses and school influence in some cases (Tyson et al., 2007). So what attracts women towards STEM careers? This is the next immediate question that transcends the STEM gender inequity phenomenon. Extensive studies indicate that there are many reasons for this situation. Along with investigating the reasons behind this disparity, it is also important to know how to address this problem.

Meadows (2016) articulated that women's participation in STEM courses and careers lags behind in comparison to men's. Her academic research pointed out three areas, which account for the under representation of girls in STEM: social and environmental factors, the school climate, and the influence of bias. In order to engage and retain girls in STEM, her suggestion is for educators to eliminate bias in classrooms, change school culture, introduce female role models, help girls access their abilities accurately, and develop talent in areas related to science, technology, engineering, and mathematics (Meadows, 2016). Meadows also insisted that educators should encourage girls to ask questions about the world, to problem solve, and to develop creativity through play and experimentation.

Studies Related to Women and STEM

Gender disparity exists among the reasons why both men and women find interest in STEM fields. The motivational factors for men and women differ at various levels, which affects career choices too. Men tend to have a different self-concept regarding their interest for a field of study than women. There are studies that explore what would inspire women towards STEM studies and what would improve self-efficacy among women in STEM careers (Stout, Dasgupta, Hunsinger, & McManus, 2011). Detailed study about what makes women choose technological fields or science and mathematics majors has been conducted at different times. For instance, three studies testing a stereotype-inoculation model proposed that contact with same-sex experts (advanced peers, professionals, professors, etc.) in academic environments involving STEM enhances the female self-concept in STEM, attitudes towards STEM, and motivation to pursue STEM careers. (Stout et al., 2011)

Students with strong mathematics and science foundations during their middle and high school experiences demonstrated much better accomplishments in STEM careers after

graduation (Burrelli, Arena, Fort, & Shettle, 1996). Several studies provide evidence in support of high school achievements as one of the factors for choosing STEM majors in college, one of which is a 25-year longitudinal study by Wai, Lubinski, Benbow, and Steiger (2010). These researchers conducted a longitudinal study of students who have mathematics scores of more than 500 on the Scholastic Aptitude Test (SAT) and observed their career trends over a period of 25 years. Many of them who have scores towards the higher end of the SAT demonstrated success in STEM fields but evidently there was no substantial gender inequity. Their study showed similar results for both men and women. But the number of girls and boys who have SAT scores above 500 did vary initially, which explains the results (Wai et al., 2010). Wai, along with his team, also concluded that the more students gain STEM educational exposure during their school years, the higher the tendency is for students to choose STEM careers in post-secondary education. In summary, efforts to strengthen and develop female personnel in STEM have started, and increased support in the form of scientific research would aid this attempt to balance the contributions between the genders. The National Science Foundation and federal government continue to examine studies that will help strengthen the nation and STEM education.

There are studies that investigated the persistence of interest in one or more of STEM categories from school to college. Boschor and his peers performed a longitudinal mixed methods study to gain understanding of whether female academic high school students who intended to study STEM actually enrolled in such studies two years later (Boschor, Berweger, Keck, & Kappler, 2014). They also investigated how women perceived the school to college transition retrospectively. Their results revealed a high persistence of students' intentions to pursue a career in STEM areas. Also, in comparison with students who entered the social

sciences or humanities, STEM students demonstrated higher competencies in mathematics and placed more importance on pursuing investigative qualities (Boschor et al., 2014). Their qualitative analysis revealed that learning experiences, parental support, and role models were decisive in terms of the female students' choice of majors in college.

There have been numerous studies that investigate female under-representation, female STEM involvements, and female self-efficacy, beliefs, etc. The following are some of the works that delve into the subject of women and STEM.

Zeldin, Britner, and Pajares (2008) attempted to explore the self-efficacy beliefs of men and women with careers in STEM. They further investigated how beliefs influenced academic and career choices. They conducted a qualitative research study by interviewing 15 women and 10 men in STEM careers. Most women consistently recalled experiences that involved an influential person, often during a critical time, which helped them develop their beliefs about their capabilities while they also developed their competencies. Analysis of 10 narratives revealed that mastery experience was the primary source of the men's self-efficacy beliefs. For women, social persuasions and vicarious experiences were the primary sources of self-efficacy beliefs. Zeldin et al. also concluded that their findings were consistent with the theoretical tenets of Bandura's social cognitive theory.

Social coping is another aspect where men and women differ. Morganson et al, (2010) attempted to address the under enrollment of women in STEM majors through social coping. Of 1,061 undergraduate students from two urban universities in the eastern United States who participated in their survey, 75.3% were men and the rest women. Morganson's team collected social coping data using the COPE scale created by Carver, Scheier, and Weintraub (1989). Their multiple regression analysis on the data collected revealed that social coping was a

stronger predictor of commitment to major for women than for men. Social coping negatively predicted female intent to turn over or withdraw from a major, but it was not so for men. Also, social coping negatively predicted academic course grades for men, but not for women. Thus, the researchers concluded that women benefit more from social coping than do men (Morganson et al., 2010).

There is gender inequity not only among students, but also among the STEM professorate (Walters & McNeely, 2010). In their study, Walters and McNeely (2010) attempted to characterize and delineate the relevance of Title IX to gender disparities in the STEM professoriate with an intent to identify areas for policy consideration and future application. They strongly pointed out the marginalization of women in STEM faculty positions, particularly in the areas of disparities in salary, laboratory space, resources, responses to job offers, and awards despite comparability with male colleagues in terms of professional qualifications and accomplishments. The researchers concluded and summarized that Title IX has been presented and interpreted as a legislative response for combating gender bias in academia, and accordingly, the current administration has cited enforcement of Title IX as one of the tools to address inequity and discrimination against girls and women in science, specifically referencing extant conditions.

Laura McCullough (2011), chairperson of the physics department at the University of Wisconsin–Stout examined the primary barriers to women's participation in STEM areas and leadership arenas. She mentioned that there is a distinct lack of research in the area of women's leadership in STEM fields (McCullough, 2011). This deficit is a major problem that is not currently understood and not being addressed. Thus, she concluded that it is difficult to say for

certain whether women in STEM fields on a leadership path have an easier time or harder time. McCullough concluded that the issues hindering

> women's participation in STEM areas have a large overlap with the issues hindering women's participation in leadership. Implicit biases and discrimination, family obligations, and the lack of role models and mentors are just a few of the problems facing society and the women trying to succeed in their chosen area. (McCullough, 2011, p. 8)

Her investigation and the limited data she collected suggested that there are more hurdles for female leaders in STEM areas than in other fields.

Personality and Personality Traits

The word *personality* is derived from *persona*, a Latin word which means an actor's character or mask or in a play. MacKinnon (1944) noted that the word personality in English has two meanings in German: *personlichkeit,* the impression a person gives off; and *personalitat,* the inner aspects of the self. Trait words describe reputations that reflect the degree of status and social acceptance a person enjoys in his or her community (Hogan, 1996). Allport (1937) defined personality as "the dynamic organization within the individual of those psychological systems that determine his unique adjustment to his environment" (p. 48). He suggested that personality plays a major role in the way people conduct themselves. As such, personality traits can predict how a person behaves in specific situations (Cattell, 1950). Moreover research suggests that these personality traits endure and remain largely stable across a person's lifetime (Vernon, 1966). These personality traits include physical, emotional, and behavioral features that can be examined across the people (Eysenck & Eysenck, 1985). Other researchers such as Phares and Chaplin (1997) mentioned that personality attributes such as individuality, stability, and consistency remain stable across a person's lifetime in similar situations.

Investigation into personality traits and their correlations to successful careers can help one to understand the issues surroundings gender imbalances in the STEM environment. There are studies indicating that there are certain personality traits that correlate to achieving success in college. In a study conducted by Serdar and Suleyman in 2009, academic success in terms of GPA was positively related with Openness to Experience and Conscientiousness, and negatively related with Neuroticism among the Big Five personality traits among candidates of physical education (as cited in Tok & Morali, 2009). Also, personality plays a crucial role in choice of major by an individual. A recent study showed that personality plays an important role in choosing a business major over other academic majors. Lounsbury et al. (2009) wanted to differentiate between two groups of undergraduate university students with regard to the Big Five personality factors: those enrolled in business majors (n = 347) and those enrolled in other majors (n = 2252). The results of their study revealed that business students are more emotionally stable, more extraverted, and more conscientious. However, they are less agreeable and less open to experience than students in other majors. A study by Lakhal et al., (2012) established that there is a relationship between behavioral traits as identified by the Big Five and in choice of major by undergraduate studies in business.

Hudson and Fraley (2015) conducted two 16-week intensive longitudinal randomized experiments to determine if people can change their personality traits over a period of time with intension. They have found that over the period of time, some people did change their trait-relevant daily behavior. The researchers concluded that people may be able to change their personality traits through volitional means (Hudson & Fraley, 2015). Also Specht et al. (2011), while studying a sample of 14,718 Germans, found that major life events and their socialization

effects could have an impact on personality traits, but these changes were more pronounced in young and old ages.

There have been many attempts and some established tools to examine and predict personality types. Some of the commonly used assessment tools include the Myers and Briggs Type Indicator (MBTI). This tool was developed by Katharine Cook Briggs and Isabel Briggs Myers based on three different inventories (Myers & Myers, 2010). The three inventories include

1. Carl Gustav Jung's typological theories of dichotomous pairs of cognitive functions: Extraversion vs. Introversion, Sensing vs. Introversion, Thinking vs. Feeling, and Judging vs. Perceiving (Myers & Myers, 1980; Phares, 1988);
2. Hans Jurgen Esyneck and Sybil B. G. Esyneck's personality questionnaire (EPQ), which was based on the three-factor model of personality: Extraversion, Psychoticism, and Neuroticism (Eysenck & Eysenck, 1975); and
3. Paul T. Costa, Jr and Robert R. McCrae's NEO Personality Inventory - Revised (NEO PI-R; Costa & McCrae, 1992).

Big Five and the Five-Factor Model of Personality

Spearman (1904) coined the general factor (*g*) of intelligence while researching a way to measure and record human intelligence levels in early 1904. Webb (1915) expanded on Spearman's factor *g* further and discovered a second factor indicated by characteristics such as tendency not to abandon tasks, perseverance in face of obstacles, and conscientiousness, which he interpreted as a function of individual will. He proposed the symbol *w* for the second factor, will (Digman, 1996). Later, Garnett (1919) identified a third factor, Cleverness, which was isolated from Webb's theory according to Garnett's analysis of Webb's correlations. Garnett's Cleverness factor (*c*) was indicated by general tendency to be cheerful, degree of sense of humor,

fondness for large social gatherings, and wideness of one's influence. Thus the cleverness was clearly Extraversion. Cattell (1933), after the analysis of temperament traits shed light on the fourth factor, denoted by terms such as Emotional-Unemotional, Balanced-Extreme, Objective-Subjective, and Frank-Secretive (Digman, 1996).

There were others like Guilfords and Thurstone who worked on personality factors in their research; the vectors of mind and personality factors—*specificities*, *error variance*, and *masculine ideal*; and their measurement, respectively (Guilford & Guilford, 1936; Thurstone, 1934). But these models were taking a different direction than Cattell's solution, which was closer to the contemporary Big Five model (Digman, 1996). By the mid-1940s, Cattell began an ambitious program of systematic research on personality traits based on the compendium of personality trait terms assembled by Allport and Odbert (1936) and Thurstone's (1947) *Multiple Factor Analysis*. After this review, research, and analysis, Cattell (1950) concluded and believed that "Only six—A, B, F, H, K, and M—are repeatedly confirmed" (p. 57). Meanwhile, Eysenck (1947) held steadily to a model of personality that stands in sharp contrast to Cattell (1950), Thurstone (1934), and Guilford and Guilford (1936). Eysenck (1950) continued to examine and understand the personality traits to expand and include any new traits that could be added. Eysenck (1953) proposed Extraversion and Neuroticism initially and subsequently added Psychoticism. These three were called the three "super factors" according to Eysenck.

Personality psychology has rediscovered the FFM in the 1980s. Costa and McCrae (1976) organized a research seminar at the Gerontology Research center at Baltimore. Goldberg (1992) sent the message to this research seminar about adding Agreeability and Conscientiousness to Costa and McCrae's three-factor view of personality (Costa & McCrae, 1976), which they agreed upon. This addition gave birth to the first inventory based on the Big

Five factors of personality—Neuroticism, Extraversion, Openness, Agreeability, and Conscientiousness (Costa & McCrae, 1985).

The FFM of personality is considered as the most comprehensive and most descriptive model of personality traits to date. It measures five domain scales and their six facet scales (Costa & McCrae, 1992):

1. Neuroticism–Emotional Stability: anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability;
2. Extraversion: warmth, gregariousness, assertiveness, activity, excitement-seeking, and positive emotions;
3. Openness–Intelligence/Intellect: fantasy, aesthetics, feelings, actions, ideas, and values;
4. Agreeability: trust, straightforwardness, altruism, compliance, modesty, and tender-mindedness; and
5. Conscientiousness: competence, order, dutifulness, achievement striving, self-discipline, and deliberation.

Personality Traits and Related Studies

There are many studies on how personality variables influence academic excellence, performance, student success, and life satisfaction. Smart, Elton, and Burnett (1970) investigated the personality traits affecting the level of achievement of 84 college students at the University of Kentucky using the five Omnibus Personality Inventory factor scores—Humanistic Orientation, General Well-Being, Tolerance and Autonomy, Social Spontaneity, and Scientific Orientation—using a mean of 50.00 and a standard deviation of 10.00 (Kang, 2012). The participants were divided into under-achievers, average achievers, and over-achievers based on

their ACT scores and high school grades. These grades were used to predict their course grades. From this study it was found that introverted students (those who avoided social activities, did not take initiative at social gatherings, and preferred to work alone) tended to attain higher achievement. Humanistic-oriented students, like those who preferred the arts, thought-provoking lectures, and tended to examine personal motives and attitudes, were negatively related to achievement. These results indicated that when considering the personality differences of students, teaching and evaluation methods could be a predictor of academic performance (Kang, 2012).

Joshanloo and Afshari (2009) investigated the relationship between the Big Five Personality Traits, self-esteem, and life satisfaction among 235 university students at the University of Tehrain. Their sample consisted of 175 female (74.5%) and 60 male (25.5%) students who were recruited from different fields of study. They conducted independent *t* tests to examine the sex differences in life satisfaction scores. The results showed that female students scored significantly higher than male students on Satisfaction with Life Scale, $t\ (233) = 2.63$, $p < .01$. They also used hierarchical regression analysis to examine the impact of gender on the relationship between personality traits and life satisfaction. According to this analysis, among personality traits extraversion and neuroticism significantly predicted life satisfaction. Gender significantly predicted life satisfaction, $\beta = -.115$, illustrating that female students were more satisfied with their lives than male students. Finally there was a significant interaction between gender and conscientiousness, $\beta = -.74$. This study succeeded with its premise that gender differences and gender itself both contribute to predicting life satisfaction.

Lounsbury et al. (2009) researched data from 347 undergraduate business majors and 2,252 non-business majors at a large Southeastern university; specifically whether they differed

on the Big Five model of personality and four other narrow personality traits (Assertiveness, Optimism, Tough-Mindedness, and Work Drive). The authors also examined the relationships between personality traits and life satisfaction in business majors. The Big Five traits accounted for 24% ($p < .01$) of the variance in life satisfaction, 3% ($p < .01$) of the variance in optimism, and 1.5% ($p < .01$) of the variance in work drive. Altogether, the Big Five and narrow personality traits accounted for a total of 29% of life satisfaction variance. In conclusion, business majors scored higher for conscientiousness, emotional stability, extraversion, assertiveness, and tough-mindedness while they scored lower on agreeability and openness. All of the traits except for agreeability and tough-mindedness correlated significantly and positively with life satisfaction.

Hart, Stasson, Mahoney, and Story (2007) investigated the relationship between the Big Five and a two-factor model of achievement motivation (Intrinsic and Extrinsic) among 777 participants. The sample included 229 male and 528 female participants. Their analysis revealed a significant relation among the Big Five and achievement motivation. Their findings concluded that, as a complete set, the Big Five traits were more predictive of intrinsic motivation ($R^2 = .41$) than extrinsic motivation ($R^2 = .15$). In conclusion, their study found that conscientiousness, openness, and extraversion were positively associated with intrinsic achievement motivation while extraversion, conscientiousness, and neuroticism were positively related to extrinsic achievement motivation. Agreeability was the only trait found to be negatively associated with extrinsic achievement motivation.

Mulyanegara, Tsarenko, and Anderson (2009) conducted a study to explore the relationship between personality and brand personality as measured by constructs reflecting the Big Five dimensions in the context of fashion products. They also investigated gender

differences in choices towards these products. The respondents in the study were 251 undergraduate students enrolled within the business school of one of the leading universities in Australia, of which 150 were female and 101 were male students. After performing regression analysis and other statistical testing, Mulyanegara's team concluded that consumers who exhibit a conscientious personality demonstrate preferences towards "trusted" brands. Findings related to gender reveal that male and female consumers differ in how they express their personality when it comes to brand personality. Male respondents who are dominant on the neuroticism dimension prefer a trusted brand, whereas female respondents who are dominant on the conscientiousness dimension preferred a trusted brand.

A longitudinal study conducted with a heterogeneous sample of 14,718 Germans in their adulthood by Specht et al. (2011) indicated that major life situations could alter personality trait rankings. They indicated that the rank order of the Big Five could change between the ages of 40 and 60. They concluded that personality changes in this age group could be partly attributable to social demands and life experiences (Specht et al., 2011). Another study by Robert et al. (2006) used meta-analytic techniques to determine patterns of mean-level change in personality traits across the life course. Results showed that people increase in measures of social dominance (a facet of extraversion), conscientiousness, and emotional stability, especially in middle to old age (Robert et al., 2006).

In general, most studies indicated that personality variables have a significant relationship with success among students in terms of grades, performance, and choice of majors. Gender disparity is evident when measuring personality traits in most of the studies conducted thus far. Men and women tend to have different sets of personality traits that define their behavior or outcomes in each of the cases.

Saucier (2002) studied the case of Big Five personality traits and their orthogonality in detail. The Big Five factors are held to be orthogonal, but Saucier asserted that that may not be the case in some of the old marker sets developed for them. Saucier extensively researched on the markers and found that the 40-item short form of Goldberg's 100 unipolar markers, a new set of modular markers with item parcels, and a 40-item short form of these (mini-modular markers [the 3M40]) are three most orthogonal. These Big Five marker sets have markedly lower interscale correlations, with no loss of validity, relative to previous marker sets with comparable numbers of items. He concluded that the nonorthogonality in some markers does not reflect on the Big Five model but rather an outcome of commonly used scale construction procedures (Saucier, 2002).

International Personality Item Pool

The International Personality Item Pool (IPIP) is the standard self-reporting questionnaire of the FFM. The IPIP inventory was initially constructed in 1996. Since then, the IPIP inventory has been extensively used and its items have been translated from English into more than 25 other languages (IPIP, 2014). Currently more than 90 publications use IPIP scales and they are all listed on the IPIP website (IPIP, 2014). Currently the IPIP holds more than 2000 items and scoring keys to measure and analyze the Big Five personality traits (Goldberg, et al., 2006). The Big Five Personality Trait taxonomy is a robust, clear, and concise model, which was developed by analyzing the thousands of trait adjectives used by individuals to describe themselves or others (Goldberg, 1999; John & Srivatsava, 1999). This study used the IPIP Big Five broad domains short form structure. The mean item intercorrelation for shorter scales used is .40 for extraversion, .31 for agreeability, .29 for conscienteousness, .38 for emotional stability, and .34

for intellect with a mean of .34 overall. The Cronbach's coefficient alpha for extraversion is .87, agreeability is .82, conscientiousness is .79, emotional stability is .86, and intellect is .84 with an overall mean alpha of .84 (Goldberg, 1992).

Chapter Summary

This chapter opened with a review of the evolution of STEM, its importance, and its growing awareness. Science and technology are the foundational subjects for technology and innovation. The National Science Foundation in the early 1990s first offered the acronym STEM representing science, technology, engineering and mathematics. Focusing and improving on these disciplines is essential for advancing in global competition. The National Academy of Science, the National Academy of Engineering, and the Institute of Medicine jointly issued a report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, which called for strengthening the STEM pipeline from primary through post-secondary U.S. education (National Academy of Science, 2005). In response to their valid and pressing recommendations, President George W. Bush signed the America COMPETES Act into law on August 9, 2007. Federal interest in STEM education and STEM fields was widely evident from then. Specialized schools were encouraged to stress STEM education. Several studies investigated attitudes towards STEM subjects and how these can help if integrated into curricula. Other studies looked into how the specialized STEM schools perform in comparison to other schools. Performance in STEM subjects is another topic that is widely researched. Most of these studies revealed that there is gender disparity in STEM program enrollments across most schools in the nation.

There are numerous studies regarding women in STEM fields. Detailed studies about what makes women choose technological fields or science and mathematics majors have been

conducted at different times. The self-efficacy levels of men and women differ, along with their social conditioning (Smith, 2011). Women are found to perform equally with or slightly better than men during their K-12 education in mathematics and sciences. However, women are not choosing STEM careers from postsecondary education onwards when compared with men. Various researchers have investigated the reasons for these choices. Some studies also indicated gender disparity among the STEM professorate.

Findings from several studies indicated that personality is a key factor that affects performance, proficiency, and choices throughout a person's lifetime. It is also known that personality remains fairly constant throughout a person's lifetime unless actively worked upon (Hudson & Fraley, 2015; Specht et al., 2011; Robert et al., 2006). Hence, learning and educating about personality profiles is greatly beneficial in order to interpret, understand, and effectively draw inspiration from role models.

The FFM of Personality is considered as the most comprehensive and descriptive model of personality traits to date. It measures neuroticism, extraversion, openness, agreeability, and conscientiousness. Goldberg's IPIP instrument was used to incorporate the FFM for the purpose of this study. The reliability and consistency of this instrument has been tested time and again for numerous studies. It had been used in more than 90 studies at the time of this study. The IPIP instrument has a clear, robust, and concise Big Five Personality Trait taxonomy model developed by analyzing the thousands of traits used by individuals to describe themselves or others (Goldberg, 1999; John & Srivatsava, 1999). This study used the IPIP Big Five broad domains short form structure.

CHAPTER 3

METHODOLOGY

The research methodology and design used in this study along with the details about participants, instrumentation, data-collection, and data-analysis are described in this chapter. The study identifies the personality traits associated with students, especially women, in STEM fields at Indiana State University. The purposes of this study were to identify whether there are any personality traits that are noticeably common or different among students in STEM fields from those of non-STEM students, among students in various levels of study (graduate/undergraduate), and finally if there are any unique observable trends in personality traits based on gender in the given sample pool. The Midwestern university chosen for this study was Indiana State University (ISU) located at Terre Haute, Indiana.

For this study, personality traits are identified by extraversion, agreeability, conscientiousness, emotional stability, and intellect/imagination–the FFM–and are measured using a survey with the IPIP questionnaire. The personality traits were identified and were used to check for any generally observable trends. Therefore, the method adopted for this study was specifically designed to survey and identify the personality traits of students at ISU. The subjects were all the students studying at ISU, including both graduate and undergraduate levels excluding freshman and first-semester sophomores. Upon approval from the University sources

and in view of IRB implications, all the students were sent the survey via email three times in a time span of one month. Participation in the survey was voluntary and was actively encouraged.

Research Questions

Based on the identified research purposes, this study addressed the following research questions. The corresponding null hypotheses are also listed:

1. What are the levels of personality traits among the students of Indiana State University?
2. What are the levels of personality traits among female students of Indiana State University?
3. Is there any influence of gender, academic majors (STEM or Non-STEM), and level of education (graduate and undergraduate) on personality traits?

   H_{01}: Gender will have no significant influence on the Big Five personality traits

   H_{02}: Choice of major (STEM or Non-STEM) will have no significant influence on the Big Five personality traits.

   H_{03}: Level of education will have no significant influence on the Big Five personality traits.

4. Is there any influence of academic majors (STEM or Non-STEM) and level of education (graduate and undergraduate) on personality traits of female students at Indiana State University?

   H_{01}: Choice of major (STEM or Non-STEM) will have no significant influence on the Big Five personality traits among female students at ISU.

   H_{02}: Level of education will have no significant influence on the Big Five personality traits among female students at ISU.

Design of the Study

In order to investigate the relationship between personality traits and STEM choices of students at ISU, a five-point Likert-scale IPIP questionnaire was used in this quantitative study. The responses from this self-reported survey were used to examine the influence of gender, level of education, and STEM/Non-STEM majors. The survey was sent to all the students enrolled in fall 2015 (all the needed approvals are documented in Appendix A) at ISU. The results collected from students who participated voluntarily were analyzed using several statistical procedures, including descriptive statistics and analysis of variance (ANOVA) for different criteria as appropriate.

Participants

The survey was sent to all students enrolled at ISU during the fall semester in 2015. The students were categorized based on gender, level of education (graduate and undergraduate), and choice of major (STEM or non-STEM) for the purpose of this study.

On August 27, 2015, ISU announced that the enrollment was at an all-time high with 13,584 students enrolled in the fall semester. However, students with enrollment between 0 to 45 credits (freshman and first-semester sophomore students) were filtered out of the survey analysis. The rationale for such filtering was that students with less than 45 credits might not have made concrete decisions on the choice of their major. Given that their decisions may be unstable, there is a high probability that if these samples were considered, they may convolute the results. Nevertheless, the survey was sent to all the students. Based on responses in the demographic section of the instrument to number of credits enrolled in and/or if the choice of major is a pre-professional designation, those student responses were excluded from the data analysis.

This study excluded faculty from its investigation in order to singly focus on the student characteristics. However, investigations into the personality traits of faculty would be useful for future studies. It is quite possible that students may choose a major because they identify themselves with the personality type of instructors' or their favorite teacher from grade school. Also, there may be other reasons apart from personality types that contribute to a student choosing a major. With all these considerations, this study seeks only to find correlations, if any, among personality types and the categorizations identified.

Instrumentation

This study used the IPIP scales in order to measure the Big Five personality traits associated with the subjects. The IPIP was first proposed by Goldberg (1999) as a scientific collaborator for the development of advanced measures of personality traits and other individual differences. The IPIP has over 2000 items, each consisting of a short verbal phrase. Participants of the survey were given 50 items from this 2000 item pool, 10 for each of the Big Five factors-I: Extraversion, II: Agreeability, III: Conscientiousness, IV: Emotional Stability, and V: Intellect/Imagination-to which to respond. The translations of the 50-scale (short form) IPIP instrument have been tested and reviewed for their validity and reliability by experts across the world. In the American community sample used to develop the English language version of the IPIP instrument (Goldberg et al., 2006), the internal consistency reliability estimates (Cronbach's coefficient alpha) of the short form for each of the five domains were .87 (Factor I: Extraversion), .82 (Factor II: Agreeability), .79 (Factor III: Conscientiousness), .86 (Factor IV: Emotional Stability), and .84 (Factor V: Intellect/Imagination). The number of items per pole by factor number (i.e., the number of items keyed in the positive and negative ways for each construct measured by the IPIP instrument) helped determine the total counts for each of the five

domains. See Appendix B for more detailed information on items keyed in for positive and negative ways.

The 50-item IPIP survey was administered with a 5-point, Likert-type scale system for of the 50 keys ranging from ranging from 1 to 5: 1 = *very inaccurate*, 2 = *moderately inaccurate*, 3 = *neither inaccurate nor accurate*, 4 = *moderately accurate*, and 5 = *very accurate* as designed in the original instrument designed by (Goldberg, 1999). Each participant had an overall score based on his or her keyed in responses. This instrument was administered in the form of an online survey and typically took 25-30 minutes to complete.

Data Collection

ISU's Office of Student Success and Center for Graduate and Professional Studies were contacted by email with a detailed explanation of the research. These departments had approved the request to send the survey to ISU's student population and receive the completed surveys for further analysis. The survey as in Appendix C was sent out to all the students via email after receiving IRB approvals. Instructors were requested to encourage students to take this survey. All 13,584 students enrolled in fall semester of 2015 were sent the survey with an optimistically expected response rate of 20%-30% overall. As response was far lower than 20%, the survey was resent to all the students after two weeks from the initial dispatch. Because the survey was created, sent, and monitored online, the results were recorded systematically in Qualtrics as students complete their sessions.

The entire study was divided into the following phases:

Phase 1 (Approvals, access, and lists): This phase began after approval from the research committee. The study's proposal was sent to Institutional Review Board (IRB) for its approval. Only after the permission from ISU authorities, instructors, and ISU institutional research

department, a complete list of student email addresses was obtained. Approvals from ISU authorities were received and are documented in Appendix A

Phase 2 (Data Collection): Upon approval from IRB, the survey was sent out to all the students enrolled in the fall of 2015 at ISU. Students were given specific directions to maintain the accuracy of the results.

Phase 3 (Data Analysis): After receiving responses from all the three times the surveys were sent, data was analyzed for identifying any patterns or common scores among any of the categories.

Phase 4 (Results and Recommendations): A thorough data analysis was done in order to lead to an informed data interpretation. Based on the interpretations the results obtained were tabulated and/or explained accordingly. With results from the study, recommendations that are appropriate were made.

Data Analysis

This study intended to identify any commonalities and/or differences among personality traits based on gender, academic majors and level of education at ISU. The research was completely on quantitative analysis and findings from data at ISU.

The quantitative data analysis was conducted with the latest version of Statistical Package for the Social Sciences (SPSS Statistics Version 24) for Macintosh Operating System. Initially, descriptive statistics including means, standard deviations, and frequencies were calculated to represent the demographic background information of students who took the survey at ISU. These descriptors helped gauge the numbers pertaining to gender, academic majors (STEM and non-STEM), and level of education (graduate and undergraduate). Descriptive statistics were also used in summarizing the overall personality traits in all the categories.

To further examine the influence of gender, academic majors, and level of education on personality traits, an ANOVA was conducted on each of Big Five personality traits. These analyses helped to determine if there is a difference in trends of personality traits in the categories of students by gender by academic majors, and by levels of education. For example, considering Category 1–Gender, Gender was the independent variable and the five personality domains with their 50 keys were the dependent variables.

Chapter Summary

For this study, personality traits are identified by extraversion, agreeability, conscientiousness, emotional stability, and intellect/imagination. The five-factor model personality traits were measured using a survey with the IPIP questionnaire. The 50-item IPIP survey was administered with a 5-point, Likert-type scale system. This system uses the 50 keys ranging from ranging from 1 to 5: 1 = *very inaccurate*, 2 = *moderately inaccurate*, 3 = *neither inaccurate nor accurate*, 4 = *moderately accurate*, and 5 = *very accurate* as designed in the original instrument designed by Goldberg (Goldberg, 1999). Each participant had an overall score based on his or her keyed in responses. After receiving all the necessary approvals and permissions from the university, students at ISU that enrolled in the fall 2015 semester were sent the IPIP survey including questions regarding their demographic information.

This survey collected all the relevant data for further analysis. The data was then systematically arranged to identify and form personality profiles of students who took the survey. Certain descriptive analyses helped delve into details of the surveyed students. To further examine the influence of gender, academic majors, and level of education on personality traits, an ANOVA was conducted for each of Big Five personality traits.

CHAPTER 4

DATA ANALYSIS

The study's main purpose was to investigate personality traits and the influence of gender, academic majors (STEM and non-STEM), and level of education. One of the objectives of this study was to identify typical personality traits of students, and specifically female students at Indiana State University using the IPIP 50 point scale for the FFM. One other objective of the study was to examine the influence of gender, academic majors (STEM or Non-STEM) and level of education (graduate and undergraduate) on personality traits. Based on these research objectives, this study addressed the following research questions:

1. What are the levels of personality traits among the students of Indiana State University?
2. What are the levels of personality traits among female students of Indiana State University?
3. Is there any influence of gender, academic majors (STEM or Non-STEM), and level of education (graduate and undergraduate) on personality traits?

H_{01}: Gender will have no significant influence on the Big Five personality traits

H_{02}: Choice of major (STEM or Non-STEM) will have no significant influence on the Big Five personality traits.

H_{03}: Level of education will have no significant influence on the Big Five personality traits.

4. Is there any influence of academic majors (STEM or Non-STEM) and level of education (graduate and undergraduate) on personality traits of female students at Indiana State University?

H_{01}: Choice of major (STEM or Non-STEM) will have no significant influence on the Big Five personality traits among female students at ISU.

H_{02}: Level of education will have no significant influence on the Big Five personality traits among female students at ISU.

To report research findings and address the null hypothesis above, several statistical analyses were utilized. Descriptive analyses for the IPIP inventory were computed for frequencies, means, and standard deviations. One-way ANOVA was utilized to examine the influence of gender, majors, and levels of education on the Big Five personality traits.

Demographic Characteristics

Demographic information on gender, academic majors, number of credit hours, and proficiency levels was collected using the survey sent. One thousand seven hundred and forty three students that were registered in fall of 2015 at Indiana State University participated in the survey. Students with 0 to 45 credit hours were removed from the data analysis as they may not have made a decision about the major as yet and their data could have convoluted the results. As shown in Table 1, the sample consisted of 498 students enrolled with 0 to 45 credit hours and 77 others who did not enter their credit information. These 575 students were removed from the analysis.

Table 1

Distribution of Participants by Credit Hours

Number of Credit Hours	Frequency
0 -29 (Freshman)	333
30 – 45 (Sophomore)	165
46 – 59 (Sophomore)	121
60 – 89 (Junior)	347
90 or above	357
Graduate Hours	343
Missing	77
Total	1743

There were 1168 participants after removing students with missing information on credit hours and those with fewer than 45 credit hours. The seven participants with a pre-professional major were removed. Many pre-professional students decide upon their majors late and may not have declared their major at the time of the survey as they indicated their pre-professional choice instead of the major. Also, even if these pre-professional students had made their choice of major, they indicated their pre-professional choice instead of their actual major in the survey. Hence, such subjects would not be useful to the analysis. There were also 21 students who had not yet decided their major, or their major was not listed, or the participant was not interested in disclosing their major as shown in Table 2. These participants were also removed, as their data was not useful for further analysis. Hence, the total number of valid participants who completed the survey for further analysis was 1140.

Table 2

Distribution of Participants with Missing Choice of Major

Level of Education	Frequency
Bachelor's	5
Master's	10
Doctoral	6

Among these 1140 participants there were 88 participants who did not choose to answer either one or more of the personality inventory questions. Thus, their data were not useful in determining their personality types. Hence, these 88 students' data were discarded for further analysis. Finally, the total number of participants with valid responses useful for analysis was 1052.

As demonstrated in Table 3, there were 309 male students, 737 female students, and six students with undisclosed sex among the 1052 participants. There were 336 students who indicated they held a major that falls under STEM category and 716 students indicated a non-STEM major.

Table 3

Distribution of Participants by Gender and Choice of Major

Gender	n	%	%	Choice of Major	n	%
Male	309	29.3	29.5	STEM	336	31.9
Female	737	70.1	70.5	Non-STEM	716	68.1
Undisclosed	6	0.6	-			

According to the level of education classified as undergraduate and graduate levels, there were 716 students at the undergraduate level enrolled in bachelor's programs and 336 students at

the graduate level. Of those 336 graduate students, 227 students were enrolled at a master's level and 109 students enrolled at a doctoral level as shown in the table below.

Table 4

Distribution of Participants by Level of Education

Level of Education	n	%	n	%
Bachelors (Undergraduate)	716	68.1	716	68.1
Masters (Graduate)	227	21.6	336	31.9
Doctoral (Graduate)	109	10.4		

Among the 737 female participants, there were 528 students indicating a non-STEM major and 209 students indicating a STEM major. In the same pool of female participants, there were 523 undergraduate students and 214 graduate students.

Table 5

Distribution of Female Participants by Level of Education and Choice of Major

Level of Education	n	%	Choice of Major	n	%
Undergraduate	523	71	Non-STEM	528	71.6
Graduate	214	29	STEM	209	28.4

Descriptive Analysis

Five-Factor Model of Personality

Because the FFM is central to this study, the issue of the reliability of the five-factor personality assessment and its internal consistency used in this study must be addressed. Cronbach's alpha reliability coefficients were calculated from this study's data to test the internal consistency and are shown in Table 6. The responses from participants with incomplete response

sets were excluded from the calculations. The Cronbach's alpha values for all of the personality traits are above .8 and hence the internal consistency is interpreted to be good; indicating the IPIP inventory used here is appropriate for the purposes of the study (Field, 2009).

Table 6

Reliability Estimate of the IPIP Personality Inventory Within the Data

Scale	N	Cronbach's alpha
Extraversion	1041	.898
Agreeability	1042	.861
Conscientiousness	1039	.837
Emotional Stability	1035	.884
Intellect/Imagination	1043	.802

Table 7 shows the overall means and standard deviations of the five domains of the FFM for all students from whom data was drawn. Out of the five domains, agreeability showed the highest mean, followed by intellect/imagination, conscientiousness, emotional stability, and extraversion. The standard deviations were in the reverse order of the means. As the mean value decreased, the standard deviation increased indicating that the values were more scattered for emotional stability and extraversion. The standard deviation values for agreeability and intellect factors indicate that they were much closer to the mean when compared to emotional stability and extraversion. This answered the first research question regarding the levels of personality traits among students at ISU who have taken the survey questionnaire.

Table 7

Five Domains: Means and Standard Deviations

Domain	N	M	SD
Agreeability	1052	39.88	5.834
Intellect/Imagination	1051	37.21	5.346
Conscientiousness	1052	36.70	6.099
Emotional Stability	1051	31.11	7.459
Extraversion	1052	31.08	7.676

Pearson's *r* correlation was computed to investigate the inter-correlations among the five domains at the broadest level. The five domains are expected to be orthogonal and any correlation could raise questions on the internal reliability of the instrument used. However, in this case, the correlations found are very small, the *R* squared is even smaller. Given the large sample size, the effect of intercorrelations on internal reliability is negligible and so is the non-orthogonality. The five domains, as shown in Table 8, were all moderately correlated with one another, and a statistically significant positive relationship ($p < .001$) was found among almost all of the individual personality facets except for conscientiousness and extraversion ($p = .090$), and intellect/imagination and conscientiousness ($p = .023$). The strongest positive correlation was found between extraversion and emotional stability followed by extraversion and intellect/imagination, and emotional stability and conscientiousness. The weakest and most statistically insignificant relationship was between extraversion and conscientiousness ($p = .09$).

Table 8

Five Domains: Intercorrelations

Domain	Extraversion	Agreeability	Conscientiousness	Emotional Stability	Intellect/ Imagination
Extraversion	-				
Agreeability	.224**	-			
Conscientiousness	.052	.149**	-		
Emotional Stability	.287**	.110**	.241**	-	
Intellect/ Imagination	.259**	.166**	.070*	.145**	-

*$p < .05$. **$p < .01$.

There were no negative correlations among any of the five facets in the data being analyzed. This means that as one of the facet values increases the other facet with a significant variation also increases. Generally, students with higher extraversion are more agreeable, emotionally stable, and have higher intellect. Also, students with higher conscientiousness show higher emotional stability.

Table 9 shows the means and standard deviations of the five domains of the FFM among female students at ISU. This addressed the second research question on personality traits of female students at ISU. The highest means among female students at ISU was the same as for the total population as the sample for this analysis is comprised of 70.1% female students. The descending order showed mild difference when compared to the order of all students in that conscientiousness and intellect/imagination swapped their ranking position along with extraversion and emotional stability. Out of the five domains agreeability showed the highest means, followed by conscientiousness, intellect/imagination, extraversion and emotional stability.

Table 9

Five Domains Among Women in ISU: Means and Standard Deviations

Domain	N	M	SD
Agreeability	737	40.74	5.614
Conscientiousness	737	36.94	6.137
Intellect/Imagination	737	36.83	5.268
Extraversion	737	30.65	7.652
Emotional Stability	737	30.22	7.112

Pearson's *r* correlation was computed to investigate the intercorrelations among the five domains at the broadest level among female students at Indiana State University. As shown in Table 10, the five domains were all moderately to strongly correlate with one another, and a statistically significant positive relationship ($p < .001$) was found among almost all of the individual personality facets except for conscientiousness and extraversion ($p = .241$), and intellect/imagination and conscientiousness ($p = .065$).

Table 10

Five Domains: Intercorrelations

Domain	Extraversion	Agreeability	Conscientiousness	Emotional Stability	Intellect/ Imagination
Extraversion	-				
Agreeability	.251**	-			
Conscientiousness	.043	.129**	-		
Emotional Stability	.283**	.171**	.266**	-	
Intellect/ Imagination	.258**	.224**	.068*	.135**	-

*$p < .05$. **$p < .01$.

The strongest positive correlation among women was also found between extraversion and emotional stability followed by emotional stability and conscientiousness, and extraversion and intellect/imagination. In conclusion, compared to the overall population, women were found to have similar facet correlations in general. One major difference was that women have a stronger correlation between intellect and agreeability at .224 ($p < .01$) when compared to the correlation of .166 ($p < .01$) between the same facets for all students. This means that female students with greater agreeability generally have higher intellect.

Statistical Analysis

In this study, gender, level of education, and choice of major were the independent variables and the big five personality traits were the dependent variables. To determine if there is a significant impact of one variable on another, a one-way ANOVA was employed. The dependent variables are continuous and the independent variables are categorical. The null hypothesizes for impact of gender; choice of major, and level of education on all students along with null hypothesizes for impact of choice of major and level of education on female students at ISU were addressed using one-way ANOVA.

Extraversion

The extraversion domain references a tendency to prefer stimulation, the company of others, and engagement with the external world (Costa & McCrae, 1992). The 10 questions that explored this domain included

1. Am the life of the Party.
2. Feel comfortable around people.
3. Start conversations.
4. Talk to a lot of different people at parties.

5. Don't mind being the center of attention.
6. Don't talk a lot.
7. Keep in background.
8. Have little to say.
9. Don't like to draw attention to myself.
10. Am quiet around strangers.

A one-way between subjects ANOVA was conducted to compare the influence of extraversion on gender condition. There was a significant influence of extraversion on gender at the $p < .05$ level for the gender condition, $F(1, 1044) = 7.951$, $p = 0.005$. Hence the null hypothesis for level of gender and extraversion, *H_0: Gender will have no significant influence on extraversion,* is rejected. The mean score for all of ISU's subjects ($M = 31.08$, $SD = 7.67$) was significantly different than the mean score for female subjects ($M = 30.65$, $SD = 7.65$). Taken together these results suggest that among the students in fall of 2015, women had a lower extraversion trait rating in comparison with all the students in general.

Table 11

ANOVA on Extraversion and Gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	465.014	1	465.014	7.951	.005
Within Groups	61058.240	1044	58.485		
Total	61523.254	1045			

Table 12 shows the one-way between subjects ANOVA conducted to compare the influence of choice of major (STEM or Non-STEM) on extraversion. Results of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for choice of major and

extraversion. Major (STEM or Non-STEM) does not have a significant influence on extraversion scores among the subjects of the survey at $p < .05$ level for the condition, $F(1, 1050) = 2.752$, $p = .097$. The mean score for STEM choice of major ($M = 30.51$, $SD = 7.46$) did not significantly differ from the mean score for non-STEM choice of major ($M = 31.35$, $SD = 7.76$). All these results suggested that choice of major between STEM and non-STEM did not affect the extraversion personality trait rating among the subjects of this study.

Table 12

ANOVA on Extraversion and Choice of Major

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	161.916	1	161.916	2.752	.097
Within Groups	61771.554	1050	58.830		
Total	61933.471	1051			

Table 13 shows outcomes of a one-way ANOVA conducted to capture the influence of level of education (graduate and undergraduate) on extraversion. There was a significant influence of level of education on extraversion at $p < .05$ level for graduate and undergraduate conditions, $F(1, 1050) = 9.033$, $p = 0.003$. Hence the null hypothesis for level of education and extraversion, *H_0: Level of education will have no significant influence on extraversion,* is to be rejected. The mean score for graduate subjects ($M = 32.12$, $SD = 7.97$) was significantly different than the undergraduate subjects ($M = 30.60$, $SD = 7.49$). Taken together, these results suggested that level of education does have an influence on the extraversion personality trait rating among the subjects. Specifically, graduate subjects were more extraverted than the undergraduate subjects.

Table 13

ANOVA on Extraversion and Level of Education

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	528.273	1	528.273	9.033	.003
Within Groups	61405.198	1050	58.481		
Total	61933.471	1051			

Individual one-way ANOVAs were performed specifically among female subjects to test for the influence of choice of major and level of education on extraversion. Tables 14 and 15 show the details of significance and F scores of both of the one-way ANOVA's respectively. Results of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for choice of major and extraversion for female subjects also. Major (STEM or Non-STEM) does not have a significant influence on extraversion scores among the female subjects of the survey at $p < .05$ level for the condition, $F(1, 735) = .460$, $p = .498$. The mean score for STEM choice of major ($M = 30.34$, $SD = 7.49$) did not significantly differ from the mean score for non-STEM choice of major ($M = 30.77$, $SD = 7.72$) among women. All these results suggested that choice of major between STEM and non-STEM did not affect the extraversion personality trait rating even among the female subjects of this study.

Table 14

ANOVA on Extraversion and Choice of Major among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	26.974	1	26.974	.460	.498
Within Groups	43073.007	735	58.603		
Total	43099.981	736			

Table 15 shows the outcomes of a one-way ANOVA conducted to capture the influence of level of education (graduate and undergraduate) on extraversion among female subjects. There was a significant influence of level of education on extraversion at $p < .05$ level for graduate and undergraduate conditions, $F(1, 735) = 4.129$, $p = 0.043$. Hence the null hypothesis for level of education and extraversion, *H_0: Level of education will have no significant influence on extraversion among women* is to be rejected. The mean score for female graduate subjects ($M = 31.54$, $SD = 7.84$) was significantly different than the female undergraduate subjects ($M = 30.28$, $SD = 7.55$). Taken together, these results suggested that level of education does have an influence on the extraversion personality trait rating even among the female subjects.

Table 15

ANOVA on Extraversion and Level of Education among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	240.741	1	240.741	4.129	.043
Within Groups	42859.240	735	58.312		
Total	43099.981	736			

Agreeability

Agreeability is a personality trait manifesting itself in individual behavioral characteristics that are perceived as kind, sympathetic, cooperative, warm, and considerate. The 10 questions that explored this aspect included

1. Am interested in people.
2. Sympathize with others' feelings.
3. Have a soft heart.
4. Take time out for others.

5. Feel others' emotions.
6. Make people feel at ease.
7. Am not really interested in others.
8. Insult people.
9. Am not interested in other people's problems.
10. Feel little concern for others.

Table 16 shows the one-way between subjects ANOVA to compare the influence of agreeability on gender condition. There was a significant influence of agreeability on gender at $p < .05$ level for the gender condition, $F(1, 1044) = 54.885$, $p = 0.000$. Hence the null hypothesis for level of gender and agreeability, *H_0: Gender will have no significant influence on agreeability* is to be rejected. The mean score for all of ISU's subjects ($M = 39.90$, $SD = 5.83$) was significantly different than the mean score for female subjects ($M = 40.74$, $SD = 5.61$). Taken together these results suggested that among the students in fall of 2015, women have a higher agreeability trait rating in comparison with all students in general.

Table 16

ANOVA on Agreeability and Gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1775.855	1	1775.855	54.885	.000
Within Groups	33779.787	1044	32.356		
Total	35555.641	1045			

Table 17 shows the one-way between subjects ANOVA conducted to compare the influence of choice of major (STEM or Non-STEM) on agreeability. Results of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for choice of major and agreeability. Major (STEM or Non-STEM) does not have a significant influence on agreeability scores among the subjects of the survey at $p < .05$ level for the condition, $F(1, 1050) = 2.358$, $p = .125$. The mean score for STEM choice of major ($M = 39.48$, $SD = 6.07$) did not significantly differ from the mean score for non-STEM choice of major ($M = 40.07$, $SD = 5.71$). All these results suggested that choice of major between STEM and non-STEM does not affect the agreeability personality trait rating among the subjects of this study.

Table 17

ANOVA on Agreeability and Choice of Major

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	80.163	1	80.163	2.358	.125
Within Groups	35693.221	1050	33.994		
Total	35773.384	1051			

Table 18 shows the outcomes of a one-way ANOVA conducted to capture the influence of level of education (graduate and undergraduate) on agreeability. There was a significant influence of level of education on agreeability at $p < .05$ level for graduate and undergraduate conditions, $F(1, 1050) = 12.694$, $p = 0.000$. Hence the null hypothesis for level of education and agreeability, H_0*: Level of education will have no significant influence on agreeability,* is to be rejected. The mean score for graduate subjects ($M = 40.81$, $SD = 5.85$) was significantly different than the undergraduate subjects ($M = 39.45$, $SD = 5.78$). Taken together, these results suggested that level of education does have an influence on the agreeability personality trait rating among

the subjects. Specifically, graduate subjects are more agreeable in terms of the trait rating than the undergraduate subjects.

Table 18

ANOVA on Agreeability and Level of Education

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	427.321	1	427.321	12.694	.000
Within Groups	35346.063	1050	33.663		
Total	35773.384	1051			

Results as seen in Table 19 of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for choice of major and agreeability for female subjects also. Major (STEM or Non-STEM) does not have a significant influence on agreeability scores among the female subjects of the survey at $p < .05$ level for the condition, $F(1, 735) = .045$, $p = .832$. The mean score for STEM choice of major ($M = 40.67$, $SD = 5.80$) did not significantly differ from the mean score for non-STEM choice of major ($M = 40.77$, $SD = 5.54$) among women. All these results suggested that choice of major between STEM and non-STEM does not affect the agreeability personality trait rating even among the female subjects of this study.

Table 19

ANOVA on Agreeability and Choice of Major Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.414	1	1.414	.045	.832
Within Groups	23192.567	735	31.555		
Total	23193.981	736			

Table 20 shows the outcomes of a one-way ANOVA conducted to capture the influence

of level of education (graduate and undergraduate) on agreeability among female subjects. There was a significant influence of level of education on agreeability at $p < .05$ level for graduate and undergraduate conditions, $F(1, 735) = 21.132$, $p = 0.000$. Hence the null hypothesis for level of education and agreeability, H_0*: Level of education will have no significant influence on agreeability among women,* is to be rejected. The mean score for female graduate subjects ($M = 42.21$, $SD = 5.17$) was significantly different than the female undergraduate subjects ($M = 40.14$, $SD = 5.68$). Taken together, these results suggested that level of education does have an influence on agreeability personality trait rating even among the female subjects.

Table 20

ANOVA on Agreeability and Level of Education Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	648.217	1	648.217	21.132	.000
Within Groups	22545.764	735	30.675		
Total	23193.981	736			

Conscientiousness

Conscientiousness is a personality trait of being careful and vigilant. Conscientious people are efficient and organized. The 10 questions that explored this aspect included

1. Am always prepared.
2. Pay attention to details.
3. Get chores done right away.
4. Like order.
5. Follow a schedule.
6. Am exacting in my work.

7. Leave my belongings around.
8. Make a mess of things.
9. Often forget to put things back in their proper place.
10. Shirk my duties.

Table 21 shows the one-way between subjects ANOVA was conducted to compare the influence of conscientiousness on gender condition. There was a significant influence of conscientiousness on gender at $p < .05$ level for the gender condition, $F(1, 1044) = 3.912$, $p = 0.048$. Hence the null hypothesis for level of gender and extraversion, *H_0: Gender will have no significant influence on conscientiousness,* is to be rejected. The mean score for all of ISU's subjects ($M = 36.70$, $SD = 6.08$) was significantly different than the mean score for female subjects ($M = 36.94$, $SD = 6.14$). Taken together these results suggested that among the students in fall of 2015, women have a higher level of conscientiousness trait rating in comparison with all students in general.

Table 21

ANOVA on Conscientiousness and Gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	144.104	1	144.104	3.912	.048
Within Groups	38460.429	1044	36.839		
Total	38604.533	1045			

Table 22 shows the one-way between subjects ANOVA conducted to compare the influence of choice of major (STEM or Non-STEM) on conscientiousness personality trait. Results of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for choice of major and conscientiousness. Major (STEM or Non-STEM) does not have a significant

influence on conscientiousness scores among the subjects of the survey at $p < .05$ level for the condition, $F(1, 1050) = 1.378$, $p = .241$. The mean score for STEM choice of major ($M = 37.02$, $SD = 6.16$) did not significantly differ from the mean score for non-STEM choice of major ($M = 36.55$, $SD = 6.07$). All these results suggested that choice of major between STEM and non-STEM does not affect the conscientiousness personality trait rating among the subjects of this study.

Table 22

ANOVA on Conscientiousness and Choice of Major

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	51.238	1	51.238	1.378	.241
Within Groups	39042.240	1050	37.183		
Total	39093.478	1051			

Table 23 shows the outcomes of a one-way ANOVA conducted to capture the influence of level of education (graduate and undergraduate) on conscientiousness. There was a significant influence of level of education on conscientiousness at $p < .05$ level for graduate and undergraduate conditions, $F(1, 1050) = 5.833$, $p = 0.016$. Hence the null hypothesis for level of education and conscientiousness, H_0*: Level of education will have no significant influence on conscientiousness,* is to be rejected. The mean score for graduate subjects ($M = 37.36$, $SD = 6.29$) was significantly different than the undergraduate subjects ($M = 36.39$, $SD = 5.98$). Taken together, these results suggested that level of education does have an influence on the conscientiousness personality trait among the subjects. Specifically, graduate subjects are more conscientious than the undergraduate subjects in terms of the trait rating.

Table 23

ANOVA on Conscientiousness and Level of Education

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	215.991	1	215.991	5.833	.016
Within Groups	38877.487	1050	37.026		
Total	39093.478	1051			

Individual one-way ANOVAs were performed specifically among female subjects to test for the influence of choice of major and level of education on conscientiousness. Tables 24 and 25 show the details of significance and F scores of both of the one-way ANOVAs respectively. Results of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for choice of major and conscientiousness for female subjects also. Major (STEM or Non-STEM) does not have a significant influence on conscientiousness scores among the female subjects of the survey at $p < .05$ level for the condition, $F(1, 735) = 1.499$, $p = .221$. The mean score for STEM choice of major ($M = 37.38$, $SD = 6.35$) did not significantly differ from the mean score for non-STEM choice of major ($M = 36.77$, $SD = 6.05$) among women. All these results suggested that choice of major between STEM and non-STEM does not affect the conscientiousness personality trait rating even among the female subjects of this study.

Table 24

ANOVA on Conscientiousness and Choice of Major Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	56.418	1	56.418	1.499	.221
Within Groups	27665.189	735	37.640		
Total	27721.607	736			

Table 25 shows the outcomes of a one-way ANOVA conducted to capture the influence of level of education (graduate and undergraduate) on conscientiousness among female subjects. There was a significant influence of level of education on conscientiousness at the $p < .05$ level for graduate and undergraduate conditions, $F(1, 735) = 5.972$, $p = 0.015$. Hence the null hypothesis for level of education and conscientiousness, *H_0: Level of education will have no significant influence on conscientiousness among women,* is to be rejected. The mean score for female graduate subjects ($M = 37.80$, $SD = 6.38$) was significantly different than the female undergraduate subjects ($M = 36.59$, $SD = 6.00$). Taken together, these results suggested that level of education does have an influence on the conscientiousness personality trait rating even among the female subjects.

Table 25

ANOVA on Conscientiousness and Level of Education Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	223.414	1	223.414	5.972	.015
Within Groups	27498.193	735	37.413		
Total	27721.607	736			

Emotional Stability

Emotional Stability refers to a person's ability to remain calm or even keel when faced with pressure or stress. The 10 questions that explored this aspect included

1. Am relaxed most of the time.
2. Seldom feel blue.
3. Get stressed out easily.
4. Worry about things.

5. Am easily disturbed.

6. Get upset easily.

7. Change my mood a lot.

8. Have frequent mood swings.

9. Get irritated easily.

10. Often feel blue.

A one-way between subjects ANOVA was conducted to compare the influence of emotional stability on gender condition as shown in Table 26. There was a significant influence of emotional stability on gender at the $p < .05$ level for the gender condition, $F(1, 1043) = 39.382$, $p = 0.000$. Hence the null hypothesis for level of gender and emotional stability, H_0: *Gender will have no significant influence on emotional stability,* is to be rejected. The mean score for all of ISU's subjects ($M = 31.14$, $SD = 7.45$) was significantly different than the mean score for female subjects ($M = 30.22$, $SD = 7.11$). Taken together these results suggested that among the students in fall of 2015, women have a lower emotional stability trait rating in comparison with all students in general.

Table 26

ANOVA on Emotional Stability and Gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2106.096	1	2106.096	39.382	.000
Within Groups	55778.943	1043	53.479		
Total	57885.039	1044			

Table 27 shows the outcomes of a one-way ANOVA conducted to capture the influence of choice of major among STEM and non-STEM categories on emotional stability. There was a

significant influence of choice of major on emotional stability at the $p < .05$ level for STEM and non-STEM conditions, $F(1, 1049) = 4.579$, $p = 0.033$. Hence the null hypothesis for choice of major and emotional stability, *H_0: Choice of Major (STEM or Non-STEM) will have no significant influence on emotional stability,* is to be rejected. The mean score for STEM choice of major ($M = 31.83$, $SD = 7.94$) was significantly different than the mean score for non-STEM choice of major ($M = 30.77$, $SD = 7.20$). Taken together, these results suggested that choice of major does have an influence on the emotional stability personality trait among the subjects. Specifically in terms of the trait ratings, graduate subjects who chose a STEM major are more emotionally stable than the subjects who have chosen a non-STEM major in fall of 2015.

Table 27

ANOVA on Emotional Stability and Choice of Major

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	253.914	1	253.914	4.579	.033
Within Groups	58163.283	1049	55.446		
Total	58417.197	1050			

Table 28 shows the outcomes of a one-way ANOVA conducted to capture the influence of level of education (graduate and undergraduate) on emotional stability. There was a significant influence of level of education on emotional stability at the $p < .05$ level for graduate and undergraduate conditions, $F(1, 1049) = 5.833$, $p = 0.000$. Hence the null hypothesis for level of education and emotional stability, *H_0: Level of education will have no significant influence on emotional stability,* is to be rejected. The mean score for graduate subjects ($M = 33.05$, $SD = 7.22$) was significantly different than the undergraduate subjects ($M = 30.20$, $SD = 7.40$). Taken together, these results suggested that level of education does have an influence on the emotional

stability personality trait among the subjects. Specifically in terms of the trait ratings, graduate subjects are more emotionally stable than the undergraduate subjects.

Table 28

ANOVA on Emotional Stability and Level of Education

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1864.967	1	1864.967	5.833	.000
Within Groups	56552.230	1049	53.911		
Total	58417.197	1050			

Individual one-way ANOVAs were performed specifically among female subjects to test for the influence of choice of major and level of education on emotional stability. Tables 29 and 30 show the details of significance and F scores of both of the one-way ANOVA's respectively. Results of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for choice of major and emotional stability for female subjects also. Major (STEM or Non-STEM) does not have a significant influence on emotional stability scores among the female subjects of the survey at the $p < .05$ level for the condition, $F(1, 735) = 1.326$, $p = .250$. The mean score for STEM choice of major ($M = 30.70$, $SD = 7.62$) did not significantly differ from the mean score for non-STEM choice of major ($M = 30.03$, $SD = 6.90$) among women. All these results suggested that choice of major between STEM and non-STEM does not affect the emotional stability personality trait rating even among the female subjects of this study.

Table 29

ANOVA on Emotional Stability and Choice of Major Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	67.066	1	67.066	1.326	.250
Within Groups	37162.994	735	50.562		
Total	37230.060	736			

Table 30 shows the outcomes of a one-way ANOVA conducted to capture the influence of level of education (graduate and undergraduate) on emotional stability among female subjects. There was a significant influence of level of education on emotional stability at the $p < .05$ level for graduate and undergraduate conditions, $F(1, 735) = 37.380$, $p = 0.000$. Hence the null hypothesis for level of education and emotional stability, H_0*: Level of education will have no significant influence on emotional stability among women,* is to be rejected. The mean score for female graduate subjects ($M = 32.67$, $SD = 7.00$) was significantly different than the female undergraduate subjects ($M = 29.22$, $SD = 6.90$). Taken together, these results suggested that level of education does have an influence on the emotional stability personality trait rating even among the female subjects.

Table 30

ANOVA on Emotional Stability and Level of Education Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1801.790	1	1801.790	37.380	.000
Within Groups	35428.270	735	48.202		
Total	37230.060	736			

Intellect/Imagination

Intelligence/Imagination describes a dimension that describes a person's openness to experience. The 10 questions that explored this aspect included

1. Have a rich vocabulary.
2. Have a vivid imagination.
3. Have excellent ideas.
4. Am quick to understand things.
5. Use difficult words.
6. Spend time reflecting on things.
7. Am full of ideas.
8. Have difficulty understanding abstract ideas.
9. Am not interested in abstract ideas.
10. Do not have a good imagination.

A one-way between subjects ANOVA was conducted to compare the influence of intellect/imagination on gender condition as shown in Table 31. There was a significant influence of extraversion on gender at the $p < .05$ level for the gender condition, $F(1, 1043) = 11.753$, $p = 0.001$. Hence the null hypothesis for level of gender and intellect/imagination, H_0: *Gender will have no significant influence on intellect/imagination,* is to be rejected. The mean score for all of ISU's subjects ($M = 37.20$, $SD = 5.35$) was significantly different than the mean score for female subjects ($M = 36.83$, $SD = 5.45$). Taken together these results suggested that among the students in fall of 2015, women have a lower intellect/imagination rating in comparison with all students in general.

Table 31

ANOVA on Intellect/Imagination and Gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	333.095	1	333.095	11.753	.001
Within Groups	29558.901	1043	28.340		
Total	29891.996	1044			

Table 32 shows the outcomes of a one-way ANOVA conducted to capture the influence of choice of major among STEM and non-STEM categories on intellect/imagination. There was a significant influence of choice of major on intellect/imagination at the $p < .05$ level for STEM and non-STEM conditions, $F(1, 1049) = 8.148$, $p = 0.004$. Hence the null hypothesis for choice of major and intellect/imagination, H_0*: Choice of major (STEM or Non-STEM) will have no significant influence on intellect/imagination,* is to be rejected. The mean score for STEM choice of major ($M = 36.53$, $SD = 5.62$) was significantly different than the mean score for non-STEM choice of major ($M = 37.54$, $SD = 5.19$). Taken together, these results suggest that choice of major does have an influence on intellect/imagination personality trait rating among the subjects. Specifically, subjects who chose a STEM major had lower intelligence/imagination trait rating than the subjects who have chosen a non-STEM major in fall of 2015.

Table 32

ANOVA on Intellect/Imagination and Choice of Major

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	231.289	1	231.289	8.148	.004
Within Groups	29775.543	1049	28.385		
Total	30006.832	1050			

Table 33 shows the one-way between subjects ANOVA conducted to compare the influence of level of education on intellect/imagination. Results of the one-way ANOVA clearly indicate a failure to reject the null hypothesis for level of education and intellect/imagination. Level of education, graduate or undergraduate does not have a significant influence on intellect/imagination scores among the subjects of the survey at the $p < .05$ level for the condition, $F(1, 1049) = 3.456$, $p = .063$. The mean score for graduate subjects ($M = 37.66$, $SD = 5.38$) did not significantly differ from the mean score for undergraduate subjects ($M = 37.00$, $SD = 5.32$). All these results suggest that level of education does not affect intellect/imagination personality trait rating among the subjects of this study.

Table 33

ANOVA on Intellect/Imagination and Level of Education

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	98.523	1	98.523	3.456	.063
Within Groups	29908.309	1049	28.511		
Total	30006.832	1050			

Table 34 shows the outcomes of a one-way ANOVA conducted to capture the influence of choice of major among STEM and non-STEM majors on intellect/imagination among female subjects. There was a significant influence of choice of major on intellect/imagination at the $p < .05$ level for STEM and non-STEM conditions, $F(1, 735) = 10.253$, $p = 0.001$. Hence the null hypothesis for choice of major and intellect/imagination, H_0*: Choice of major (STEM or non-STEM) will have no significant influence on intellect/imagination among women,* is to be rejected. The mean score for female subjects who chose STEM major ($M = 35.85$, $SD = 5.47$) was significantly different than the female subjects who chose non-STEM major ($M = 37.22$, *SD*

= 5.14). Taken together, these results suggested that choice of major does have an influence on intellect/imagination personality trait rating even among the female subjects.

Table 34

ANOVA on Intellect/Imagination and Choice of Major Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	280.996	1	280.996	10.253	.001
Within Groups	20143.476	735	27.406		
Total	20424.472	736			

Results of the one-way ANOVA as shown in Table 35 clearly indicate a failure to reject the null hypothesis for level of education and intellect/imagination for female subjects. Level of education does not have a significant influence on intellect/imagination scores among the female subjects of the survey at the $p < .05$ level for the condition, $F(1, 735) = .374$, $p = .541$. The mean score for graduate subjects ($M = 37.02$, $SD = 5.35$) did not significantly differ from the mean score for undergraduate subjects ($M = 36.76$, $e = 5.24$) among women. All these results suggested that level of education does not affect the intellect/imagination personality trait rating among the female subjects of this study, unlike all other personality traits discussed above.

Table 35

ANOVA on Intellect/Imagination and Level of Education Among Female Students at ISU

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.386	1	10.386	.374	.541
Within Groups	20414.086	735	27.774		
Total	20424.472	736			

Chapter Summary

In interest of addressing the research questions, the demographic data was broken down, and descriptive analysis for each category was performed. Further statistical analysis to delve deeper into addressing the personality profile was performed. These statistical procedures included one-way ANOVAs between the personality traits and categories for gender, level of education, and choice of major. The results of all the individual ANOVAs are summarized in Table 36 with the subsequent null hypothesis being rejected or accepted. If the null hypothesis is rejected it will be represented by an alternate hypothesis H_1 which contradicts the null hypothesis and states that the independent variable has a significant influence on the dependent variable. Choice of major (STEM or Non-STEM) is represented as COM and level of education (Graduate or Undergraduate) as LOE in Tables 37 and 38.

Table 36

Summary of Null Hypotheses

Dependent Variables	Independent Variables				
	All Students at ISU			Female Students at ISU	
	Gender	COM	LOE	COM	LOE
Extraversion	H_1	H_0	H_1	H_0	H_1
Agreeability	H_1	H_0	H_1	H_0	H_1
Conscientiousness	H_1	H_0	H_1	H_0	H_1
Emotional Stability	H_1	H_1	H_1	H_0	H_1
Intellect/Imagination	H_1	H_1	H_0	H_1	H_0

The mean scores for all students under various categories are summarized in Table 37.

Table 37

Summary of Mean Scores for All Students

	Gender		COM		LOE	
Personality Trait	All	Female	STEM	Non-STEM	Graduate	Under Graduate
Extraversion	31.08	30.65	30.51	31.35	32.12	30.60
Agreeability	39.90	40.74	39.38	40.07	40.81	39.45
Conscientiousness	36.70	36.94	37.02	36.55	37.36	36.39
Emotional Stability	31.14	30.22	31.83	30.77	33.05	30.20
Intellect /Imagination	37.20	36.83	36.53	37.54	37.66	37.00

The mean scores for female students under various categories are summarized in the Table 38.

Table 38

Summary of Mean Scores for Female Students

	COM		LOE	
	STEM	Non-STEM	Graduate	Under Graduate
Extraversion	30.34	30.77	31.54	30.28
Agreeability	40.67	40.77	42.21	40.14
Conscientiousness	37.38	36.77	37.80	36.59
Emotional Stability	30.70	30.03	32.67	29.22
Intellect /Imagination	35.85	37.22	37.02	36.76

CHAPTER 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

The current study investigated the personality traits of students at ISU with a detailed analysis into the influence of gender, choice of major between STEM and non-STEM categories, and level of education on the big five personality traits using the IPIP questionnaire. The study also investigated if choice of major and level of education had any influence on the personality traits of just the female subjects in the study. Again, if personality types are indeed malleable (Hudson & Fraley, 2015; Robert et al., 2006; Specht et al., 2001) having such information may support students, faculty, advisors, and administrators in developing supports to address barriers to student success. The IPIP 50 item questionnaire was used to assess the extraversion, agreeability, conscientiousness, emotional stability, and intellect/imagination scores on a Likert scale. Various descriptive and statistical analyses are performed to obtain details pertaining to personality traits and their relationships. The research questions were formulated to reflect the purpose of this study, which was to identify the Big Five personality traits of students at Indiana State University along with the influence of gender, choice of major, and level of education on each of the Big Five personality traits. These research questions were translated into null hypotheses' addressed by the statistical tests performed on the data. The results thus obtained were systematically tabulated for statistical references.

Discussion and Recommendations

This study was conducted during the fall of 2015 at ISU. All the students enrolled in that semester were sent the questionnaire via emails asking for demographic data along with an IPIP questionnaire to assess the big five personality traits of the respondents. Out of more than 10,000 students who had enrolled, 1743 students completed the survey. After filtering for valid responses, there were 1056 student responses that were used in this study. The intention of the survey was to identify the personality traits of students, especially female students at ISU, and to determine if gender, choice of major among STEM and non-STEM majors, and level of education had any influence in relationship to the big five personality traits for this group of students. The six students with undisclosed sex are not exclusively investigated further as the study focused on female students and all students.

Extraversion

The current study found that gender has a significant influence on ratings associated with extraversion. The null hypotheses for the influence of gender on this personality trait were rejected based on the one-way ANOVA conducted for all subjects. The mean score for all of ISU's subjects ($M = 31.08$, $SD = 7.67$) was significantly different than the mean score for female subjects ($M = 30.65$, $SD = 7.65$). Taken together these results suggest that among the students in fall of 2015, women had a lower extraversion trait rating in comparison with all the students in general.

Similarly, level of education also had a significant influence on extraversion. The null hypothesis for influence of level of education on this personality trait was also rejected based on the one-way ANOVA conducted for all subjects and female subjects alone. This indicates that extraversion scores among graduate students and undergraduate students at Indiana State

University are significantly different. The mean score for graduate subjects (M = 32.12, SD = 7.97) was significantly different from the undergraduate subjects (M = 30.60, SD = 7.49). Specifically, graduate subjects were more extraverted than the undergraduate subjects. Even among female students alone, extraversion presented the same pattern. The mean score for female graduate subjects (M = 31.54, SD = 7.84) was significantly different from the female undergraduate subjects (M = 30.28, SD = 7.55).

Choice of a STEM or non-STEM major did not have a significant influence; therefore, the null hypothesis failed to be rejected. This means that the extraversion aspect is the same in general for students irrespective of their choice of major. STEM students are not more or less outgoing than their non-STEM counterparts, indicating that extroversion is not affected at all by science, technology, engineering or mathematics choices. This pattern also remained consistent when female students were considered exclusively.

Extraversion has been one of the most discussed personality factors and the findings from previous studies on extraversion appear to be rather consistent except for a study conducted by Smart et al. in 1970. Most studies found that extraversion had a significant relationship with achievement and life satisfaction (Hart et al., 2007; Joshanloo & Afshari, 2009; Lounsbury et al., 2009). It was also observed that business majors have high extraversion ratings from a study conducted by Lounsbury et al. (2009). But Smart et al. (1970) in their research found that those who avoided social activities, did not take initiative at social gatherings, and preferred to work alone tended to attain higher achievement. Because the majority of research studies have linked extraversion with success, gauging extraversion rating outcomes from a personality profile and assessing the standard deviation will help guidance counselors or academic advisors in directing the student in a more informed way. This could include providing additional supports to women

who have an interest in STEM and are otherwise well positioned intellectually to succeed. Knowing the extraversion ratings could also help professors in encouraging students not to deviate away from STEM enrollments. Though extraversion ratings are not affected by choice of major, success is linked with higher extraversion ratings. For this reason high performing female students, based on their extraversion scores, can be strongly encouraged to take up STEM fields and persevere towards completion of their STEM degree. The standard deviation for extraversion of female students at ISU is the highest (SD = 7.652) in comparison with other traits. This indicates that the extraversion scores are more spread out implying that female students are all different. Female students may have very low extraversion ratings or very high extraversion ratings. This wide range of extraversion scores call for more detailed understanding of each student's personality profile in order to guide him or her accordingly towards their STEM choices. Female students with a low extraversion rating may need more support and encouragement if they choose or want to persist in their STEM choices as they move toward graduation. Nothing was found in the literature about practical supports that could be offered but this could be a promising avenue for future research.

Agreeability

The results of statistical tests on agreeability ratings revealed similar relationships like that for extraversion ratings. Gender has a significant influence on ratings associated with agreeability. The null hypotheses for the influence of gender on this personality trait were rejected based on the one-way ANOVA conducted for all subjects and for female subjects. The mean score for all of ISU's subjects ($M = 39.90$, $SD = 5.83$) was significantly different than the mean score for female subjects ($M = 40.74$, $SD = 5.61$). This indicates that the agreeability aspect among Indiana State University male students is comparatively and significantly different

from Indiana State University female students that caused the mean for all students to drop. In short, male students seem to have lower levels of agreeability than female students according to their rating outcomes.

Similarly, level of education also had a significant influence on agreeability. The null hypothesis for influence of level of education on this personality trait was also rejected based on the one-way ANOVA conducted for all subjects and for among female subjects. The mean score for graduate subjects (M = 40.81, SD = 5.85) was significantly different than the undergraduate subjects (M = 39.45, SD = 5.78). This indicates that agreeability scores among graduate students and undergraduate students at Indiana State University are significantly different. This pattern remained the same among just the female students, too. The mean score for female graduate subjects (M = 42.21, SD = 5.17) was significantly different than the female undergraduate subjects (M = 40.14, SD = 5.68). Graduate subjects are more agreeable in terms of the trait rating than the undergraduate subjects.

Choice of STEM or non-STEM major did not have a significant influence on agreeability ratings; therefore, the null hypothesis failed to be rejected. This means that the agreeability aspect is the same in general for students irrespective of their choice of major. STEM students are not more or less agreeable than their non-STEM counterparts indicating that agreeability scores were not affected at all by science, technology, engineering or mathematics choices of majors. This pattern also remained consistent when female students were considered exclusively.

Agreeability has a unique position in all of the literature reviewed on the trait. In most cases this personality trait is found to oppose all other personality traits' relationships. For example, Lounsbury et al. (2009) in their study found that agreeability is significantly correlated with life satisfaction and success only among non-business majors while all other personality

traits in the FFM significantly correlated with life satisfaction and success among business majors. Another study by Hart et al., (2007) found that agreeability was negatively associated with extrinsic achievement motivation, which again is contrary to all other personality traits.

In the current study agreeability ratings held a similar position is as extraversion and conscientiousness. Female students at ISU scored the highest mean value ($M = 40.74$) with a standard deviation of 5.614. This indicates that agreeability is the most prominent personality trait found among ISU's female students. As agreeability ratings do not have any significant influence on choice of major, it may not be as useful in helping guidance counselors or academic advisors guide students in regard to entering in STEM fields. But gender and level of education do have a significant influence on agreeability ratings. Higher means on the agreeability ratings of female students and graduate students indicate that they are more agreeable than their counterparts. A high agreeability rating in an undergraduate students' profile could help counselors, academic advisors, and professors motivate the student to advance towards graduate level STEM courses or careers. There were no proven supports in the literature that could help students with high agreeability trait to choose or persist in STEM academic choices. There is scope for future research in finding ways to support such students with high agreeability trait.

Conscientiousness

The results of statistical tests on conscientiousness revealed the same relationships like that for extraversion and agreeability. Gender has a significant influence on conscientiousness ratings. The null hypotheses for the influence of gender on this personality trait were rejected based on the one-way ANOVA conducted for all subjects and for female subjects. The mean score for all of ISU's subjects ($M = 36.70$, $SD = 6.08$) was significantly different than the mean score for female subjects ($M = 36.94$, $SD = 6.14$). At ISU, the mean conscientiousness rating for

female (M = 36.94) and male students (M = 36.13) is very close with female students being slightly higher. Taken together these results suggested that women have a higher level of conscientiousness trait rating in comparison with all students, and also when compared to their male counterparts in general.

Similarly, level of education also had a significant influence on the conscientiousness rating. The null hypothesis for influence of level of education on this personality trait was also rejected based on the one-way ANOVA conducted for all subjects and for female subjects. The mean score for graduate subjects (M = 37.36, SD = 6.29) was significantly different than the undergraduate subjects (M = 36.39, SD = 5.98). Specifically, graduate subjects are more conscientious than the undergraduate subjects in terms of the trait rating. This pattern remained the same among just the female students, too. The mean score for female graduate subjects (M = 37.80, SD = 6.38) was significantly different than the female undergraduate subjects (M = 36.59, SD = 6.00).

Choice of STEM or non-STEM major did not have significant influence on the conscientiousness rating; therefore, the null hypothesis failed to be rejected. This means that the conscientiousness aspect is the same in general for students irrespective of their choice of major. STEM students are not more or less conscientious than their non-STEM counterparts indicating that conscientiousness ratings were not affected at all by science, technology, engineering, or mathematics choices of majors. This pattern also remained consistent when female students were considered exclusively.

In a study conducted by Serdar and Suleyman in 2009, academic success in terms of GPA was positively related with conscientiousness. Hart et al. (2007) studied the relationship between the Big Five and a two-factor model of achievement motivation (intrinsic and extrinsic). The

researchers found that conscientiousness was positively associated with intrinsic achievement motivation and extrinsic achievement motivation. Understanding the conscientiousness rating on a student's profile is highly recommended to motivate them toward academic success. Female students with high conscientiousness rating are more likely to pursue advanced studies as conscientiousness is associated with academic success and has a significant influence on level of education.

Female students with high conscientiousness rating at ISU should be encouraged and supported better to complete their STEM pursuits. The type of supports that could be provided was not found in the literature surrounding this personality trait. Future research to find such support systems could be useful. One of the ways is to provide continuous external motivation to female students already in undergraduate STEM fields to encourage them to complete their degree and continue their education toward graduate studies. Another method would be to educate students with low conscientiousness scores. If they understand the relationship between being organized and success, this could motivate them to learn more about and work on their conscientiousness skills like time management, efficiency, and organization.

Emotional Stability

Results on gender and level of education's influence on emotional stability ratings are similar in nature to those of the extraversion, agreeability, and conscientiousness ratings. Gender has a significant influence on emotional stability. The null hypotheses for the influence of gender on this personality trait were rejected based on the one-way ANOVA conducted for all subjects and for female subjects. The mean score for all of ISU's subjects (M = 31.14, SD = 7.45) was significantly different than the mean score for female subjects (M = 30.22, SD = 7.11). Taken together these results suggested that among the students in fall of 2015, women have a lower

emotional stability trait rating in comparison with all students in general. The mean score for male students ($M = 33.34$) is significantly higher than ISU female students ($M = 30.22$).

Similarly, level of education also had a significant influence on emotional stability. The null hypothesis for influence of level of education on this personality trait was also rejected based on the one-way ANOVA conducted for all subjects and for among female subjects. The mean score for graduate subjects ($M = 33.05$, $SD = 7.22$) was significantly different than the undergraduate subjects ($M = 30.20$, $SD = 7.40$). Graduate students are more emotionally stable than undergraduate students. This pattern remained the same among just the female students too. The mean score for female graduate subjects ($M = 32.67$, $SD = 7.00$) was significantly different than the female undergraduate subjects ($M = 29.22$, $SD = 6.90$).

However choice of STEM or non-STEM major did not have the same influence for female subjects as for their male counterparts. Choice of major had a significant influence on emotional stability among all subjects. But when looked at in regard to the female subjects alone, it did not have a significant influence; therefore, the corresponding null hypothesis failed to be rejected. This means that female subjects did not show any difference in their emotional stability trait ratings with respect to their choice of STEM or non-STEM majors. However, as choice of major had a significant influence on emotional stability ratings for all ISU students, it is possible that male students at ISU are a main factor contributing to this finding. This could be a very promising area to research further if the choice of major and emotional stability ratings among male students alone is related. The mean values of emotional stability seem to further support this initial consideration. The emotional stability mean rating for male students is 33.34 and for female students is 30.22. This difference indicates that emotional stability is a factor that is very much different for male and female students at ISU.

Eysenck (1955) proposed neuroticism along with extraversion and psychoticism as the three super factors. Many recent studies found that this neuroticism or emotional stability aspect in a person plays a major role in their preferences, success, academics, and career. In a study conducted by Serdar and Suleyman in 2009, academic success in terms of GPA was found to be negatively related with neuroticism among the Big Five personality traits among candidates of physical education (Tok & Morali, 2009). Joshanloo and Afshari (2009) investigated the relationship between the Big Five personality traits, self-esteem, and life satisfaction among 235 university students at the University of Tehrain. According to this analysis, among personality traits extraversion and neuroticism significantly predicted life satisfaction. Hart et al. (2007) studied the relationship between Big Five and a two-factor model of achievement motivation (intrinsic and extrinsic) among 777 participants. They found that neuroticism was positively related to extrinsic achievement motivation. Lounsbury et al. (2009) researched data from 347 undergraduate business majors and 2,252 non-business majors at a large Southeastern university. In conclusion, Lounsbury et al. asserted that business majors scored higher for conscientiousness, emotional stability, extraversion, assertiveness, and tough-mindedness while they scored lower on agreeability and openness. All of the traits except for agreeability and tough-mindedness correlated significantly and positively with life satisfaction.

Among students at ISU, emotional stability had the lowest mean both for the full population ($M = 31.21$) and among female students ($M = 30.22$). The standard deviation in both cases is above 7 indicating that the range of values is substantially spread out. This means that students emotional stability may fall anywhere on the three standard deviation range. Students should be educated and encouraged towards their education and career goals keeping this factor in consideration. Anxiety, stress, lack of confidence and fear of failure could be the factors that

contribute to a low emotional stability among students. Coping mechanisms for anxiety, stress, lack of confidence, and fear of failure have to be in place for female students who are struggling to find academic success. Some of the common coping mechanisms include avoiding caffeine, alcohol, and nicotine; getting sufficient sleep, increasing physical activity, managing time, having a daily journal, having a friend of mentor to vent out concerns, taking well balanced meals, meditation, and breathing techniques. Female students with higher emotional stability ratings could be encouraged to enter and persist in STEM majors. Setting role models in STEM fields with similar personality trait ratings could be a practice that will help with extrinsic motivation among female students with low emotional stability ratings.

Intelligence/Imagination

This personality trait has a completely different outcome in comparison to the other traits. Gender has a significant influence on the intellect/imagination rating. The null hypotheses for the influence of gender on this personality trait were rejected based on the one-way ANOVA conducted for all subjects and for female subjects. This indicates that the intelligence/imagination aspect among Indiana State University male students is comparatively and significantly different than Indiana State University female students. Male subjects at ISU (M = 38.07) have higher mean intelligence/imagination rating than their female (M = 36.83) counterparts.

Level of education on the other hand did not have a significant influence on the intellect/imagination rating. The null hypothesis for influence of level of education on this personality trait was accepted based on the one-way ANOVA conducted for all subjects and for female subjects. This indicates that intellect/imagination scores among graduate students and

undergraduate students at Indiana State University are similar with no major differences. This pattern remained the same among just the female students, too.

Choice of STEM or non-STEM major had a significant influence; therefore, the null hypothesis was rejected. This means that the intellect/imagination aspect is different among ISU students as per their choice of major. STEM students have a lower intelligence/imagination mean rating (M = 36.53) than that of non-STEM students (M = 37.54). Individually, STEM students may be more or less intelligent/imaginative than their non-STEM counterparts. This pattern also remained consistent when female students were considered exclusively.

Serdar and Suleyman in 2009 conducted a study regarding academic success. Within their study, GPA was positively related with openness to experience. Other studies (Hart, et al., 2007; Joshanloo & Afshari, 2009; Lounsbury et al., 2009) indicated that openness/imagination/intellect may not be a prime personality trait, but does show a positive influence on success. At ISU, it was found that the standard deviation of this trait is the lowest both for total population (SD = 5.267) and for female population (SD = 5.268). This indicates that most subjects are close to the group's mean value in comparison to other traits. Female students (M = 36.83) at ISU showed lower intelligence /imagination rating means than male students (M = 38.07).

Female students need to be supported with additional aids and motivation to help them persist and complete their STEM degrees. There is no evidence of any known methods of supporting students with low intelligence to help succeed in STEM fields. But experiential learning is known to help students' imagination and openness. Professors could revamp their subject delivery techniques to include more experiential learning components. This could increase the intelligence/imagination ratings of the class to some extent. Female students with

high intelligence ratings could be strongly encouraged to take up STEM fields. Investigation into the supports that could help female students persist and complete STEM degrees would be an area for future research.

Recommendations for Future Research

This study is conducted in Indiana State University is only descriptive of the personality traits and relationships between the big five personality traits with respect to gender, choice of major and level of education. The following could be possibilities for future research.

This study can be expanded across universities that have a focus on learning about their students' personality profiles, relationships among and between gender and choices of major. Comparison between personality profiles of students from universities with similar demographics could be useful.

This study can also be replicated to staff and faculty in learning their personality profiles and finding if their personality traits are markedly different from students entering their classes. Knowing the profiles of students entering their classes will help the instructor understand how he or she should modify the instruction and carry on with interactions. Personality profiling of staff and faculty categorized by STEM and non-STEM affiliation could also be useful in that knowing their own profile may help staff and faculty recognize similarities and differences with students. Such could provide a means for increasing sensitivity and appropriate response to difference.

Finding personality profiles of successful people in the STEM fields is another area that could be researched. Such studies would help form role models. Students can draw inspiration from their role models and also look into the personality trait ratings of their role models to enhance external motivation. This could also have a counter effect if the students do not find any role models that match their personality profiles.

Based on the personality trait ratings, students can be offered support mechanisms to counterbalance any of their personality trait related constraints that could be restricting their chances of success. As there is no evidence of any such specific support mechanisms, this area has a scope for further research. Conducting qualitative studies to find support mechanisms that can help students cope with the personality traits that are counterproductive to their academic success may be useful.

Personality profiling could also assist in designing the curriculum that best supports the incoming students based on their personality profiles. If the student personality profiles change sufficiently each year, it could be challenging to adapt the curriculum and course delivery methods every year. It is also possible for advisors/professors to develop passive bias towards certain students based on their personality profiles, which could cause integrity issues.

Chapter Summary

This chapter provided a comprehensive summary of the study and its analysis followed by a detailed discussion for each of the five personality traits under the FFM. For each personality trait, an indepth discussion of findings in light of the knowledgebase was offered. Recommendations for practice were considered. Possibilities for future research from this study's outcomes include expanding the study to include the faculty and staff population, performing this study across more universities and educational institutions, and including successful STEM role models with their personality profiles in the research.

The study provided a comprehensive review of the personality profiles of students at ISU, and female students in particular. Though there are not marked differences overall between men and women's personality profiles, they do have some acute differences and apparent similarities in their profiles. Among the five personality traits, subjects showed more agreeability than any

other trait. Agreeability was the leading trait even among female subjects. However, the order of the other four traits slightly varied for the entire subject population when compared to female subjects only. Female students comprised of 70.5% of the total population and hence there was not a great difference in the personality profile of the subject pool. Female students at ISU scored higher on conscientiousness and emotional stability when compared to intellect and extraversion with their male counterparts. The personality profile of all subjects in the descending order of the mean scores was agreeability, intellect/imagination, conscientiousness, emotional stability, and extraversion. The personality profile of female subjects in descending order of the mean scores is agreeability, conscientiousness, intellect/imagination, and extraversion followed by emotional stability. Gender did have a significant influence on all of the big five personality traits. STEM or non-STEM choice of major however did not influence extraversion, agreeability and conscientiousness for all the subjects and for the female subjects. Graduate and undergraduate level of education significantly influenced extraversion, agreeability, conscientiousness and emotional stability for both male and female subjects. Level of education had no influence on intellect/imagination trait for any of the subjects.

Multiple one-way ANOVA's revealed the big five personality traits are not uniform through the length and breadth of the sample by various categorizations. These predictors, though limited by their significance level, may provide a clue to the type of personalities by categories like gender, level of education, and choice of major. This in turn will help faculty and staff prepare appropriately to address and deliver the best for their students' personality profiles.

The study was successful in identifying the personality profiles of the subjects in the sample, that of the female subjects in the sample and also in identifying the relationships between gender, choice of STEM or non-STEM major, level of education on the Big Five

personality traits. ISU professionals can use this personality profiling to understand their students better and give guidance in motivating them towards retention in their choice of majors. Among female students it is observed that intelligence/imagination plays a crucial role affecting their choice of major. Hence, guidance counselors, academic advisors, and mentors can use the personality profiles of female students to encourage them appropriately toward pursuing higher education in STEM fields. Female students with lower intelligence/imagination ratings will need more extrinsic motivation to enter STEM fields. Those female students that have chosen STEM fields will need to be given well-considered support to help them persist until completion.

Finally, recommendations for practice specific to each personality trait was made that could be directly applied at ISU. Female students with low extraversion trait should be provided with constant motivation and guidance to help them graduate. Female students with high agreeability ratings should be encouraged to advance towards graduate level STEM courses or careers. Female students with low conscientiousness scores should be given additional training to help them understand the importance of being organized and its relationship to academic success. This will help them get motivated to work on their conscientiousness skills like time management, efficiency and organization. The university should arrange workshops for students to enhance such skills. Female students with higher emotional stability ratings should be encouraged to enter and persist in STEM majors. While students with low emotional stability ratings should be given more counselling and be provided with support mechanisms to help them manage the issues surrounding emotional stability. Incorporating experiential learning techniques into the curriculum would help students with low imagination/intelligence ratings persist and complete their STEM commitments.

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APPENDIX A: EMAIL COMMUNICATIONS

An email to Mr. Nolan Davis, Interim Vice President for Student Affairs and Dean of Students was sent on April 20th, 2015 requesting to conduct a survey involving students at ISU for the purpose of the current study. Below is the email sent:

> ***From:*** *Sowmya Challa [mailto:schalla@sycamores.indstate.edu]*
> ***Sent:*** *Monday, April 20, 2015 8:01 PM*
> ***To:*** *Nolan Davis*
> ***Cc:*** *Susan Kiger*
> ***Subject:*** *Permission to conduct your research . . . FW: researcher wanting to survey ISU students*
>
> *Dear Mr Davis,*
>
> *I am Sowmya Challa, a Ph.D candidate at ISU working towards preparing a dissertation proposal. I hope you remember me. I was the Graduate Student Association President for 2011 -12 and was on Diversity Council and Assessment Council the same years.*
>
> *After a few major modifications as recommended by my dissertation Committee chair Dr. Susan Kiger, my dissertation proposal draft is now in good shape to be presented sometime soon. However, I still have a few things to be checked off in my to do list in this regard. One of which is to get a general assent from you to send out surveys and get data from currently enrolled students at ISU. I will also be sending my material requesting IRB approval in next few days appropriately.*
>
> *I want to research on the personality traits of students at ISU with keen interest on comparing and finding similarities and dissimilarities between and among STEM (Science, Technology, Engineering and Mathematics) cohorts and others. I have attached the latest version of my dissertation proposal draft for your reference. This study would be valuable to ISU and peer institutions that can compare with ISU in demographics in understanding the personality traits of their student body. This in turn could open doors to much more informed academic advising, greater understanding of personality traits of students and their choice of majors.*
>
> *I humbly request you to consider the value of this study and provide a general assent for my work to commence. I would be glad to hear your suggestions and any input in regards*

to my study.

Have a great day!

Sowmya Challa.

On April 22nd, 2015 a response indicating permission has been received from Mr. Nolan Davis via email below.

From: *Nolan Davis <Nolan.Davis@indstate.edu>*
Subject: RE: Permission to conduct your research . . . FW: researcher wanting to survey ISU students
Date: *April 21, 2015 at 10:09:55 AM CDT*
To: *Sowmya Challa <schalla@sycamores.indstate.edu>*
Cc: *Susan Kiger <Susan.Kiger@indstate.edu>, Brooks Moore <Brooks.Moore@indstate.edu>*

Hi Sowmya,

Your topic sounds very valuable to higher education.
Once you get approval from the IRB, please send it to me.
Brooks Moore will then help you to connect with students who may wish to participate.
Nolan.

Nolan L. Davis
Interim Vice President for Student Affairs
and Dean of Students
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I*ndependence*
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S*uccess*
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APPENDIX B: IPIP ITEMS AND THEIR SCORING

The number of items per pole by factor number i.e., the number of items keyed in the positive and negative ways for each construct measured by the IPIP instrument are:

I. Extraversion
- + Keyed:
  - Am the life of the Party.
  - Feel comfortable around people.
  - Start conversations.
  - Talk to a lot of different people at parties.
  - Don't mind being the center of attention.
- - Keyed:
  - Don't talk a lot.
  - Keep in background.
  - Have little to say.
  - Don't like to draw attention to myself.
  - Am quiet around strangers.

II. Agreeability
- + Keyed:
  - Am interested in people.
  - Sympathize with others' feelings.
  - Have a soft heart.
  - Take time out for others.
  - Feel others' emotions.
  - Make people feel at ease.
- - Keyed:
  - Am not really interested in others.
  - Insult people.
  - Am not interested in other people's problems.
  - Feel little concern for others.

III. Conscientiousness
- + Keyed:
  - Am always prepared.
  - Pay attention to details.
  - Get chores done right away.
  - Like order.
  - Follow a schedule.

Am exacting in my work.

- Keyed:

Leave my belongings around.
Make a mess of things.
Often forget to put things back in their proper place.
Shirk my duties.

IV. Emotional Stability

+ Keyed:

Am relaxed most of the time.
Seldom feel blue.

- Keyed:

Get stressed out easily.
Worry about things.
Am easily disturbed.
Get upset easily.
Change my mood a lot.
Have frequent mood swings.
Get irritated easily.
Often feel blue.

V. Intellect or Imagination

+ Keyed:

Have a rich vocabulary.
Have a vivid imagination.
Have excellent ideas.
Am quick to understand things.
Use difficult words.
Spend time reflecting on things.
Am full of ideas.

- Keyed:

Have difficulty understanding abstract ideas.
Am not interested in abstract ideas.
Do not have a good imagination.

The scoring for each of these keys will be according to the answer choices as follows:

		Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree	
+	Am the life of the party	1	2	3	4	5	Extraversion
+	Feel comfortable around people	1	2	3	4	5	
+	Start conversations	1	2	3	4	5	

+	Talk a lot with different people at parties	1	2	3	4	5	
+	Don’t mind being the center of attention	1	2	3	4	5	
-	Don’t talk a lot	5	4	3	2	1	
-	Keep in the background	5	4	3	2	1	
-	Have little to say	5	4	3	2	1	
-	Don’t like to draw attention to myself	5	4	3	2	1	
-	Am quiet around strangers	5	4	3	2	1	
+	Am interested in people	1	2	3	4	5	
+	Sympathize with others feelings	1	2	3	4	5	
+	Have a soft heart	1	2	3	4	5	
+	Take time out for others	1	2	3	4	5	
+	Feel others emotions	1	2	3	4	5	Agreeability
+	Make people feel at ease	1	2	3	4	5	
-	Am not really interested in others	5	4	3	2	1	
-	Insult people	5	4	3	2	1	
-	Am not interested in other people's problems	5	4	3	2	1	
-	Feel little concern for others	5	4	3	2	1	
+	Am always prepared	1	2	3	4	5	
+	Pay attention to details	1	2	3	4	5	Conscientiousness
+	Get chores done right away	1	2	3	4	5	
+	Like order	1	2	3	4	5	
+	Follow a schedule	1	2	3	4	5	
+	Am exacting in my work	1	2	3	4	5	

-	Leave my belongings around	5	4	3	2	1
-	Make a mess of things	5	4	3	2	1
-	Often forget to put things back in their proper place	5	4	3	2	1
-	Shirk my duties	5	4	3	2	1
+	Am relaxed most of the time	1	2	3	4	5
+	Seldom feel blue	1	2	3	4	5
-	Get stressed out easily	5	4	3	2	1
-	Worry about things	5	4	3	2	1
-	Am easily disturbed	5	4	3	2	1
-	Get upset easily	5	4	3	2	1
-	Change my mood a lot	5	4	3	2	1
-	Have frequent mood swings	5	4	3	2	1
-	Get irritated easily	5	4	3	2	1
-	Often feel blue	5	4	3	2	1
+	Have a rich vocabulary	1	2	3	4	5
+	Have a vivid imagination	1	2	3	4	5
+	Have excellent ideas	1	2	3	4	5
+	Am quick to understand things	1	2	3	4	5
+	Use difficult words	1	2	3	4	5
+	Spend time reflecting on things	1	2	3	4	5
+	Am full of ideas	1	2	3	4	5
-	Have difficulty in understanding abstract ideas	5	4	3	2	1

-	Am not interested in abstract ideas	5	4	3	2	1
-	Do not have a good imagination	5	4	3	2	1

APPENDIX C: ACTUAL SURVEY SAMPLE

Big Five Personality Survey at Indiana State University

You are invited to participate in a research study about personality traits of students at Indiana State University. The intent of the study is to understand relationships between personality traits of students and choice of major. This study is conducted by Sowmya Challa, as a part of the requirement for the PHD degree at Indiana State University.

The survey is anonymous. Your participation in this study is voluntary. You may withdraw from participation at any time by simply choosing not to complete the survey and closing the browser. You are free to decline to answer any particular question you do not wish to answer for any reason.

There are no known risks and no costs to you if you decide to participate in this research study. The survey takes an average of 7 minutes to complete. The information you provide will help in identifying more ways to retain students in fields related to science, technology, engineering and mathematics. However, the information collected may not benefit you directly.

Individuals from the Institutional Review Board may inspect these records. The survey does not collect any individually identifiable information or IP addresses. Should the data be published, no individual information will be disclosed at any point of time.

Your answer to the first question indicates your consent that you are voluntarily agreeing to participate.

If you have any questions about your rights as a research subject or if you feel you've been placed at risk, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN, 47809, by phone at (812) 2378217, or by email at irb@indstate.edu.

Q1.2. **Would you like to complete the survey?**

Yes
No - I choose to exit the survey

Q1.3. Indicate your sex
Man
Women

Q1.4. Indicate the level of education you are pursuing at Indiana State University
Bachelors
Master's
Specialist
Doctoral
Other

Q1.5. How many credit hours have you successfully completed?
0 - 29 (Freshman)
30- 45 (Sophomore)
46 - 59 (Sophomore)
60 - 89 (Junior)
90 or above (Senior) Graduate Hours

Q1.6. Indicate your choice of major.
Accounting (B.S.)
Adult and Career Education (B.S.)
African and African American Studies (B.A., B.S.)
Architectural Engineering Technology (B.S.)
Art Education All Grade (B.A.)
Art with 2D Arts, 3D Arts, Graphic Design, and Intermedia Concentrations (B.A.)
Art with Art History Concentration (B.A.)
Athletic Training (B.S.)
Automation and Control Engineering Technology (B.S.)
Automotive Engineering Technology (B.S.)
Aviation Management (B.S.)
Biology (B.A., B.S.)
Biology with Medical Laboratory Science Specialization (B.S.)
Business Administration (B.S.)
Business Education (B.S.)
Chemistry (B.A., B.S.)
Civil Engineering Technology (B.S.)
Communication (B.A., B.S.)
Computer Engineering Technology (B.S.)
Computer Science (B.S.)
Construction Management (B.S.)
Criminology and Criminal Justice (B.A., B.S.)

Earth and Environmental Sciences (B.A., B.S.)
Economics (B.A., B.S.)
Electronics Engineering Technology (B.S.)
Elementary Education (B.A., B.S.)
Engineering Technology (B.S.)
English (B.A., B.S.)
English Teaching (B.A., B.S.)
Finance (B.S.)
Financial Services (B.S.)
Fine Arts (B.F.A.)
Food and Nutrition with Dietetics Option (B.S.)
Food and Nutrition with Food Service Management Option (B.S.)
General Studies (B.A./B.S.)
Health Sciences (B.S.)
Health Services (B.A.S.)
History (B.A., B.S.)
Human and Environmental Systems (B.A., B.S.)
Human Development and Family Studies (B.S.)
Human Resource Development for Higher Education and Industry (B.S.)
Information Technology (B.S.)
Insurance and Risk Management (B.S.)
Interior Architecture Design (B.S.)
Language Studies (B.A.)
Language Studies Teaching (B.A.)
Legal Studies (B.A., B.S.)
Management (B.S.)
Management Information Systems (B.S.)
Manufacturing Engineering Technology B.S.
Marketing (B.S.)
Mathematics (B.A., B.S.)
Mathematics Teaching (B.A., B.S.)
Mechanical Engineering Technology (B.S.)
Multidisciplinary Studies (B.A., B.S.)
Music Composition (B.M.)
Music Education (B.M.E.)
Music Liberal Arts (B.A., B.S.)
Music Performance (B.M.)
Music with Merchandising or Business Administration Concentrations (B.S.)
Nursing: Accelerated Second Degree (B.S.)
Nursing: L.P.N./L.V.N. to B.S. Track
Nursing: R.N. to B.S. Track
Nursing: Traditional Track for Students without R.N. or L.P.N. Licensure (B.S.)

Operations and Supply Chain Management (B.S.)
Packaging Engineering Technology (B.S.)
Philosophy (B.A., B.S.)
Physical Education All Grade (B.S.)
Physical Education—Exercise Science (B.A., B.S.)
Physics (B.A., B.S.)
Political Science (B.A., B.S.)
Pre-Dentistry
Pre-Engineering
Pre-Law
Pre-Medicine
Pre-Optometry
Pre-Pharmacy
Pre-Veterinary
Professional Aviation Flight Technology (B.S.)
Psychology (B.A., B.S.)
Recreation and Sport Management (B.S.)
Safety Management (B.S.)
Science Education (B.A., B.S.)
Social Studies Education (B.A., B.S.)
Social Work (B.S.W.)
Special Education (B.A., B.S.)
Speech-Language Pathology (B.A., B.S.)
Technology (B.A.S.)
Technology and Engineering Education (B.S.)
Technology Management (B.S.)
Textiles, Apparel, and Merchandising (B.A., B.S.)
Theater (B.A., B.S.)
Unmanned Systems (B.S.)
Not in the list / Not yet decided

Q1.7. Indicate your choice of major
Art Studio (M.A.)
Athletic Training (M.S.)
Biology with Thesis (M.S.)
Biology without Thesis (M.S.)
Business Administration (M.B.A.)
Career and Technical Education (M.S.)
Clinical Mental Health Counseling (M.S.)
Communication (M.A.)
Computer Science (M.S.)
Criminology and Criminal Justice (M.A.)

Criminology and Criminal Justice (M.S.)
Curriculum and Instruction (M.Ed.)
Earth and Quaternary Sciences: Non-Thesis Option (M.S.)
Earth and Quaternary Sciences: Thesis Option (M.S.)
Educational Technology (M.S.)
Electronics and Computer Technology (M.S.)
Elementary Education (M.Ed.)
English (M.A.)
Family and Consumer Sciences: Dietetics Specialization (M.S.)
Fine Arts (M.F.A.)
Genetic Counseling (M.S.)
Geography (M.A.)
Health Sciences (M.S.)
History (M.A.)
History (M.S.)
Human Resource Development for Higher Education and Industry (M.S.)
Mathematics (M.A.)
Mathematics (M.S.)
Music (M.M.)
Nursing (M.S.)
Occupational Safety Management (M.A., M.S.)
Occupational Therapy (M.S.)
Physical Education: Coaching (M.A., M.S.)
Physical Education: Exercise Science (M.A., M.S.)
Physician Assistant Studies (M.S.)
Psychology: General (M.A., M.S.)
Public Administration (M.P.A.)
Recreation and Sport Management (M.S.)
School Administration and Supervision (M.Ed.)
School Counseling (M.Ed.)
Social Work (M.S.W.)
Special Education (M.S.)
Speech-Language Pathology (M.S.)
Student Affairs and Higher Education (M.S.)
Technology Management (M.S.)
TESL/Language Studies (M.A.)
Not in the list / Not yet decided

Q1.8. Indicate your choice of major
Athletic Training (DAT)
Biology: Ecology (Ph.D.)
Biology: Microbiology (Ph.D.)
Biology: Physiology (Ph.D.)

Clinical Psychology (Psy.D.)
Curriculum and Instruction (Ph.D.)
Educational Administration (Ph.D.)
Guidance and Psychological Services: School Psychology (Ph.D.)
Health Sciences (D.H.Sc.)
Nursing (D.N.P.)
Physical Therapy (D.P.T.)
Spatial and Earth Sciences (Ph.D.)
Technology Management (Ph.D.)
Not in the list / Not yet decided

Personality Trait Related Questions

Q2.1.

The next set of questions are random statements about personality, attitudes and behavior. There are no right or wrong answers. You may choose the option that is true for you or according to you.

Q2.2. I am the life of the party
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.3. I feel comfortable around people
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.4. I easily start conversations
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.5. I talk a lot with different people at parties
Strongly Disagree
Disagree
Neither Agree nor Disagree

Agree
Strongly Agree

Q2.6. I don't mind being the center of attention
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.7. I don't talk a lot
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.8. I usually keep in the background
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.9. I feel I have little to say
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.10. I don't like to draw attention to myself
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.11. I am quiet around strangers
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.12. I am generally interested in people
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.13. I sympathize with others feelings
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.14. I have a soft heart
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.15. I take time out for others
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.16. I feel others emotions
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.17. I make people feel at ease
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.18. I am not really interested in others

Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.19. I tend to insult people
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.20. I am not interested in other people's problems
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.21. I feel little concern for others
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.22. I am always prepared
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.23. I pay attention to details
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.24. I get chores done right away
Strongly Disagree

Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.25. I like order
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.26. I follow a schedule
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.27. I am usually exacting in my work
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.28. I tend to leave my belongings around
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.29. I make a mess of things
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.30. I often forget to put things back in their proper place
Strongly Disagree
Disagree
Neither Agree nor Disagree

Agree
Strongly Agree

Q2.31. I tend to shirk my duties
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.32. I am relaxed most of the time
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.33. I seldom feel blue
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.34. I get stressed out easily
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.35. I worry about things
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.36. I am easily disturbed
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.37. I get upset easily
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.38. I tend to change my mood a lot
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.39. I have frequent mood swings
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.40. I get irritated easily
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.41. I often feel blue
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.42. I have a rich vocabulary
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.43. I have a vivid imagination

Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.44. I have excellent ideas
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.45. I am usually quick to understand things
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.46. I tend to use difficult words
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.47. I often spend time reflecting on things
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.48. I am full of ideas
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.49. I have difficulty understanding things

Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.50. I am usually not interested in abstract ideas
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree

Q2.51. I do not have a good imagination
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree