Domain-Specific Creativity and Vocational Interests: How Do Creativity and Related Factors Relate to Vocational Interests and Different Latent RIASEC Profiles?

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Creativity has tremendous potential as a key element in better understanding students’ vocational interests and preparing students for successful careers. However, the relationship between creativity and vocational interest has yet to be fully studied. Two questions were thus proposed: (1) Can potential predictors (demographics, academic achievements, domain-general and domain-specific creativity factors, and the interactions between gender and creativity-related factors) significantly predict vocational interests as derived from Holland’s RIASEC Model (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) and (2) do domain-general (e.g., creativity self-efficacy) and domain-specific (e.g., STEM, art, and writing) creativity factors exhibit differential mean levels across distinct latent vocational profiles?

This dissertation drew on a dataset that collected 4,052 valid responses from grade 9 to 12 students who registered with American College Testing (ACT) in the United States for the June 9, 2018 national test date. A series of Hierarchical Linear Regression analyses were conducted to answer the first question, whereas Latent Profile Analysis (LPA) and univariate ANOVA analyses were used to answer the second question. The findings of the regression analyses indicated that gender and ACT score were better predictors of vocational interests than ethnicity and GPA. Creativity-related factors provided more significant changes in variance in vocational interests than did demographics and academic achievements. Although interaction factors indicated only small changes in variance, some significant effects were found when
predicting Realistic, Investigative, Artistic, Social, and Conventional interests. Compared to other interests, Artistic was best explained by creativity-related factors.

For question two, LPA generated eight different groups of interest profiles: Disinterested All, Interested-Social-Enterprising, Interested-Social,Interested-All, Neutral, Interested-Investigative-Social, Disinterested-Realistic-Conventional-Enterprising, and Disinterested-Realistic-Investigative-Artistic. Follow-up post-hoc multiple comparisons analysis showed that the Neutral profile and the three disinterested-related profiles received lower scores on all creativity-related measures and the profile of Interested-All provided the highest scores. Among the three Interested-Social related profiles, domain-specific creativity factors provided more differentiated interpretation than domain-general creativity. The core results emphasized the importance of integrating vocational interests and domain-specific creativity. These findings can be useful for assisting students, educational practitioners, and career counselors to understand personal interests, develop vocational education, and provide more accurate occupational guidance.
Domain-Specific Creativity and Vocational Interests: How Do Creativity and Related Factors Relate to Vocational Interests and Different Latent RIASEC Profiles?

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Doctor of Philosophy Dissertation

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION TO THE STUDY 1

Background of the Problem 1
Research Questions 3
Summary of Methods and Analyses 5
Significance of the Study 7
Chapter Summary 7

CHAPTER 2: REVIEW OF LITERATURE 8

Vocational Interests 8
The History of Vocational Interest and Measurements 8
Holland RIASEC, the Expanded Models, and Current Measurements 10
Potential Factors Correlated with Vocational Interests 13
Gender and Ethnicity Factors 13
Academic Achievement 14
Personality and RIASEC 15
Creativity 16
Definition and the Domain-general verses Domain-specific Debate 16
Theoretical Frameworks on Creativity-Interest Integration: APT and RIASEC 18
Vocational Interests and Domain-general and Domain-specific of Creativity 20
Creativity and Profiles in Vocational Interests 22
Chapter Summary 23

CHAPTER 3: RESEARCH METHODS 25
Methods

Participants

Instruments

Data Analyses

Research Question 1

Research Question 2

CHAPTER 4: RESULTS

Research Question One

Descriptive Statistics

RQ1.1

RQ1.2

Research Question 2

LPA Results

Profile Interpretation

RQ2.1 and RQ2.2

CHAPTER 5: DISCUSSION AND IMPLICATIONS

Summary of Findings

Research Question 1

Research Question 2

Discussion

Demographic and Academic Achievements Predictors

Artistic – The Type of Interest Best Explained by Creativity

Intellect and Openness
Creativity Self-efficacy, STEM, Writing, and Art creativity 62

Interested-Social Related Profiles and Disinterested-Realistic Related Profiles 64

Implications, Limitations, and Future Perspectives 65

Conclusion 69

References 70

Appendices 77

Appendix A: Summary of the Population and Sample 77

Appendix B: List of Factors and Items 80
LIST OF TABLES

Table 4.1. Descriptive Statistics for the Outcome Variables 31
Table 4.2. Descriptive Statistics for the Predictor Variables 31
Table 4.3. Wave 1 Correlation Coefficients Table 33
Table 4.4. Wave 2 Correlation Coefficients Table 34
Table 4.5. Wave1 Results of Hierarchical Regression Analyses for Vocational Interests 41
Table 4.6. Wave2 Results of Hierarchical Regression Analyses for Vocational Interests 47
Table 4.7. Latent Profile Analysis Model Fit Statistics. 48
Table 4.8. Classification Posterior Probabilities for the Eight-Profile Solution. 49
Table 4.9. Estimated Average RIASEC Scores Across Profiles 50
Table 4.10. Means, Standard Deviations, and ANOVA Comparison of Eight Profiles on Wave 1 and Wave 2 Creativity Related Variables 54
LIST OF FIGURES

Figure 2.1. RIASEC Hexagonal Model Adapted from Holland (1997, p.6) 11

Figure 2.2. Holland’s RIASEC and Prediger’s Two Dimensions by ACT (figure and descriptions adapted from ACT, 2009a, p. 3; ACT, 2009b; Holland, 1997, p. 30) 12

Figure 4.1. Gender*CSE Interaction Effect on Realistic 36
Figure 4.2. Gender*INT Interaction Effect on Realistic 37
Figure 4.3. Gender*OPE Interaction Effect on Investigative 38
Figure 4.4. Gender*INT Interaction Effect on Social 39
Figure 4.5. Gender*CSE Interaction Effect on Conventional 40
Figure 4.6. Gender*WRTC Interaction Effect on Investigative 43
Figure 4.7. Gender*ARTC Interaction Effect on Artistic 44
Figure 4.8. Gender*ARTC Interaction Effect on Social 45
Figure 4.9. Trend Lines of BIC and SABIC 48
Figure 4.10. Box Plot of Log Likelihood 49
Figure 4.11. RIASEC Variable Actual Means Across the Eight Vocational Interest Profiles. 51
Figure 4.12. Standardized Means of Wave 1 Five Creativity Related Factors Across the Eight Profiles 55
Figure 4.13. Standardized Means of Wave 2 Four Creativity Related Factors Across the Eight Profiles 55
CHAPTER 1: INTRODUCTION TO THE STUDY

Background of the Problem

New technologies are continuously redefining the world we live in, including the areas of study and work. It has become harder for students to deal with the stress of vocational decisions because schools are preparing students for careers that may not even exist yet. In addition, the workplace is hiring people with diverse knowledge, work, and cultural backgrounds to respond to rapidly changing industries (Holinger et al., 2017). Understanding how personal interests intersect with different fields or careers has become more and more important when choosing a potential college major, a first job after graduation, or even a long-term career path. Moreover, creativity, as a 21st century skill that students need to master to work and live successfully, should be called upon as a key element to prepare students for future careers in the 21st century workforce (Trilling & Fadel, 2009).

“What do I want to be when I grow up?” “How do I know if I like or dislike a college major?” “How should I choose my job?” To answer these questions, many measures have been developed to help students make decisions about their careers over the last century (Educational Test Service [ETS], 1961; Strong, 1927, 1933). Today, Holland’s (1973, 1985, 1997) RIASEC Model of Personal Interests is one of the most widely used models to measure people’s degree of interest across six different vocational types – Realistic (e.g., agriculture or industrial vocations that involve working with tools or machines), Investigative (e.g., science or technology), Artistic (e.g., working with visual or verbal aesthetic ideas), Social (e.g., working with people to provide services, education, or related offerings), Enterprising (e.g., business or marketing involving leading or persuading other people), and Conventional (e.g., routine work, such as organizing or tracking information as an accountant or clerk), hereafter collectively referred to as RIASEC.
Although the commonly used interest assessments have demonstrated strong predictive validity in the past century, new changes and challenges have arisen in recent years (Tracey, 2012). Researchers today are looking for more combinations of interest types as they consider both “like” and “dislike” dimensions. Meanwhile, the profile characteristics of interests are needed for more accurate and individualized interpretations (Prediger & Vansickle, 1992; Tracey, 2002).

There are similarities between the structure of creativity and personal interests in careers, however creativity’s relationship across different vocational interests has not been studied in much detail. Studies on the relationship between creativity and interests suggest creativity across different career domains (e.g., STEM, Arts, Business) can map onto different vocational interest types (Kaufman et al., 2013). For example, the Amusement Park Theory (APT; Baer & Kaufman, 2005, 2017; Kaufman & Baer, 2004) offers a structure that is comparable to Holland’s theory in that both models include personal traits (such as personality and motivation), the environment, and the interaction between people and their environment (Holland, 1997; Kaufman, 2016). The role of specific domains of creativity, such as creativity in the arts, the sciences, or writing (as opposed to domain-general creativity, such as divergent thinking or creative self-efficacy) has not been fully examined. There was a hypothesis from Holland et al. (1991) that the interests related to creativity from greatest to least would be Artistic (A), Investigative (I), Social (S), Enterprising (E), Realistic (R), and Conventional (C). However, studies across the field of interests and domains of creativity are weighted toward interests in the sciences and the arts (Investigative and Artistic), often ignoring other specific types of careers (e.g., business, social service, education, and law).

Furthermore, few works have examined individuals differentiated by interests according to the RIASEC profile patterns. For example, does an individual show interest in a single type of
career (e.g., they are only interested in an Investigative type of career, like math or physics) or in multiple types (e.g., they are interested in Investigative and Artistic types of careers, like biology and music)? No studies have focused on students who rate similarly across interests (e.g., they have high, neutral, or low ratings on everything) or who dislike certain types of interests (e.g., they dislike Realistic, Enterprising, and Conventional and report neutral on everything else). How are these groups of people with different combinations of personal interests differentiated and how do the factors of domain-specific creativity discriminate between them?

The need to develop a better approach to explaining personal interests in careers is evident in students’ career development, especially in high school education. From longitudinal studies, early adolescence could provide a vague prediction of adult vocational-interest patterns (Lubinski et al., 1995). In late adolescence and early adulthood (i.e., students in grade 11 and 12), individuals start to develop generally stable interests as compared to younger students that eventually provides valuable resources for college planning (Xu & Tracey, 2016). Before applying to college, students need to be in touch with their interest in possible future majors and career choices. Therefore, the goal of this study is to better explain and predict types of vocational interests, examine the role of creativity factors, and explore the effect of the interaction between gender and creativity factors. This study will also develop a new way of describing individuals with profiles on the basis of their interest patterns and creativity. Finally, this study will provide possible practical use for high school students and future perspectives for vocational practitioners, educators, and researchers.

**Research Questions**

Taking into consideration the importance of exploring the role of creativity in predicting vocational interests and investigating profiles of vocational interest, this study seeks to address
the following research questions. The first question investigated the relationship between predictors (demographics, academic achievements, and creativity related factors) and the outcomes (six types of vocational interests). The second question discerned kinds of distinct characteristics within different creativity factors performed by profiles based on RIASEC interest scores.

*Research question one, Wave 1 (RQ1.1).* Can demographic factors and academic achievements (gender, ethnicity, GPA, and ACT_C), domain-general creativity and personality-related factors (Creativity Self-efficacy, Intellect, Openness, Academic, and Art), as well as the interaction between gender and these areas of creativity, significantly predict the six types of vocational interests?

*Research question one, Wave 2 (RQ1.2).* Can demographic factors and academic achievements (gender, ethnicity, GPA, and ACT_C), environment and domain-specific creativity factors (School Environment of Creativity, STEM creativity, Writing Creativity, and Art Creativity), as well as the interaction between gender and these areas of creativity, significantly predict the six types of vocational interests?

*Research question two, Wave 1 (RQ2.1).* Is there evidence that domain-general creativity and personality-related factors (Creativity Self-efficacy, Intellect, Openness, Academic, and Art) exhibit differential mean levels across the latent vocational interest profiles generated from RIASEC scores?

*Research question two, Wave 2 (RQ2.2).* Is there evidence that environment and domain-specific creativity factors (School Environment of Creativity, STEM creativity, Writing Creativity, and Art Creativity) exhibit differential mean levels across the latent vocational interest profiles generated from RIASEC scores?
For RQ1, the differences between females and males, and each ethnic group, are not expected to be significant (Ivcevic & Kaufman, 2013; Kaufman, 2010). However, it is possible they will relate differently to specific aspects of creativity or other factors. The evidence from prior studies suggest complex results; it is possible that different groups may have different strategies on creativity self-rating than others. Thus, we anticipated that adding creativity factors and the interactions between gender and creativity factors can improve the model of predicting interest on six different vocational types.

For RQ2, many studies of creativity in different types of college majors suggested that students in Investigative and Artistic majors scored higher on self-assessed creativity than Realistic and Social (Kaufman et al., 2013). For divergent thinking, Artistic majors scored higher than non-artistic majors (Silvia et al., 2008).

Summary of Methods and Analyses

The target population consisted of students from grades 9 to 12 who registered for the American College Testing (ACT) in the United States for the June 9, 2018 national test date. The survey was sent to a sample of 35,000 students randomized into one of two groups (Wave 1 and Wave 2), with each group receiving different survey items. This dissertation draws on a dataset collected of 4,052 valid responses, with 2,444 in Wave 1, and 1,608 in Wave 2. See Appendix A for a summary of descriptive statistics by the population, sample, and by the two Waves.

Instruments for Personal Vocational Interests and Creativity

The Unisex Edition of the ACT Interest Inventory, High School Version (UNIACT; ACT, 2009a, 2009b) was used to help high school students identify personally relevant educational and occupational options. This inventory includes 72 items, uses a three-choice response (dislike, indifferent, like), and parallels the RIASEC types to provide scores for six
scales (12 items for each scale): Technical (Realistic, R), Science & Technology (Investigating, I), Arts (Artistic, A), Social Service (Social, S), Administration & Sales (Enterprising, E), and Business Operation (Conventional, C). The current study will use six scores ranging from 12 to 36 to represent the level of “like” in regards to the six types of vocational interest.

Along with the demographic and academic predictors we will use for the current study, we also included creativity-related self-rated surveys that were also designed by ACT to collect non-cognitive characteristics. After conducting factor analysis on the responses, Wave 1 revealed five factors: Creative Self-Efficacy, Intellect, Openness, Academic, and Art. Wave 2 included four factors on different domains or aspects of creativity: School Environment Creativity, and three domain-specific creativity factors – STEM Creativity, Writing Creativity, and Art Creativity.

To answer RQ1.1, Pearson correlation coefficients were examined using Wave 1 and Wave 2 data to explore the relationships between potential predictors and the six vocational interest outcomes. Then, hierarchical linear regression analysis was conducted to evaluate how well the creativity-related factors and their interactions with gender improved the model of predicting six types of interest. After the first step of entering the demographic and academic information, the creativity-related factors were entered as the second set of factors, and the interaction between step 2 factors and gender were added as the final step. To answer RQ1.2, the same procedure was used with Wave 2 data.

To answer RQ2.1 and RQ2.2, a person-centered approach – Latent Profiling Analysis (LPA) – was used to examine the hidden distinct profiles of individuals differentiated on the basis of RIASEC vocational interests variables. Our study used R version 3.6.2 and a robust maximum likelihood estimator to clearly classify individuals into a single class. After choosing
the best number of groups and labeling the groups based on the profiles of interest scores, separate univariate ANOVA was conducted to examine if there were significant differences across profiles on creativity factors in Wave 1’s data to answer RQ2.1 and Wave 2’s data to answer RQ2.2.

**Significance of the Study**

Original interest instruments and career counseling had limited consideration of creativity factors. This study provided the evidence for creativity as a supplemental factor to assist in predicting personal interest. The person-centered approach was also explored for individualized interpretation for the individual uniqueness of users. This study can provide important resources for future work on the integration of vocational interests and domain-specific creativity and the development of more individualized vocational services for students.

**Chapter Summary**

This chapter has outlined the importance of understanding the relationship between personal RIASEC interest scores and demographic, academic, and creativity predictors as well as the interaction between gender and creativity factors. In addition, a person-centered approach was introduced as a way to redefine the profiles of interest patterns to explore the distinct characteristics of creativity. The summary of the method and analysis were interpreted to examine the research questions listed above.
CHAPTER 2: REVIEW OF LITERATURE

To better understand types of interests and creativity, three areas will be examined in this section: types of vocational interest, factors that have been studied correlating with personal vocational interests, and general and domain-specific creativity across different types of vocational interests.

Vocational Interests

The History of Vocational Interest and Measurements

In the early 20th century, pioneers started to explore the guiding theory and scientific methods behind career counseling. Parsons (1909, p.5) pointed out three key elements of career counselling to help people prepare to make a vocational choice and find employment in cities:

“…a clear understanding of yourself, your aptitudes, abilities, interests, ambitions, resources, limitations, and their causes; a knowledge of the requirements and conditions of success, advantages and disadvantages, compensation, opportunities, and prospects in different lines of work; true reasoning on the relations of these two groups of facts…”

Simultaneously, Munsterberg (1910) defined three vocational aspects in people as well as three types of vocations: thinking (knowledge or information), feeling (demands or desire), and doing (a combination of action and motive) (Porfeli, 2009). Unlike Parson’s rather unscientific approach to accessing people’s characteristics, Munsterberg provided scientific vocational guidance, particularly, developing assessments on clients, for both individuals looking for the best job and employers looking for the best workers. The integration of Parsons and Munsterberg’s theory gave rise to career psychology and led researchers to develop better theories and assessments (Watson & McMahon, 2015).
Vocational interest inventories, “the bridge from career development theory to practice” (Whitfield et al., 2009, p.14), have been developed and recognized as valuable tools for more than a hundred years. The earliest interest assessment, the Student Vocational Self Analysis, was published by an educator in 1914 to help students in public schools find a proper vocation in life by analyzing their self-awareness towards the occupation process through self-reported questionnaires (Davis, 1914; see also Harrington & Long, 2013). Soon the assessment of interest was studied and standardized by psychologists, researchers, and career practitioners, leading to the development of several important inventories in the following decades. Early tests such as the Strong Vocational Interest Blank (Strong, 1927) and the Vocational Interest Blank for Women (Strong, 1933) helped people recognize the similarities and dissimilarities between their interests and the characteristic interests of people in a designated occupation. Later tests such as the first edition of the Interest Checklist from the U.S. Department of Labor in 1957 (Hays, 2017) and the Interest Index from Educational Testing Service (ETS, 1961) followed. In the 1960s, universities, companies, and the general public started to accept the interest inventory as a useful tool in occupational guidance and career counseling (Harrington & Long, 2013).

In 1958, Holland’s Vocational Preference Inventory (VPI) was published. Although the primary purpose was to assess personality, the revised version was soon incorporated into the American College Testing (ACT) Guidance Profile (ACT, 2009b) for career guidance. Holland (1973) defined vocational interests as “the expression of personality in work, hobbies, recreational activities, and preferences” (p. 7) that highlighted the inner correlation between personality and interests. Holland’s model characterized people and the environments in which they live by their resemblance to one of six types; these types were then presented as the six vertices of a hexagon: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional.
He determined that pairing people and the environment could predict vocational and educational choice and achievement, vocational stability, personal competence, social behavior, and susceptibility to influence (Holland, 1997). His work was the first attempt to use the same model to describe vocations, individuals, and their interaction together. The structure he developed became the most widely used and the most influential model of vocational interest in the long history of career practice (Nauta, 2010). Given the wide consensus of its profound empirical contribution, Holland's RIASEC Model was referred to as the framework by which we continued to examine vocational interests in the current study.

**Holland RIASEC, the Expanded Models, and Current Measurements**

Holland’s theory of vocational choice (Holland, 1997) made the following four assumptions: most people can be categorized into one of the RIASEC personality types; environments can be assigned to the RIASEC types; people who search for environments that match their personality type will benefit from this process; and behavior is determined by an interaction between one’s personality and their environment. The five key concepts researchers have focused on are (1) *consistency*, the degree of relatedness between different personality types or between environments, (2) *differentiation*, how defined a person or environment is (e.g., a person who closely resembles a single type shows a high degree of differentiation while a person who resembles many types is undifferentiated), (3) *identity*, the estimate of the clarity and stability of a person’s or environment’s goals, interests, and talents, (4) *congruence*, the degree of harmony between one’s personality and the environment one lives in (e.g., though social environments provide a Social type of person with the valuable opportunities and rewards that he or she needs, it may not provide the same for other types of people), and (5) *calculus*, how spatial arrangement provides distance between types that is proportional to the theoretical
relationships between them. The latest Holland RIASEC hexagonal model (1997) is presented in Figure 2.1.

Figure 2.1. RIASEC Hexagonal Model Adapted from Holland (1997, p.6)

Given the rising number of occupations identified by the United States Department of Labor, more than six broad groups, and their combinations, are needed to clarify and define the characteristics of new personalities and types of work (Prediger, 1982). To extend Holland’s hexagonal model, Prediger suggested that two work task dimensions underlie the hexagon: working with data or ideas and working with things or people. In short, Prediger provided compelling evidence for the addition of two basic dimensions within the RIASEC model and further pointed to the relationship between complex interest profiles and occupational environments (Holland, 1997; Tracey, 2002).

The model used in this study is the expanded model developed by American College Testing (ACT; ACT, 2009a, b) from the integration of Holland’s RIASEC and Prediger’s two dimensions that identifies personally relevant career (educational and occupational) options. For Holland's hexagon and underlying dimensions by ACT see Figure 2.2.
Technical (Realistic – R)
Working with tools, instruments, and mechanical or electrical equipment. Activities include building, repairing machinery, and raising crops/animals.
Examples of major fields: industrial arts, agriculture.
Examples of vocations: surveyor, mechanic.

Science & Technology (Investigative – I)
Investigating and attempting to understand phenomena in the natural sciences through reading, research, and discussion.
Examples of major fields: physics, biology.
Examples of vocations: chemist, physicist.

Arts (Artistic – A)
Expressing oneself through activities such as painting, designing, singing, dancing, and writing; artistic appreciation of such activities (e.g., listening to music, reading literature).
Examples of major fields: fine art, music.
Examples of vocations: artist, writer.

Social Service (Social – S)
Helping, enlightening, or serving others through activities such as teaching, counseling, working in service-oriented organizations, and engaging in social/political studies.
Examples of major fields: education, social science.
Examples of vocations: teacher, counselor.

Administration & Sales (Enterprising – E)
Persuading, influencing, directing, or motivating others through activities such as sales, supervision, and aspects of business management.
Examples of major fields: business administration, marketing.
Examples of vocations: salesman, executive.

Business Operations (Conventional – C)
Developing and/or maintaining accurate and orderly files, records, accounts, etc.; following systematic procedures for performing business activities.
Examples of major fields: accounting, business.
Examples of vocations: accountant, clerk.

After VPI, was introduced, various other quantitative methods were developed based on RIASEC or its expanded models. For most of the measurements, the highest score represented a
person’s type of personality; the scaled scores of the six different types, from highest to lowest, represented a person’s personality pattern or profile (Holland, 1997). Occupational classifications were also developed with better descriptions of the environments and the application of interests for career counseling such as The Dictionary of Holland Occupational Codes (DHOC; Gottfredson & Holland, 1996) and occupational interest profiles for the occupations in O*NET (Rounds et al., 1999) using three-letter-codes to classify people into detailed profiles of interest. Accordingly, various studies started to explore the predictors that correlated with different types and the factors that could describe different profiles using these measurements.

Potential Factors Correlated with Vocational Interests

Gender and Ethnicity Factors

The gender differences across types of interests were similar in the results of various studies. Recent studies found that men scored higher on Realistic, Investigative, Enterprising and Conventional interests, whereas women scored higher on Social and Artistic interests (Donnay et al., 2004; Morris, 2016). Hoff et al. (2019) arrived at similar results, except there was no gender difference on Enterprising. In addition, women shared a more similar interest pattern to women from other cultures or ethnicities than with men (Holland, 1997). The meta-analysis conducted by Su et al. (2009) examined 47 interest inventories and found men preferred working with things, scored higher on Realistic and Investigative types, and favored engineering, science, and mathematics majors; women preferred working with people and scored higher on Artistic, Social, and Conventional interests.

Studies on vocational interest in different ethnic groups provided different results. Studies with large samples generally concluded that RIASEC types were an adequate and equal fit for all
ethnic groups on the unisex edition of the ACT assessment (UNIACT) that provided supportive structural and criterion-related validity across ethnic groups (Day & Rounds, 1998; Day et al., 1998). The pattern of interests was stable and similar across all ethnic groups in a large sample of 8th to 12th grade students, indicating that the structure of interests did not vary across ethnicity (Tracey & Robbins, 2005). On the UNIACT assessment, there have been no differences (Gupta et al., 2008) or very small ones across ethnic groups (Morris, 2016). Although most studies found there were no or small differences by ethnicity, however, there was also evidence has indicated differences across different ethnicities in the United States. Higher Investigative and Enterprising scores were presented by Asians, Indians, and Middle Easterners, lower Realistic scores for Blacks and Native Americans, higher Realistic, Artistic, and Social scores for Pacific Islanders, and lower Conventional scores for Whites (Morris, 2016).

**Academic Achievement**

The characteristics that vocational interests reflect may be related to individuals’ academic achievement in school. Wiley and Magoon (1982) found students with higher levels of interest consistency achieved higher GPAs than students with lower levels of consistency. Students with higher GPAs scored higher on Investigative than lower achievers with low GPAs (Vock et al., 2013). For college students, the evidence indicated that a high congruency of interest-environment is related to persistence in a college major, attainment of a college degree and a job in the same field, a high college GPA, and high job earnings as well as satisfaction (ACT, 2009a). Although RIASEC is not generally used in college admissions, it has been suggested that interest scores be used to identify an applicants’ congruency with the academic program that they are applying for and, as a supplement measurement with other selection criteria (e.g., GPA, SAT, or GRE), to make admission decisions (Nye et al, 2012).
Personality and RIASEC

Prior meta-analyses of adults on the cross-sectional relation between the RIASEC model and the Big 5 (which describes the basic dimensions of personality: Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience) showed consistent results relating to the meaningful overlap between different personalities and types of interests. Both models share the common goal of attempting to describe individuals’ characteristics and predict future outcomes in both life and work. Some moderately strong positive correlations (with r’s exceeding .3) were found in different studies. In all these studies, there were significant associations between Enterprising and Extraversion, Social and Extraversion, and Artistic and Openness to Experience (Barrick et al., 2003; Larson et al., 2002; Mount et al., 2005).

Openness to experience is the most creativity-related personality particularly to creativity self-efficacy in general (Karwowski & Kaufman, 2017), arts, and verbal creativity (O’Neil, 2014; King et al., 1996). Current research demonstrated that each of the Big Five can be split into two distinct facets and Openness to Experience could be split into Openness associated with creativity, and Intellect associated with fluid intelligence (DeYoung, 2014; Nusbaum & Silvia, 2011). Artistic was correlated to Openness while the intellect facet related to Investigative vocational interests (Kaufman et al., 2015; Larson et al., 2002), indicating that the Openness/Intellect split was more appropriate to study the different types of vocational interests.

Several notable conclusions were generated from the analysis above. First of all, individual’s interests could be predicted differently due to a variety of factors. In addition, clear differences have been shown across gender when predicting personal interests while complex relations have been revealed across ethnic groups. Vocational interests were correlated with
academic achievements, and highly correlated with personality. However, more potential factors should be considered to have a full picture on predicting students’ interests.

There is a growing call to consider creativity in vocational education and college admissions for many reasons: to reduce potential ethnic and cultural bias (Kaufman, 2010), to understand and develop a person’s identity and characteristics (De Valverde et al., 2017), and to predict their vocational interests alongside occupational achievement (Wai et al., 2005). There are also similarities between the structure of creativity and personal interests in careers. The Amusement Park Theory Studies (APT; Baer & Kaufman, 2005, 2017; Kaufman & Baer, 2004) suggests creativity across different career domains (e.g., STEM, Arts, Business) can map onto different vocational interest types (Kaufman et al., 2013). Creativity assessments are also developed by educators and researchers to supplement traditional educational and vocational measurements. Creativity is important for the economic, social, and personal welfare of people in modern Western society (Cropley, 2014), and has been described as the most important economic resource (Florida, 2002). Therefore, it is essential to understand the structure of creativity, compare its similarities and differences across domains, and find a good way to align interests with domains of creativity.

Creativity

Definition and the Domain-general verses Domain-specific Debate

Creativity as a modern construct became a scientific concept during the mid-20th century (Runco & Albert, 2010). Early perceptions of creativity as being generated from outside the person (i.e. following the inspiration and instructions from God’s act of creation or imitating nature) gave way to the view that creative abilities and characteristics originated internally along
with characteristics of genius. More recently, a balanced view emerged regarding the individual and social factors that contribute to creativity (Glăveanu & Kaufman, 2019).

Early creativity research often took a domain-general approach (Baer & Kaufman, 2017). This perspective sees all forms of creativity as being combinatorial (Simonton, 2019), with minimal difference across domains. Creativity was therefore seen as using the same set of generic processes and procedures, sharing not only skills but also abilities and traits (Guilford, 1950; Torrance, 1963). Creativity is traditionally defined as being something “new” and “task appropriate” (Guilford, 1950), and, depending on the source, an element of “surprise” that provided individuals with knowledge they didn’t have before (Simonton, 2012). Simonton also generated a quantitative and multiplicative definition that include three parameters – originality, appropriateness of a certain task, and surprise – that could be multiplied to get a final “creativity” score. Creativity, under the domain-general approach, can therefore be seen as an all-or-nothing concept: if one of the criteria becomes zero, the final creativity score is also zero.

The domain-specific view, on the other hand, believes that the personality, cognitive strengths, and underlying components of creativity are different from one domain to another (Kaufman, 2016). It argues that creativity in one domain is not necessarily predictive of creativity in other domains (Baer, 2012). Rather than finding one single, grand unifying theory that encompasses all of creativity, domain specificity suggests that many theories of creativity are needed to fully understand creativity across different domains. According to this view, different domains of creativity underlie different features or reverse and cannot be fully explained without considering the role of knowledge or task content. They focus on distinguishing features of creativity on domains that highlight different components.
Currently there is an agreement among both domain-general and domain-specific theorists (Simonton, 2017), along with researchers of different types of occupations, that definition of creativity from Plucker et al. (2004) is an appropriate and comprehensive one: "creativity is the interaction among aptitude, process and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context” (p. 90).

Although there is still movement between the domain-general and domain-specific approaches, both sides offer supportive evidence that a rigid dichotomy does not exist. Furthermore, current studies that focus on types of interest cannot be explained simply by only the domain specific or general theory. Domains share some common creativity traits and overlapping skills. At the same time, the content or context matters very deeply for creativity. The specific components of motivation, personality traits, cognitive strengths and styles, self-beliefs, and knowledge bases lead to creativity differently (Kaufman et al., 2017).

**Theoretical Frameworks on Creativity-Interest Integration: APT and RIASEC**

To integrate both the domain-specific and domain-general approach, Kaufman and Baer (2004; Baer & Kaufman, 2005, 2017) developed the Amusement Park Theoretical (APT) Model of Creativity. The APT Model leaves space for creativity researchers to examine the nuance of domains and identify generality and domain specificity within the constructs they are investigating (Baer & Kaufman, 2017). APT has four levels that range from largely domain-general to extremely domain-specific: Initial Requirements, General Thematic Areas, Domains, and Microdomains.

The *Initial Requirements* level highlights three key factors required to be creative in any domain: general intelligence, motivation, and a supportive environment (Baer & Kaufman,
The General Thematic Areas level consists of many attempts to create a structure that represents general domains. Various models can be used to examine it. For instance, the Kaufman Domains of Creativity Scale (K-DOCS; Kaufman, 2012) proposed five General Thematic Areas: everyday, scholarly, performance, math/scientific, and artistic. RIASEC could also be seen as potentially suggesting six general thematic areas. Other examples include Gardner’s (2000) eight “intelligences” and Carson et al. (2005)’s Creativity Achievement Questionnaire (CAQ), which has two factors encompassing ten domains as equally viable options. The Domains level in APT theory follows; once a thematic area is chosen, a particular component of that area is chosen to pursue (such as going from science to biology). Depending on the domain, different specific skills should be pursued and developed. Ultimately, at the Microdomain level, an even more specific aspect of the domain is chosen and this becomes a person’s professional or occupational path. The transition from General Thematic Area to Microdomain could be sequential. For example, a student with a broad interest in the arts (General Thematic Area) may study singing in college (Domain) and then choose the career of Jazz Improvisational Singing (Microdomain) after graduation.

Like Holland’s theory on vocational interests, APT postulates that creativity should be seen as dimensions or domains rather than distinct categories or types. Individuals can assess their levels of creativity on different aspects to have a fuller picture of their personal creativity status. Meanwhile, the RIASEC model uses a hexagon structure to provide an integrated view of personal interest. RIASEC also provides an effective model of General Thematic Areas in the APT model (Kaufman, 2016). Given the fit of APT and RIASEC, the APT model was chosen as the framework to continue examining the relationship between creativity and RIASEC in our current study.
Vocational Interests and Domain-general and Domain-specific of Creativity

Thinking about creativity in different domains of interests raises several questions: does domain-specific creativity factors differently predict vocational types than domain-general creativity factors? Does lower artistic creativity lead to a low interest in the artistic occupations (or reverse)? Does high STEM creativity predict a high interest in STEM domains? Many studies have been conducted to understand the relationships between creativity and vocational personalities, as well as the relationship between creativity and vocational environments, which can provide sufficient evidence on the latent relationships between creativity and types of interests. Other studies focused on certain creativity traits and skills in a specific domain or microdomain.

General creative self-efficacy (CSE) has been studied across different types of interests. It was noticed by both Albert (1990) and Dollinger and Dollinger (2017) that those who are disinterested in exploring possibilities for the creative self often performed poorly on recognizing and developing their vocational interests. Self-perceptions of creativity were more accurate for students interested in the arts, humanities, and social sciences (Pretz & Nelson, 2017). The self-construction perspective suggested that creative methods could be used for both increasing students’ interests to be involved in vocational education and to be trained (Heppner et al., 1994). Similarly, divergent thinking, as another domain-general creativity facet, resulted in different performance on different vocations. Artistic majors scored higher than other majors on measures of divergent thinking (Silvia et al., 2008). Interest in the arts is related to both self-reported creative behaviors (Kelly & Kneipp, 2009) and creative thinking styles (Zhang & Fan, 2007).

However, these domain-general creativity facets are not sufficient to fully understand people in different vocations. The arts and sciences, for example, are described along two broad
domains of creativity, offering distinct perceptions and focuses of creativity regarding the creative process and creative products. Arts are based on divergence and self-expression and see novelty as the key component to creativity. Studies on acting also argue that the creative product in acting is equal to the creative process that includes acting itself alongside interactions with the audience and environment (Sawyer, 2005). The sciences, however, gravitate toward convergence and effective problem-solving, practical outcomes, functionality, and orderliness, clearly seeing usefulness as the key component (Cropley & Cropley, 2010; Kaufman & Baer, 2002). In addition, Cropley et al. (2017) argued that the more creative the product, the better its level of creativity can be predicted by effectiveness.

Also, the differences across different micro-domains (e.g., acting, math, architecture) provided indirect evidence that different vocations can be better explained by domain-specific creativity. Architects with higher creativity in architecture exhibited higher intellectual openness and fluid intelligence (Kirsch et al., 2016). Actors were found to be more extroverted (Wilson, 1985), more sociable, and more sensitive to the expressive behavior of other people (Hammond & Edelmann, 1991). Krutetskii’s (1976) study on math showed that mathematically gifted students had more creative solutions compared to non-gifted students. Thinking about self-reported creativity, students interested in or studying architecture, acting, or math could rate the same level on the general creativity question “I have confidence in my ability to come up with new ideas” but would clearly provide different responses on the domain-specific question “I have confidence in my ability to come up with new ways to find solutions to math problems” (items adapted from Beghetto, 2006). Since none of the studies from the above literature have explained the direct relationship between types of vocational interests using creativity factors, both general creativity (such as CSE) or domain-specific creativity (e.g., STEM creativity) could
be added into the model of predicting vocational interests and provide a unique approach to explain the differences between RIASEC types of interests.

Furthermore, measurements assessing personalities and environments were too focused on organizations and traditional occupations (Holland, 1997) despite the current rise in number of new occupations and the number of people who are self-employed. Contemporary jobs require a more dynamic and complex combination of abilities and personal traits than ever before. Therefore, it is essential to understand the structure of creativity, compare the similarities and differences across domains, and find a good way to align interests with domains of creativity.

**Creativity and Profiles in Vocational Interests**

There is another debate within domain-general and specific discussions: is a polymath or a *multipotentialite* (an individual whose knowledge or interests span a significant number of subjects) evidence for domain generality? Domain specificity argues that being creative in one domain is not predictive of creativity in other domains; it does not say that an individual can only be creative in a single domain (Baer, 2012). As many polymaths or multipotentialites are observed, do people who share a similar pattern of interest scores also share a similar pattern of creativity scores? How many different patterns could be found if we use the number of high interest domains as the criteria?

There have been a variety of attempts to recategorize people by profiling their RIASEC results. McLarnon et al. (2015) profiled people into different groups based on their RIASEC scores. They categorized people using different combinations of codes instead of one dominant code (e.g., RAC stands for Realistic-Artistic-Conventional) and found five *multi-interest* groups, one *single-interest* group, one *disinterested in anything* group, and another *neutral to everything* group. Although this study showed no or slight differences in personalities across groups, it
introduced a good example for the current study for exploring group characteristics of creativity factors.

Two studies in one paper that explored the latent class structure of creative accomplishments and creative self-descriptions noted the importance of creativity classes (Silvia et al., 2009). For creative achievements, the “uncreative” class had the majority of people, with smaller groups of people found for visual arts and performing. For creative self-descriptions however, latent classes were not found. The Artistic type of vocational interest was significantly, positively correlated with creativity using various measurements (Kelly & Kneipp, 2009). Although some of the profiling analyses did not show distinct differences, they demonstrated how investigating the profiles of vocational interests is possible and the potential of future investigations of other factors like domains of creativity.

**Chapter Summary**

Four major topics were introduced to set the framework for this study and support two main questions. These included: (1) the history, development, and the application of the Holland RIASEC Model, (2) research on correlated factors (gender, ethnicity, academic achievement, and personality) that may influence personal vocational interests, (3) the definition and debate of domain-specific creativity, (4) and the domains of creativity across vocational interests and an explanation of similarities between the APT and RIASEC theories. While findings from these prior studies provide that a relationship between vocational interests and creativity exists, we know little about (1) the role of creativity in assisting the prediction of interests along with other factors and (2) the characteristics described by creativity factors of latent profiles generated from recent large samples. To maximize the use of the measurements of interest and creativity and to provide evidence for future development of dynamic and individualized career guidance,
quantitative methods were used to solve the research questions and examine the potential of using creativity as the supplemental tool to predict vocational interests.
CHAPTER 3: RESEARCH METHODS

Methods

Participants

The target population of this study was the 334,117 students in grades 9 through 12 who registered to take the American College Testing (ACT) test in the United States on June 9th, 2018. After excluding Canadian email addresses and email addresses appearing on the ACT’s master opt-out list, as well as those sampled and asked to participate in other ACT-related surveys, the remaining valid population for the study included 329,624 students. Using the survey software Qualtrics, 35,000 students were randomly sorted into two groups and contacted to complete one survey each. These groups were labeled Wave 1 and Wave 2, with each wave focused on how different sets of creativity factors (“domain-general and personality-related creativity factors” and “environment and domain-specific creativity factors”) impacted the model.

This dissertation draws on a dataset of 4,052 valid responses (2,444 in Wave 1, and 1,608 in Wave 2) as part of a large project focused on helping people achieve educational and workplace success. The total sample included 3,011 females and 1,041 males, of which 68.3% of respondents were White, 11.5% were Hispanic, 6.3% were African American, 5.4% were Asian, 4.7% were Other (defined as American Indian, Alaska Native, Native Hawaiian, or Other Pacific Islander), and 3.9% said they preferred not to respond. Appendix A contains detailed descriptive statistics by the population, sample, and Wave group.

Instruments

In addition to general demographic and scoring information (gender, ethnicity, GPA, and ACT scores), responses from two self-reported questionnaires were used to examine the complex
relationship between vocational interests and creativity. These questionnaires were the Unisex Edition of the ACT Interest Inventory (High School Version) and a self-assessment on creative skills and tendencies. Definitions of these are outlined below:

*Unisex Edition of the ACT Interest Inventory, High School Version (UNIACT; ACT, 2009a, b)*. The first unisex edition of the ACT Interest Inventory was developed in the 1970s to assist counselors in identifying the connection between educational and occupational career options and student personalities (ACT, 2009a). The current High School Version of the UNIACT is for students in grades 8 through 12, and is intended to help them explore relevant college major and career options (Prediger & Swaney, 1995; ACT, 2009a).

The ACT Interest inventory includes 72 items, and uses a three-point response scale (1=dislike, 2=indifferent, 3=like). These items parallel the RIASEC types to provide scores on six scales (12 items for each scale): Technical (Realistic, R), Science & Technology (Investigating, I), Arts (Artistic, A), Social Service (Social, S), Administration & Sales (Enterprising, E), and Business Operations (Conventional, C).

The structure of the UNIACT was examined and reported consistent with the Holland Occupational Themes, with insignificant variation across grades 6 to 12 (Tracey & Robbins, 2005). In addition, the items displayed structures consistent with RIASEC and invariance across gender and ethnic groups in Day and Rounds’ (1998) study. In addition, this 72-item version displayed sufficient internal consistency reliability (range .82-.91) from the sample of students in grades 8, 10, and 12. To avoid the bias of gender socialization roles, UNIACT also uses a gender-balance approach to control the items, providing equal or better gender balance than the previous version (ACT, 2009a). The current study uses six individual scores ranging from 12-36 to represent interest in the six types of vocations.
ACT tests. The ACT is a common entrance exam used by many American colleges and universities to make admissions decisions for undergraduate students. It includes four sections (English, Math, Reading, and Science) and one optional writing section. This study used the ACT’s composite score, which represents the average of the four section scores on a scale from 1 to 36. The study will use ACT scores alongside respondents’ high school GPAs (grade point averages) as academic achievement factors for predicting their interest in different vocational types.

Self-assessment on creative skills and tendencies. Creativity-related assessments have been designed by the ACT organization and consulting experts to collect non-cognitive characteristics alongside the academic ones previously mentioned. In the surveys, all questions around these characteristics used a Likert scale of 1-4 (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). After conducting factor analysis on the surveys, Wave 1 revealed five factors applicable to all types of creativity: Creative Self-Efficacy (CSE), Intellect (INT), Openness (OPE), Academic (ACA), and Art (ART). These have been termed “creativity and personality-related factors.” In contrast, Wave 2 revealed more targeted areas of creativity: School Environment Creativity (ENVC), and three domain-specific creativity factors – STEM Creativity (STEMC), Writing Creativity (WRTC), and Art Creativity (ARTC). These have been termed “environment and domain-specific creativity.” Appendix B contains a full list of factors and items.

CSE included 10 items. It was defined as “the belief one has the ability to produce creative outcomes” (Tierney & Farmer, 2002, p. 1138), and is measured based on the “perceived confidence to creatively perform a particular task” (Beghetto & Karwowski, 2017). Some items were adapted from previous general CSE scales, for example, “I have confidence in my ability to
come up with new ideas” (Beghetto, 2006) or “I have confidence in my ability to be creative” (Karwowski, 2011). INT included 13 items on reasoning and knowledge, for example “I ask questions to learn how things work” or “I like discussing abstract concepts.” OPE, one of the most creativity-defining personality traits (Feist, 1998), consisted of six items adapted from personality tests focused on rating an individual’s curiosity about the world and its people (for instance, “I enjoy the beauty of nature”), as well as an interest in gaining new skills and knowledge. ACA included eight items asking each respondent to reflect on his or her academic ability, such as “I easily learn the material I am taught in school.” ART, with six items, focused on the personal interest of creating artwork (for example, “I enjoy creating art.”).

ENVC included 20 items to understand respondents’ opinions on how the school or classroom environment encourages or discourages creativity, for example, “I am allowed to be creative on my assignments” or “My teachers value creative students.” STEMC was adapted from the domain-specific CSE measures in Beghetto et al. (2011) and includes six items such as “I have confidence in my ability to come up with new ways to find solutions to science problems.” WRTC includes four items around the creative side of writing such as “I have confidence in my ability to write something creative.” Similarly, ARTC includes six items on creativity in art such as “I have confidence in my ability to draw something creative.”

Data Analyses

Research Question 1

RQ1.1. Can demographic factors and academic achievements (gender, ethnicity, GPA, and ACT_C), domain-general creativity and personality-related factors (CSE, INT, OPE, ACA, and ART), as well as the interaction between gender and these areas of creativity, significantly predict the six types of vocational interests?
RQ1.2. Can demographic factors and academic achievements (gender, ethnicity, GPA, and ACT_C), environment and domain-specific creativity (ENVC, STEMC, WRTC, and ARTC), as well as the interaction between gender and these areas of creativity, significantly predict the six types of vocational interests?

To answer RQ1.1, first, Pearson correlation coefficients were examined using Wave 1 and Wave 2 data to explore the relationships between potential predictors and the six Holland vocational interest outcomes: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). Then, hierarchical linear regression analysis was conducted to evaluate how well the creativity and personality-related factors and their interactions with gender improved the model in predicting the six types of interest. After the first step of entering the demographic and academic information, creativity factors were entered as the second set of factors, and the interaction between step 2 factors and gender were added as the final step. The same procedure was used to answer RQ1.2, using the environment and domain-specific creativity factors.

Research Question 2

RQ2.1. Is there evidence that domain-general creativity and personality-related factors (CSE, INT, OPE, ACA, and ART) exhibit differential mean levels across the latent vocational interest profiles generated from RIASEC scores?

RQ2.2. Is there evidence that environment and domain-specific creativity (ENVC, STEMC, WRTC, and ARTC) exhibit differential mean levels across the latent vocational interest profiles generated from RIASEC scores?

To answer RQ2.1 and RQ2.2, a person-centered approach – Latent Profiling Analysis (LPA) – was used to examine the distinct profiles of individuals differentiated on the basis of six
RIASEC types. Unlike the approach to answer RQ1, which focuses on variables, the person-centered approach focuses on groups of individuals who share similar scoring patterns across a number of different variables (Bauer & Curran, 2004). LPA is a powerful person-centered analytical framework that provides a large number of objective criteria for assessing model-fit data. Following the recommendations of McLarnon et al. in their 2015 study on undergraduate samples, this study initially started with a two-profile model, and added profiles in subsequent model iterations. Several criteria points were considered to determine the ideal number of profiles: having a significant BLRT, which indicates a model with $k$ profiles fitting the data better than a $k-1$ profiles model (McLachlan & Peel, 2000), and having the lowest or near-lowest AWE, BIC and sample-size adjusted BIC (SABIC) values.

This study used R (version 3.6.2) and a robust maximum likelihood estimator to classify individuals into distinct classes. This study chose to set the equal variance and covariances to 0. After choosing the ideal number of groups and labeling the groups based on the profiles of interest scores, separate univariate ANOVA (Analysis of Variance) was conducted to examine if there were significant differences across the profiles on creativity factors in Wave 1 data. This provided an answer to RQ2.1. Separate ANOVA was then conducted using Wave 2 data to answer RQ2.2.
CHAPTER 4: RESULTS

Research Question One

Descriptive Statistics

In the sample of 4,052 participants, a total of 3,570 completed the interest inventory and provided valid RIASEC outcomes. Of these, 2,161 were in Wave 1 and 1,409 were in Wave 2. Descriptive statistics for the outcomes and predictors are displayed in Table 4.1 and Table 4.2.

Table 4.1. Descriptive Statistics for the Outcome Variables

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Wave 1 N=2161</th>
<th>Wave 2 N=1409</th>
<th>Total N=3570</th>
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<tr>
<td></td>
<td>M  SD</td>
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<tr>
<td>Realistic (R)</td>
<td>20.26 5.98</td>
<td>20.61 5.94</td>
<td>20.40 5.97</td>
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<tr>
<td>Investigative (I)</td>
<td>26.68 6.74</td>
<td>26.67 6.87</td>
<td>26.68 6.79</td>
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<tr>
<td>Artistic (A)</td>
<td>23.08 6.38</td>
<td>23.41 6.32</td>
<td>23.21 6.36</td>
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<tr>
<td>Social (S)</td>
<td>28.43 4.98</td>
<td>28.75 4.92</td>
<td>28.56 4.96</td>
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<tr>
<td>Enterprising (E)</td>
<td>23.25 5.87</td>
<td>23.41 5.92</td>
<td>23.31 5.89</td>
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<tr>
<td>Conventional (C)</td>
<td>21.77 6.22</td>
<td>21.85 6.22</td>
<td>21.89 6.22</td>
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</tbody>
</table>

The correlation coefficients show linear relationships between the dependent variables and the independent variables; the independent variables are not highly correlated with each other.
(around or lower than 0.5), leading to less potential multicollinearity between predictors. The correlations between the outcomes and predictor variables are presented in Table 4.3 and Table 4.4.
Table 4.3. Wave 1 Correlation Coefficients Table

<table>
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<th>Gender</th>
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<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>GPA</th>
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**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

ACT Interest Inventory outcomes and the parallel with RIASEC: R= Realistic; I= Investigative; A= Artistic; S= Social; E= Enterprising; C= Conventional.

Personal information: Gender (Female=0; Male=1); Ethnicity (Dummy Variables R1 to R5 stand for Black/African American, White, Hispanic/Latino, Asian, and American Indian/Alaska Native/Native Hawaiian/Other Pacific Islands/Two or more races).

Academic achievements: GPA=High School GPA; ACT_C=ACT Composite.

Creativity and personality related factors: CSE=Creative Self-Efficacy; INT=Intellect; OPE=Openness; ACA=Academic; ART=Art.
### Table 4.4. Wave 2 Correlation Coefficients Table

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**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Domain-specific and environment creativity factors: ENVC=School Environment of Creativity; STEMC= STEM Creativity; WRTC=Writing Creativity; ARTC=Art Creativity.
Hierarchical linear regression analysis was conducted to evaluate how well the creativity and personality-related factors and their interactions with gender improved the accuracy of the model in predicting the six types of vocational interests in students: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). To begin, Wave 1 data was entered for students’ demographic backgrounds and academic achievement characteristics: gender, ethnicity, high school GPA (GPA), and ACT composite score (ACT_C). In the second step, the relationship between vocational interests and creativity and personality-related factors was examined, after controlling for students’ background and academic achievement. These factors were Creativity Self-Efficacy (CSE), Intellect (INT), Openness (OPE), Academic (ACA), and Art (ART). Finally, the interaction between gender and the above creativity factors was entered into the model, again after controlling for students’ characteristics and creativity-related factors.

For Wave 2, students’ demographic and academic achievement characteristics were entered (as in Wave 1). Next, the relationship between the six vocational interests and creative self-efficacy domains was examined (after controlling for students’ characteristics). The creative self-efficacy domains were School Environment of Creativity (ENVC), STEM Creativity (STEMC), Writing Creativity (WRTC), and Art Creativity (ARTC). In the final step, the interaction between gender and this set of creativity domains was entered after controlling for the other factors entered before.

**RQ1.1**

For Wave 1 data, six separate linear regressions were calculated to predict six vocational interest types. In the regression equation for predicting the Realistic vocational interest, as can be seen in Table 4.5, students’ characteristics explained a statistically significant amount of variance
(7%), $F(7, 1535) = 15.22, p < 0.001$, with the significant positive predictors being gender and ethnicity. Results from Step 2 revealed that including five creativity and personality-related factors increased the explanation of the model by 5% variance, $\Delta F(5, 1530) = 17.46, p < 0.001$. Including the factors ART and OPE positively explained the model, whilst gender and ethnicity remained as the significant predictors. Finally, results from Step 3 indicated that adding interactions into the model increased the variance of explanation by 1%, $\Delta F(5, 1525) = 2.90, p < 0.05$. The added interactions between gender and CSE showed as a positive predictor, and the interactions between gender and INT showed as a negative predictor in the model. See Figure 4.1 and 4.2.

**Figure 4.1. Gender*CSE Interaction Effect on Realistic**
In the regression equation for predicting the Investigative vocational interest, students’ characteristics explained a statistically significant amount of the variance (7%), $F(7, 1535) = 15.37, p < 0.001$. Here, the significant positive predictors were gender and ACT_C. Results from Step 2 revealed that including the five creativity and personality-related factors increased the explanation of the model by a 7% variance, $\Delta F(5, 1530) = 24.75, p < 0.001$. The added factors INT and ACA positively improved the model; meanwhile gender and ACT_C remained as the significant predictors. Finally, results from Step 3 indicated that adding interactions into the model increased the variance of explanation by 1%, $\Delta F(5, 1525) = 3.25, p < 0.01$. The interaction between gender and OPE showed as a negative significant predictor in the model. See Figure 4.3.
In the regression equation for predicting the Artistic vocational interest, students’ characteristics explained a statistically significant amount of the variance (3%), $F(7, 1535) = 6.75$, $p < 0.001$. The negative predictors were gender and GPA, while ACT_C positively predicted Artistic. Results from Step 2 revealed that including five creativity and personality-related factors increased the explanation of the model by a 30% variance, $\Delta F(5, 1530) = 135.69$, $p < 0.001$. The added factors CSE and ART positively improved the model, while the ACA factor negatively influence the model; meanwhile GPA and ACT_C remained as the significant predictors. However, gender was no longer statistically significant. Finally, results from Step 3 indicated that adding interactions into the model did not change the variance of explanation, with $\Delta F(5, 1525) = 1.20$, $p = 0.31$.

In the regression equation for predicting the Social vocational interest, students’ characteristics explained a non-statistically significant amount of the variance (1%), $F(7, 1535) =$
1.86, \( p = 0.07 \). Results from Step 2 revealed that including five creativity and personality-related factors increased the explanation of the model by a 8% variance, \( \Delta F(5, 1530) = 26.07, p < 0.001 \). The added factors CSE, INT, and OPE showed as positive predictors, while ACA negatively improved the model. Although results from Step 3 indicated that adding interactions didn’t improve the explanation of model, with \( \Delta F(5, 1525) = 1.62, p = 0.15 \), adding the interaction between gender and INT slightly improved the model as a negative predictor. See Figure 4.4.

Figure 4.4. Gender*INT Interaction Effect on Social

In the regression equation for predicting the Enterprising vocational interest, students’ characteristics explained a statistically significant amount of the variance (4%), \( F(7, 1535) = 10.20, p < 0.001 \). Gender and ACT_C were positively related to Enterprising. Results from Step 2 revealed that including five creativity and personality-related factors increased the explanation of model by 7% variance, \( \Delta F(5, 1530) = 24.99, p < 0.001 \). The added factors CSE and INT positively predicted Enterprising; meanwhile ACA and ART negatively related to Enterprising. Gender and ACT_C remained as the significant predictors. Finally, results from Step 3 indicated
that adding interactions didn’t improve the model, with $\Delta F(5, 1525) = 1.06, p = 0.38$.

In the regression equation for predicting the Conventional vocational interest, students’ characteristics explained a statistically significant amount of the variance (5%), $F(7, 1535) = 10.33, p < 0.001$. The significant predictors gender, ethnicity, and $ACT_C$ were positively related to Conventional. Results from Step 2 revealed that including five creativity and personality-related factors increased the explanation of model by a 3% variance, $\Delta F(5, 1530) = 9.29, p < 0.001$. The added factors INT and ACA positively explained the outcome, and ART significantly negatively related to Conventional; meanwhile gender, ethnicity, and $ACT_C$ remained as the significant predictors. Although results from Step 3 indicated that adding interactions didn’t improve the model with $\Delta F(5, 1525) = 1.82, p = 0.11$, adding the interaction between gender and CSE positively improved the model. See Figure 4.5.

Figure 4.5. *Gender*CSE Interaction Effect on Conventional
Table 4.5. **Wave 1 Results of Hierarchical Regression Analyses for Vocational Interests**

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<th>Artistic</th>
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| R²                         | 0.07***   | 0.12***       | 0.12***  | 0.07***| 0.14***      | 0.15***      |
| ΔR²                        | 0.05***   | 0.01*         | 0.07***  | 0.00   | 0.30***      | 0.00         |

N=1543

***p<.001, **p<.01, *p<.05

Gender and creativity factors were centered and multiplied to compute interaction factors GCSE, GINT, GOPE, GACA, and GART.
RQ1.2

For Wave 2 data, six separate linear regressions were calculated to predict scores of six interest types. In the regression equation for predicting the Realistic vocational interest, as can be seen in Table 4.6, students’ characteristics explained a statistically significant amount of the variance (3%), \( F(7, 1308) = 5.13, p < 0.001 \). The positive predictor was gender. Results from Step 2 revealed that including the four creativity self-efficacy domains increased the explanation of the model by a 3% variance, \( \Delta F(4, 1304) = 10.76, p < 0.001 \). The added factors STEMC and ARTC significantly improved the model as positive predictors, while gender remained significant. Finally, results from Step 3 indicated that adding interactions didn’t improve the model, \( \Delta F(4, 1300) = 0.05, p = 1.00 \).

In the regression equation for predicting the Investigative vocational interest, students’ characteristics explained a statistically significant amount of the variance (10%), \( F(7, 1308) = 20.10, p < 0.001 \). ACT_C was positively related to Investigative. Results from Step 2 revealed that including the four creativity self-efficacy domains increased the explanation of model by a 7% variance, \( \Delta F(4, 1304) = 29.14, p < 0.001 \). The added factors of STEMC and ARTC significantly improved the model and were reported as positive predictors. ENVC reported negative related to the outcome while ACT_C remained as the significant predictor. However, results from Step 3 indicated that adding interactions didn’t improve the model with \( \Delta F(4, 1300) = 1.40, p = 0.23 \). The interaction between gender and WRTC provided a slight negative explanation in significance. However, ARTC was not significant after considering this interaction. See Figure 4.6.
In the regression equation for predicting the Artistic vocational interest, students’ characteristics explained a statistically significant amount of the variance (1%), $F(7, 1308) = 6.30, p < 0.001$. The positive predictor was ACT_C and the negative predictor was gender. Results from Step 2 revealed that including the four creativity self-efficacy domains increased the explanation of the model by 24% variance, $\Delta F(4, 1304) = 108.19, p < 0.001$. The added factors ENVC and STEMC were negatively related to Artistic. WRTC and ARTC were positively related to the outcome while ACT_C remained as the significant predictor. However, gender was no longer a significant predictor. Finally, results from Step 3 indicated that adding interactions, particularly that between gender and ARTC, significantly and positively improved the predictive equation with $\Delta F(4, 1300) = 2.84, p < .05$. See Figure 4.7.
In the regression equation for predicting the Social vocational interest, students’ characteristics explained a statistically significant amount of the variance (1%), $F(7, 1308) = 2.20, p < 0.05$. The positive predictor was ACT_C. Results from Step 2 revealed that including the four creativity self-efficacy domains increased the explanation of the model by a 9% variance, $\Delta F(4, 1304) = 32.59, p < 0.001$. The added factor of WRTC significantly improved the model as a positive predictor, while ACT_C remained as the significant predictor. Although results from Step 3 indicated that adding interactions didn’t improve the model with $\Delta F(4, 1300) = 1.84, p = 0.12$, the interaction between gender and ARTC as a positive predictor provided slight significant improvement. See Figure 4.8.
In the regression equation for predicting the Enterprising vocational interest, students’ characteristics explained a statistically significant amount of the variance (4%), $F(7, 1308) = 7.76, p < 0.001$. The positive predictors were gender and ACT_C, and ethnicity reported negative influence. Results from Step 2 revealed that including the four creativity self-efficacy domains increased the explanation of the model by a 9% variance, $\Delta F(4, 1304) = 33.46, p < 0.001$, and all added factors significantly improved the model, with ENVC and ARTC negatively relating to the outcome while STEMC and WRTC positively related to the outcome. Gender and ACT_C remained as the significant predictors. However, ethnicity no longer provided a significant improvement, and GPA became one of the predictors. Finally, results from Step 3 indicated that adding interactions didn’t improve the model with $\Delta F(4, 1300) = 1.06, p = 0.38$. Ethnicity became significant again.

In the regression equation for predicting the Conventional vocational interest, students’ characteristics explained a statistically significant amount of the variance (2%), $F(7, 1308) = 4.40, p < 0.001$. The positive predictors were gender and ACT_C. Results from Step 2 revealed
that including the four creativity self-efficacy domains increased the explanation of the model by a 7% variance, $\Delta F(4, 1304) = 23.03, p < 0.001$. STEMC was a positive predictor and WRTC was a negative predictor that significantly improved the model, but gender and ACT_C were no longer significant predictors. Finally, results from Step 3 indicated that adding interactions didn’t improve the model with $\Delta F(4, 1300) = 1.85,\ p = 0.12$. 
Table 4.6. Wave 2 Results of Hierarchical Regression Analyses for Vocational Interests

<table>
<thead>
<tr>
<th>Students' Characteristics</th>
<th>Realistic</th>
<th>Investigative</th>
<th>Artistic</th>
<th>Social</th>
<th>Enterprising</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.14***</td>
<td>0.16***</td>
<td>0.16***</td>
<td>0.03</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>R1</td>
<td>-0.05</td>
<td>-0.06</td>
<td>-0.05</td>
<td>-0.05</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>R2</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>-0.05</td>
<td>-0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>R3</td>
<td>0.03</td>
<td>0.02</td>
<td>0.02</td>
<td>0.00</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>R4</td>
<td>0.03</td>
<td>0.02</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>GPA</td>
<td>-0.04</td>
<td>-0.04</td>
<td>0.02</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>ACT_C</td>
<td>-0.01</td>
<td>-0.03</td>
<td>-0.03</td>
<td>0.29***</td>
<td>0.20***</td>
<td>0.21***</td>
</tr>
<tr>
<td>Creativity Related Factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENVC</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.09**</td>
<td>0.31***</td>
<td>-0.16***</td>
<td>0.29***</td>
</tr>
<tr>
<td>STEMC</td>
<td>0.11**</td>
<td>0.11***</td>
<td>0.31***</td>
<td>0.31***</td>
<td>0.29***</td>
<td>0.29***</td>
</tr>
<tr>
<td>WRTC</td>
<td>-0.06</td>
<td>-0.06</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.19***</td>
<td>0.19***</td>
</tr>
<tr>
<td>ARTC</td>
<td>0.17***</td>
<td>0.17***</td>
<td>0.06*</td>
<td>0.05</td>
<td>0.43***</td>
<td>0.42***</td>
</tr>
<tr>
<td>Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GENVC</td>
<td>0.00</td>
<td>0.02</td>
<td>0.04</td>
<td>-0.01</td>
<td>-0.05</td>
<td>-0.01</td>
</tr>
<tr>
<td>GSTEMC</td>
<td>0.01</td>
<td>0.03</td>
<td>0.00</td>
<td>0.05</td>
<td>0.03</td>
<td>-0.03</td>
</tr>
<tr>
<td>GWRTC</td>
<td>0.00</td>
<td>-0.07*</td>
<td>-0.04</td>
<td>-0.04</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>GARTC</td>
<td>0.01</td>
<td>0.04</td>
<td>0.08***</td>
<td>0.07*</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>R²</td>
<td>0.03***</td>
<td>0.05***</td>
<td>0.10***</td>
<td>0.17***</td>
<td>0.18***</td>
<td>0.27***</td>
</tr>
<tr>
<td>ΔR²</td>
<td>0.03***</td>
<td>0.00</td>
<td>0.07***</td>
<td>0.00</td>
<td>0.24***</td>
<td>0.01*</td>
</tr>
</tbody>
</table>

N=1316

***p<.001, **p<.01, *p<.05

Gender and creativity factors were centered and multiplied to compute interaction factors GENVC, GSTEMC, GWRTC, and GARTC.
Research Question 2

LPA Results

The fit statistics and overall interpretability of the solutions were explored to ascertain the most suitable number of profiles. In Table 4.7, the fit indices suggested an eight-class solution would be preferable due to its significant BLRT $p$ value ($< 0.05$) and the smallest AWE value. Although its BIC and SABIC values weren’t the smallest, the trend lines of BIC and SABIC (Figure 4.9) showed a leveling off for solutions with eight or more classes.

Table 4.7. Latent Profile Analysis Model Fit Statistics.

<table>
<thead>
<tr>
<th>Classes</th>
<th>LogLik</th>
<th>AIC</th>
<th>AWE</th>
<th>BIC</th>
<th>SABIC</th>
<th>Entropy</th>
<th>BLRT $p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-67235.13</td>
<td>134508.27</td>
<td>134836.73</td>
<td>134625.69</td>
<td>134565.32</td>
<td>0.7</td>
<td>0.01</td>
</tr>
<tr>
<td>3</td>
<td>-66772.29</td>
<td>133596.58</td>
<td>134046.52</td>
<td>133757.27</td>
<td>133674.65</td>
<td>0.72</td>
<td>0.01</td>
</tr>
<tr>
<td>4</td>
<td>-66579.07</td>
<td>133224.13</td>
<td>133795.69</td>
<td>133428.08</td>
<td>133323.22</td>
<td>0.67</td>
<td>0.01</td>
</tr>
<tr>
<td>5</td>
<td>-66402.47</td>
<td>132884.94</td>
<td>133577.97</td>
<td>133132.16</td>
<td>133005.06</td>
<td>0.7</td>
<td>0.01</td>
</tr>
<tr>
<td>6</td>
<td>-66234.14</td>
<td>132562.28</td>
<td>133376.85</td>
<td>132852.76</td>
<td>132703.41</td>
<td>0.69</td>
<td>0.01</td>
</tr>
<tr>
<td>7</td>
<td>-66137.48</td>
<td>132382.96</td>
<td>133319.06</td>
<td>132716.7</td>
<td>132545.11</td>
<td>0.69</td>
<td>0.01</td>
</tr>
<tr>
<td>8</td>
<td>-65958.17</td>
<td>132038.34</td>
<td>133095.91</td>
<td>132415.34</td>
<td>132221.51</td>
<td>0.71</td>
<td>0.01</td>
</tr>
<tr>
<td>9</td>
<td>-65894.28</td>
<td>131924.57</td>
<td>133103.66</td>
<td>132344.83</td>
<td>132128.76</td>
<td>0.72</td>
<td>0.01</td>
</tr>
<tr>
<td>10</td>
<td>-65850.95</td>
<td>131851.89</td>
<td>133152.54</td>
<td>132315.42</td>
<td>132077.11</td>
<td>0.7</td>
<td>0.01</td>
</tr>
<tr>
<td>11</td>
<td>-65843.63</td>
<td>131851.25</td>
<td>133273.42</td>
<td>132358.04</td>
<td>132097.49</td>
<td>0.7</td>
<td>0.01</td>
</tr>
<tr>
<td>12</td>
<td>-65711.91</td>
<td>131601.82</td>
<td>133145.48</td>
<td>132151.86</td>
<td>131869.07</td>
<td>0.72</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Note. LogLik=Log Likelihood; AIC=Akaike Information Criteria; AWE=approximate weight of evidence criterion; BIC=Bayesian information criterion; SABIC=sample size-adjusted BIC; BLRT $p$=bootstrapped likelihood ratio test $p$ value.

Figure 4.9. Trend Lines of BIC and SABIC
To make sure the profile results were stable, the eight-class model was run 100 times with log likelihoods (saved in Figure 4.10), with 57% of results falling inside the range of [-65,969, -65,930]. Furthermore, in Table 4.8, the percentage of individuals of each profile ranges approximately from 7.76% to 20.59%. The posterior probabilities contained in this range are reasonably high (between 0.72 and 0.88) suggest that the eight-profiles solution are relatively distinct from one another. Individuals were clearly classified into a single profile, not to multiple profiles. It could therefore be determined that the eight-profile solution was the best fit for the data and was substantively interpretable based on the results of the previous study by McLarnon et al. (2007).

Figure 4.10. Box Plot of Log Likelihood

Table 4.8. Classification Posterior Probabilities for the Eight-Profile Solution.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
<th>Profile 1</th>
<th>Profile 2</th>
<th>Profile 3</th>
<th>Profile 4</th>
<th>Profile 5</th>
<th>Profile 6</th>
<th>Profile 7</th>
<th>Profile 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile 1</td>
<td>314</td>
<td>8.80%</td>
<td>0.88</td>
<td>0.00</td>
<td>0.00</td>
<td>0.02</td>
<td>0.00</td>
<td>0.09</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Profile 2</td>
<td>416</td>
<td>11.65%</td>
<td>0.00</td>
<td>0.78</td>
<td>0.07</td>
<td>0.02</td>
<td>0.00</td>
<td>0.07</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Profile 3</td>
<td>500</td>
<td>14.01%</td>
<td>0.00</td>
<td>0.07</td>
<td>0.73</td>
<td>0.00</td>
<td>0.02</td>
<td>0.06</td>
<td>0.09</td>
<td>0.03</td>
</tr>
<tr>
<td>Profile 4</td>
<td>277</td>
<td>7.76%</td>
<td>0.00</td>
<td>0.04</td>
<td>0.00</td>
<td>0.85</td>
<td>0.00</td>
<td>0.11</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Profile 5</td>
<td>476</td>
<td>13.33%</td>
<td>0.01</td>
<td>0.00</td>
<td>0.03</td>
<td>0.00</td>
<td>0.76</td>
<td>0.10</td>
<td>0.07</td>
<td>0.03</td>
</tr>
<tr>
<td>Profile 6</td>
<td>735</td>
<td>20.59%</td>
<td>0.00</td>
<td>0.06</td>
<td>0.05</td>
<td>0.06</td>
<td>0.07</td>
<td>0.75</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Profile 7</td>
<td>538</td>
<td>15.07%</td>
<td>0.07</td>
<td>0.00</td>
<td>0.09</td>
<td>0.00</td>
<td>0.05</td>
<td>0.00</td>
<td>0.75</td>
<td>0.04</td>
</tr>
<tr>
<td>Profile 8</td>
<td>314</td>
<td>8.80%</td>
<td>0.01</td>
<td>0.06</td>
<td>0.05</td>
<td>0.00</td>
<td>0.05</td>
<td>0.02</td>
<td>0.09</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Note. Values in boldface are the average posterior probability associated with the profile to which individuals were assigned.
Profile Interpretation

To assist in labeling profiles, two visuals were created: Table 4.9, with RIASEC-estimated means across the eight different interest profiles, and Figure 4.11, with actual mean scores after profiling centered around the score of 24. Based on the total mean, participants generally rated low on the interest types of Realistic and Conventional, and tended to rate high on the interest types Investigative and Social.

As presented in Table 4.9, Profile 1 (n = 314) was labeled as Disinterested All (DIS-ALL) because all estimated means were low. Profile 2 (n = 416) was labeled as Interested-Social-Enterprising (SE). Profile 3 (n = 500) was labeled as Interested-Social (S). Profile 4 (n = 277) was labeled as Interested-All (ALL). Profile 5 (n = 476) was labeled as Neutral (NEU). Profile 6 (n = 735) was labeled as Interested-Investigating-Social (IS). Profile 7 (n = 538) was labeled as Disinterested-Realistic-Conventional-Enterprising (DIS-RCE). Profile 8 (n = 314) was labeled as Disinterested-Realistic-Investigative-Artistic (DIS-RIA).

Table 4.9. Estimated Average RIASEC Scores Across Profiles

<table>
<thead>
<tr>
<th></th>
<th>Realistic (R)</th>
<th>Investigative (I)</th>
<th>Artistic (A)</th>
<th>Social (S)</th>
<th>Enterprising (E)</th>
<th>Conventional (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIS-ALL</td>
<td>14.99</td>
<td>22.59</td>
<td>17.65</td>
<td>18.89</td>
<td>15.79</td>
<td>16.22</td>
</tr>
<tr>
<td>SE</td>
<td>18.47</td>
<td>27.45</td>
<td>24.88</td>
<td>32.55</td>
<td>30.27</td>
<td>25.37</td>
</tr>
<tr>
<td>S</td>
<td>17.08</td>
<td>27.05</td>
<td>25.15</td>
<td>31.10</td>
<td>22.85</td>
<td>17.48</td>
</tr>
<tr>
<td>ALL</td>
<td>29.69</td>
<td>31.45</td>
<td>27.94</td>
<td>33.98</td>
<td>30.56</td>
<td>30.49</td>
</tr>
<tr>
<td>NEU</td>
<td>24.20</td>
<td>26.81</td>
<td>22.92</td>
<td>25.43</td>
<td>19.71</td>
<td>22.56</td>
</tr>
<tr>
<td>IS</td>
<td>25.68</td>
<td>28.87</td>
<td>26.03</td>
<td>31.40</td>
<td>24.19</td>
<td>23.87</td>
</tr>
<tr>
<td>DIS-RCE</td>
<td>15.67</td>
<td>24.79</td>
<td>20.26</td>
<td>25.93</td>
<td>18.95</td>
<td>16.60</td>
</tr>
<tr>
<td>Grand Total</td>
<td>20.40</td>
<td>26.67</td>
<td>23.21</td>
<td>28.56</td>
<td>23.31</td>
<td>21.80</td>
</tr>
</tbody>
</table>
Figure 4.11. RIASEC Variable Actual Means Across the Eight Vocational Interest Profiles.

**RQ2.1 and RQ2.2**

Univariate ANOVA was conducted to examine the mean difference of domain-general creativity and personality-related factors (CSE, INT, OPE, ACA, and ART) and environment and domain-specific creativity (ENVC, STEMC, WRTC, and ARTC) across eight different interest profiles. The ANOVA analyses for the above variables were significant, and the result of means, standard deviations, and ANOVA comparisons across the eight profiles are reported. Follow-up post-hoc multiple comparisons analysis was also conducted to perform mean differences between the profiles and is reported in Table 4.10. The Scheffe method was used to control for Type I error across the multiple tests. Figure 4.12 and 4.13 presented the standardized means of creativity-related factors cross eight profiles.

Based on the results, there were no significant differences across either profile for ACA and ENVC. Differences for CSE showed significantly higher scores on profile SE, IS, and ALL than all three DIS-related profiles and the NEU profile, and S was also greater than NEU, DIS-ALL, and DIS-REC. Differences for the INT suggested that profile SE and ALL were greater than all DIS-related profiles, NEU, and S, while IS reported higher means than DIS-ALL, NEU, and DIS-REC. For Openness, ALL reported higher scores than DIS-RIA, NEU, and DIS-ALL,
meanwhile S and IS reported higher scores than DIS-RIA. In addition, S reported higher means than DIS-ALL. DIS-RIA reported lower scores than all other profiles except DIS-REC on the ART variable. DIS-REC was also lower than S and IS.

For domain-specific creativity factors, STEMC, SE and ALL had higher mean scores than DIS-ALL, S, NEU, and DIS-REC; similarly, IS had a higher score than S, DIS-REC, and DIS-ALL. For WRTC, SE and IN-ALL were greater scores than all three DIS-related profiles, NEU, and IS; IS also had a higher score than DIS-ALL. For ARTC, all Interested-related profiles, NEU, and DIS-REC reported higher scores than did DIS-RIA; SE, S, IS, and ALL also had higher scores than DIS-ALL.

These results suggest that all Disinterested-related profiles had no differentiated lowest scores on CSE, INT, OPE, ENVC, and WRTC. Conversely, all Interested-related profiles reported the highest scores on CSE, STEMC, and ARTC. Also, different profiles of vocational interests on RIASEC might have specific creativity characteristics that could be differentiated with others. Overall, students who dislike everything (DIS-ALL) reported the lowest scores across all factors, except for ART, where their score was slightly higher. Students who were interested in Social and Enterprising (SE) vocations had high CSE, INT, ART, STEMC, WRTC, and ARTC scores. Students who were interested in Social (S) vocations had high CSE, OPE, ART, and ARTC scores, but had low INT, STEMC, and WRTC scores. Students who were interested in every vocation (ALL) reported high scores on all variables. Students who reported neutral interest for every vocation (NEU) reported low scores for all variables except for ART and ARTC, where their scores were moderate. One profile of particular note is students interested in Investigative and Social (IS) vocations, who had high scores against all factors except WRTC. Disliked-Realistic-Enterprising-Conventional (DIS-REC) profiles reported the
lowest scores on every creativity-related factor except ARTC where they were at the middle. Students who disliked Realistic, Investigative, and Artistic (DIS-RIA) vocations had the lowest scores for every single variable.
Table 4.10. Means, Standard Deviations, and ANOVA Comparison of Eight Profiles on Wave 1 and Wave 2 Creativity-Related Variables

<table>
<thead>
<tr>
<th>Profiles</th>
<th>DIS-ALL</th>
<th>SE</th>
<th>S</th>
<th>ALL</th>
<th>NEU</th>
<th>IS</th>
<th>DIS-REC</th>
<th>DIS-RIA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave 1 - Domain-general creativity and personality-related factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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***p < .001, **p < .01.

The mean difference is higher than DIS-ALL profile at the .05 level.

The mean difference is higher than IN-SE profile at the .05 level.

The mean difference is higher than IN-S profile at the .05 level.

The mean difference is higher than NEU profile at the .05 level.

The mean difference is higher than IN-IS profile at the .05 level.

The mean difference is higher than DIS-REC profile at the .05 level.

The mean difference is higher than DIS-RIA profile at the .05 level.
Figure 4.12. Standardized Means of Wave 1 Five Creativity Related Factors Across the Eight Profiles

Figure 4.13. Standardized Means of Wave 2 Four Creativity Related Factors Across the Eight Profiles
CHAPTER 5: DISCUSSION AND IMPLICATIONS

Prior studies on the relationship between creativity and vocational interests have mostly focused on domain-general creativity (e.g., creativity self-efficacy) and vocations specific to the fields of science and art. However, the relationships between various domain-specific creativity factors (e.g., STEM creativity, art creativity) and a wider variety of vocational types has yet to be studied in depth. Similarly, research into creativity traits revealed by vocational interest profiles has also been limited.

Since the theoretical frameworks of the Amusement Park Theory (APT) on creativity indicate that types of vocational interests parallel the broad domains of creativity, domain-specific creativity focused on STEM, art, and writing creativity were potential indicators in assisting in the prediction of vocational practices. To fill these gaps and explore the possibility of using creativity to predict and describe vocational interest types and profiles, the purpose of this dissertation was to examine the role of domain-general factors and domain-specific creativity-related factors in predicting students’ vocational interests, as well as to explore how creativity characteristics can describe different interest profiles under Holland’s RIASEC model, which includes Realistic, Investigative, Artistic, Social, Enterprising, and Conventional types of vocational interests.

Through this dissertation, the following research questions were generated:

*RQ1.1. Can demographic factors and academic achievements (gender, ethnicity, GPA, and ACT_C), domain-general creativity and personality-related factors (Creativity Self-efficacy, Intellect, Openness, Academic, and Art), as well as the interaction between gender and these areas of creativity, significantly predict the six types of vocational interests?*
RQ1.2. Can demographic factors and academic achievements (gender, ethnicity, GPA, and ACT_C), environment and domain-specific creativity factors (School Environment of Creativity, STEM creativity, Writing Creativity, and Art Creativity), as well as the interaction between gender and these areas of creativity, significantly predict the six types of vocational interests?

RQ2.1. Is there evidence that domain-general creativity and personality-related factors (Creativity Self-efficacy, Intellect, Openness, Academic, and Art) exhibit differential mean levels across the latent vocational interest profiles generated from RIASEC scores?

RQ2.2. Is there evidence that environment and domain-specific creativity factors (School Environment of Creativity, STEM creativity, Writing Creativity, and Art Creativity) exhibit differential mean levels across the latent vocational interest profiles generated from RIASEC scores?

In terms of analysis tools, Hierarchical Linear Regression analysis was conducted to answer questions 1.1 and 1.2, while Latent Profile Analysis and ANOVA analyses were used to answer research questions 2.1 and 2.2. The summary of findings is discussed in the following sections:

Summary of Findings

Research Question 1

Results of demographic factors and academic achievements in Wave 1 and 2

When controlling only for demographic and academic factors in the regression equations, the variance explanations provided significant results ranging from 3% to 10% in Waves 1 and 2, across the six types of vocational interest. After controlling for creativity-related factors in the regression equations, gender as a factor consistently improved the explanation of variance in
predicting students’ interests on Realistic and Enterprising vocations in both the Wave 1 and Wave 2 analyses. It indicated that males generally scored higher than females in terms of interest in the Realistic and Enterprising vocations after controlling for other factors, excluding interaction effects. Ethnicity and GPA didn’t show consistent results from either the Wave 1 or 2 analyses. ACT_C provided consistent improvements in predictive accuracy for Investigative, Artistic, and Enterprising vocational types after adding creativity-related factors and interactions in both the Wave 1 and Wave 2 analyses.

*Results of domain-general creativity and personality-related factors in Wave 1 analysis*

For Wave 1, adding the creativity-related factors provided significant changes in variance, ranging from 3% to 30% for the six types of interests. Domain-general creativity and personality-related factors were more accurate in explaining the Artistic type than others ($\Delta R^2=30\%$). Students with higher scores in Creativity Self-Efficacy (CSE) reported stronger interests in Artistic, Social, and Enterprising vocations. Better Intellect (INT) scores indicated higher interest scores for Investigative, Social, Enterprising, and Conventional vocations. Meanwhile, Openness (OPE) was only effective in predicting Realistic and Social vocational types. Higher Academic (ACA) scores predicted stronger interest in Investigative and Conventional vocational types, while lower ACA scores predicted a range of different interests, this time in Artistic, Social, and Enterprising vocations. Students with higher ART scores showed stronger interest in Realistic and Artistic vocations. In contrast, a decrease in ART scores significantly increased interest scores in Enterprising and Conventional vocations.

*Results of domain-specific creativity factors in Wave 2 analysis*

For Wave 2, adding the creativity-related factors provided significant changes in variance, ranging from 3% to 24% for the six types of interests. The Artistic type was better
explained by domain-specific creativity factors ($\Delta R^2=24\%$) than other factors. Before considering interaction effects, School Environment of Creativity (ENVC) negatively predicted Investigative, Artistic, and Enterprising vocations. Higher levels of STEM Creativity (STEMC) correlated to stronger interests in Realistic, Investigative, Enterprising, and Conventional vocations. For Artistic types, however, STEMC provided a negative prediction coefficient. Writing Creativity (WRTC) positively predicted Artistic, Social, and Enterprising vocation types, whereas WRTC negatively predicted interest in Conventional vocations. Art Creativity (ARTC) positively predicted Realistic, Investigative, and Artistic roles. Meanwhile ARTC negatively predicted Enterprising and Conventional vocations.

*Results of interaction between gender and creativity related factors in Wave 1 and 2*

Although the overall interaction between gender and creativity-related factors only led to a small change in variance across the different types of vocations in both Wave 1 and 2, there were several important interaction effects. The prediction for Realistic vocations derived from the CSE and INT varied by gender. Compared to females, males’ interest in Realistic vocations increased more when CSE increased. Meanwhile INT showed better positive prediction on females than males. To predict Investigative vocations, OPE was a more important positive predictor for females than it was for males. For females, higher INT revealed higher interests in Social vocations. Moreover, CSE showed different directions of influencing interests of Conventional. For female, CSE provided a negative effect on increasing of interests on Conventional, while for males it was a positive influence. For domain-specific creativity factors, the results were less revealing. However, it was found that WRTC was better at positively predicting interest in Investigative vocation types for females, while males’ ARTC scores were better than females at positively predicting interest in Artistic and Social roles.
Research Question 2

The results from LPA generated eight different groups of interests. One group consisted of students who scored high for every vocation type (ALL), one group consisted of students who scored neutral for all vocation types (NEU), and one group consisted of students who had low scores for all vocation types (DIS-ALL). Three groups had interests in Social vocation interests (S, SE, IS) and two groups were specifically disinterested in Realistic vocations (DIS-RIA, DIS-REC). In total, these eight groups were labeled Disinterested All (DIS-ALL), Interested-Social-Enterprising (SE), Interested-Social (S), Interested-All (ALL), Neutral (NEU), Interested-Investigative-Social (IS), Disinterested-Realistic-Enterprising-Conventional (DIS-REC), and Disinterested-Realistic-Investigative-Artistic (DIS-RIA).

Finally, follow-up post-hoc multiple comparisons analysis showed that the mean differences in creativity-related characteristics across these eight profiles were significant, except for ACA and ENVC. Overall, the three disinterested-related profiles as well as NEU provided low scores for all creativity factors, while the profile of ALL provided the highest scores for all factors. Amongst the three interested-Social-related profiles, CSE presented higher means than others. INT favored the SE profile and also provided high means on S and IS. As the other side of openness of experience, OPE presented slightly higher scores on S and IS. Similarly, ART favored S and IS profiles. STEMC and WRTC favored SE and IS, but did not show high scores for the S dominant profile. ARTC scored equally high scores for all three Social-related groups.

Discussion

Demographic and Academic Achievements Predictors

In this study, gender was presented as a significant predictor for Realistic and Enterprising vocational types, fitting with prior research that males scored higher on such types,
and favored “things” vocations compared to “people” vocations (Morris, 2016; Donnay et al., 2004; Su et al., 2009). However, gender was not a significant predictor of all other interest types. This result is supported by meta-analysis from Su et al. (2009) that the younger cohort showed smaller differences in gender than older generations in the Data–Ideas dimension, as well as in Artistic and Enterprising vocational interests. Results of the regression analyses on ethnicity were reflective of what has already been found in prior studies (ACT, 2009a), in that there were no consistent patterns. This provided sufficient evidence that the vocational interests of high school students didn’t vary significantly across different ethnic groups.

The results of the regression analysis indicated that ACT_C was a better predictor than GPA for students’ vocational interests, especially in predicting Investigative, Artistic, and Enterprising vocational interests. Unlike GPA, which measures a very wide range of skills and behaviors, ACT_C was based only on scores from four main academic areas – English, Math, Reading, and Science. ACT data provided sufficient evidence that Investigative, Artistic, and Enterprising vocational types can be explained by ACT scores while other types cannot.

**Artistic – The Type of Interest Best Explained by Creativity**

The Artistic vocational interest was better explained by creativity-related factors than any other vocation type, fitting with prior research findings that creativity was a strong predictor of Artistic vocations (Armstrong et al., 2008; Kaufman, 2017). Students who favored Artistic professions reported low scores on Academic and STEM creativity, but clearly enjoyed Art and reported higher Art Creativity scores. Based on literature on creativity, Arts and Science gravitate toward divergence-novelty and convergence-effectiveness, supporting this result (Cropley & Cropley, 2010; Kaufman & Baer, 2002). Interestingly, although prior research found that classroom environments focused on creative learning assisted in unveiling students’ creative
potentials (Beghetto & Kaufman, 2014), the current study found that lower ENVC scores indicated higher scores for Artistic interest. It is possible that students who have higher creative potentials are aware that these skills are not a focus of traditional schooling and feel less supported than their classmates; students who are less drawn to the Artistic vocations may have limited awareness of whether or not their school is supportive of creativity and may overestimate it (Kaufman & Beghetto, 2014).

**Intellect and Openness**

As discussed in the literature review, Openness and Intellect were the two elements of the personality area “Openness to experiences” (DeYoung et al., 2007). The findings indicated the meaningful difference between openness and intellect in terms of each factor’s ability to predict vocational interests; INT positively predicted interests in Investigative, Social, Enterprising, Conventional vocations, while OPE only effectively predicted those interests in Realistic and Social vocations. This makes sense because intellectual engagement has been found to be more related to inventions and science (Kaufman, 2013), favoring the working memory and fluid intelligence useful for understanding and reasoning (DeYoung et al, 2009; Nusbaum & Silvia, 2011). Social science vocations, however, have reported notably higher Openness scores in students (Kaufman et al., 2013), which supports this study’s findings that students interested in Social type vocations had higher INT and OPE scores.

**Creativity Self-efficacy, STEM, Writing, and Art creativity**

Domain-specific creativity provided more diversified results than general CSE. CSE positively predicted Artistic, Social, and Enterprising vocational types, which were more “people” types and supported the prior findings that CSE was more accurate for students interested in the arts, humanities, and social sciences (Pretz & Nelson, 2017). The only
significant finding here was the interaction effect for Conventional vocational interests, in that females with low CSE showed high interest in Conventional professions, but that males with the same interest showed high CSE scores. This could be explained by the differing perceptions of Conventional vocations such as Accountant or Clerk, as females generally believe these positions are not very creative, while males may see them as having creative opportunities.

The domain-specific analysis generated more nuanced results that differentiated interests. Realistic vocational interests were predicted by STEM and ARTC, fitting the description of Realistic types as “working with hands, tools, machines, or electronic equipment” (Holland, 1997, p. 22). In addition, it is logical that if a student is specifically interested in some Realistic vocations such as cooking, handicrafts, and similar roles, they will have stronger ARTC scores. Unsurprisingly, Investigative vocations were positively predicted by STEMC (focused on math and science), while Social vocations were positively predicted by WRTC. The interest in Social vocations, such as teaching or counseling, needs better self-efficacy of writing creativity to fulfill the communication needs of these roles.

Although CSE was a significant predictor of the Enterprising vocational interest, creativity self-efficacy domains revealed different relationships between the factors. Students with higher scores on STEMC and WRTC and lower ARTC scores were more interested in Enterprising vocations. Similarly, students with higher STEMC scores and lower WRTC scores tended to favor Conventional roles. These results will form a supplemental descriptive resource that can be integrated in terms of the individual characteristics used in career counseling (Armstrong et al., 2008).
Interested-Social Related Profiles and Disinterested-Realistic Related Profiles

The results from the ACT (2009a) UNIACT manual agreed with the current findings that students in grades 10 to 12 tend to have stronger interests in Social vocations and weaker ones in Realistic and Conventional fields; this was one of the reasons that disinterested-related profiles all related to Realistic vocations while interested-related profiles all related to Social vocations. Since high school students who take the ACT and are preparing for college are less likely to be interested in Realistic or Conventional vocation types (i.e., cook/surveyor/mechanic or accountant/clerk/operator), the traditional RIASEC model-based methods of balancing using all six types might be inappropriate for these students. For high school vocational counseling, more subgroups specific to the Social vocational interest could be generated than for other types of interests, with more differentiated characteristics that should be examined for bespoke support for each student.

The results from post-hoc comparisons indicated that creativity-related factors, in particular INT, STEMC, and WRTC, were the most useful factors for differentiating Social-related profiles. Students interested in Social and Enterprising vocations scored higher Intellect and STEMC scores than Social-dominant, and scored higher WRTC than IS (social-science) profiles.

Unlike in this study, the results from the study completed by McLarnon et al. (2015), which used undergraduate samples, generated more dominant groups (i.e., Artistic, Investigative, or Enterprising dominant profiles) and more diverse profiles such as Realistic-Investigative-Artistic (RIA), Realistic-Artistic-Conventional (RAC), and Conventional-Enterprising (CE). The interdisciplinary nature of college majors, expanded understanding of vocational types and roles, and wider occupational experience could be factors behind the homogeneous profiles of high
school students and heterogeneous profiles of undergraduates. In addition, high school students might be more likely to have stereotyped understandings of organizations and careers, which might influence the diversity of profile outcomes.

The current study provided more than one disinterested group, many of which specifically operated in conjunction with Realistic-type vocations. The possible interpretation of these disinterested groups could be those students who provided low scores on vocational interests fell out of RIASEC vocational types and represented a subgroup with abnormal or post-modern work interests, such as becoming a professional gamer or a social media influencer. Another possible interpretation could be considering the ALL and NEU profiles as the special patterns of responding questionnaires with individuals scoring every self-reported item low or neutral. The DIS-RIA and DIS-REC profiles comprised a 24% of the sample, representing students with clear disinterests but no clear interests. For these students, assigning “three-letter-codes” to the highest scoring RIASEC variables was less appropriate. The lowest scores were also important indicators of what students most disliked or were least motivated to do; these vocational inventories are usually ignored, but would be of interest to understand how the related personality, motivation, or creativity traits differ from those of other students as well as the career pathways these students chose when entering the workforce.

**Implications, Limitations, and Future Perspectives**

Armstrong et al. (2008) conducted research that integrated varieties of personality and ability variables to describe individual differences based on the RIASEC model. Similarly, as this study revealed, the creativity self-efficacy domains could be used to describe individual differences. Although this sample is not representative of the whole high school student population (which would also include students focused on going to trade school or those hoping
to be self-employed), findings from this study have shown sufficient support for the usefulness of self-efficacy domains in assisting with individualized career counseling, especially with interest profiles that tend to show interest in Social vocational types.

An increased number of people are expected to use web-based assessments instead of in-person counseling in the future to help themselves make vocational choices (Tracey, 2020). The wide range of individual differences from multiple sources will simplify the process of presenting information to clients, as well as the more convenient use of computer and web-based tests. LPA and creativity-related traits have also made the interpretation of vocational interests more flexible. For example, students who have been defined as having “Social-dominant” profiles and provide high Social-related creativity characteristics should not have to follow the guidance of the “three-letter-code,” which is a narrower presentation of Social types that would better fit an individual focus. If a student scores lower on Realistic-Investigative-Artistic and presents no interest in other areas, the SEC recommendation should not be presented, as it would likely mislead students to choosing an unsuitable or disliked vocation. However, the descriptive data of creativity, personality, or ability traits could be analyzed and reported to provide more effective guidance.

In addition, the findings around gender differences and interactions between factors may lead to a possible future perspective of vocational educations. For example, females’ interest in Investigative vocations was better predicted by WRTC than it was for males, meaning the nurturing of WRTC could be a useful way to lead more females into Investigative vocation types. Creativity can be nurtured by the targeted training of domain-specific creativity (Baer, 2016). More domains should therefore be introduced into the current model (i.e., business-
entrepreneur creativity, mechanic-handwork creativity, social work creativity), and the relationship between domains and interest should be examined further.

There are also a number of limitations that should be noted in order to understand how the findings of this study can be used most appropriately. Although the sample size was sufficiently large, a disproportionate percentage (74%) were females. In addition, the response ratio was only around 10% of the total number of students contacted (3,570 out of 35,000). Valid responses were not randomly selected from the sample who received the surveys and forced to complete the survey. If a respondent did not have confidence on a creativity question, he or should could skip that item, making the data systematically missing. Also, other environmental factors (e.g., background music, being watched by parents) during the survey may also have influenced the results. For future research, a more balanced gender distribution would be preferable, as would a more controlled and consistent survey environment. Ideally, representative data from social-economic statuses matching those in the U.S. census could be used to provide more accurate data, thus helping build a baseline for practical use.

Beyond using a regression model to predict vocational interests, it is also important to consider the developmental relationships between such interests and self-rated creativity predictors, as it is highly possible that the relationship between vocational interests and creativity factors changed over the course of development. Furthermore, the focus could be changed from identifying vocational interests to taking the next step in vocational or occupational choices that help high school students, researchers, and practitioners find better ways to make more reasonable decisions. A longitudinal study needs to be conducted to find changes before and after graduation from high school, as well as when students change majors during college, to see want factors most strongly predict students’ career paths.
Moreover, the self-reported creativity scores generally lacked accuracy in describing real students’ real creative and achievement potentials. Given this, however, the relation between self-reported creativity scores and objective performance measures was stronger when self-evaluations were specific to a given domain rather than described in general (Zell & Krizan, 2014). Therefore, in future applications, the measures of creative achievement should be used alongside the self-reported domains of creativity, such as in the Consensus Assessment Technique (Kaufman, 2016; Baer, 2016).

In addition, as one of the initial requirements of the APT framework on creativity, motivation should be considered as a possible factor that influences vocational choices. From prior studies, gifted individuals tend to be motivated to achieve in those courses in which they are most interested, but are also likely to purposely underachieve in those courses that interest them least (Csikszentmihalyi, 1996; Kerr & McKay, 2013). This motivation-based understanding could provide a different approach to help explain students’ interests, particularly as this study revealed that a large percentage of students fall outside traditional RIASEC profiles (i.e., DIS-related groups, NEU and ALL groups).

Finally, as previously discussed, high school is the most important time for young people to start to develop their personal interests and begin to design their career paths. As Morris (2016) summarized, major changes in students’ interests appear at the end of high school, peaking during the college years, and then settling for the following two decades. Gender differences are small during high school, but in college, for instance, females are less likely to declare or graduate from a STEM major (Goyette & Mullen, 2006; National Science Foundation [NSF], 2007). Further studies and practical interventions should therefore be conducted during
this time to help students properly prepare for this tumultuous period and begin their careers confidently and smoothly.

**Conclusion**

In summary, this study has revealed the relationship between creativity-related factors and the personal vocational interests of high school ACT test-takers. The results of this research have also highlighted the significant role of creativity self-efficacy domains in predicting and describing vocational interest types and profiles. This study was one of the first to explore the broader picture of individual differences in high school students using a large-scale sample.

This research provides sufficient evidence for future work on developing a more human-centered, flexible, and multi-dimensional approach to career and vocational counseling. The core results emphasize the importance of the integration of vocational interests and domain-specific creativity and, along with past research, can be used to help students, educational practitioners, and career counselors understand personal interests more clearly, support career preparation more appropriately, and provide occupational guidance more accurately.
References


## Appendix A: Summary of the Population and Sample

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<td>1,470</td>
<td>0%</td>
<td>148</td>
<td>0%</td>
</tr>
<tr>
<td>White</td>
<td>198,589</td>
<td>59%</td>
<td>195,484</td>
<td>59%</td>
<td>20,902</td>
<td>60%</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>52,438</td>
<td>16%</td>
<td>52,030</td>
<td>16%</td>
<td>5,463</td>
<td>16%</td>
</tr>
<tr>
<td>Asian</td>
<td>20,162</td>
<td>6%</td>
<td>19,926</td>
<td>6%</td>
<td>2,025</td>
<td>6%</td>
</tr>
<tr>
<td>Native Hawaiian/Other Pacific Islands</td>
<td>571</td>
<td>0%</td>
<td>564</td>
<td>0%</td>
<td>55</td>
<td>0%</td>
</tr>
<tr>
<td>Two or more races</td>
<td>13,781</td>
<td>4%</td>
<td>13,636</td>
<td>4%</td>
<td>1,434</td>
<td>4%</td>
</tr>
<tr>
<td>Prefer not to respond</td>
<td>15,652</td>
<td>5%</td>
<td>15,293</td>
<td>5%</td>
<td>1,613</td>
<td>5%</td>
</tr>
<tr>
<td>Region (determined from state)</td>
<td>42,007</td>
<td>13%</td>
<td>41,523</td>
<td>13%</td>
<td>4,431</td>
<td>13%</td>
</tr>
<tr>
<td>Northeast</td>
<td>42,007</td>
<td>13%</td>
<td>41,523</td>
<td>13%</td>
<td>4,431</td>
<td>13%</td>
</tr>
<tr>
<td>Southeast</td>
<td>87,831</td>
<td>26%</td>
<td>86,409</td>
<td>26%</td>
<td>9,150</td>
<td>26%</td>
</tr>
<tr>
<td>Midwest</td>
<td>87,439</td>
<td>26%</td>
<td>86,230</td>
<td>26%</td>
<td>9,250</td>
<td>26%</td>
</tr>
<tr>
<td>Southwest</td>
<td>50,571</td>
<td>15%</td>
<td>49,884</td>
<td>15%</td>
<td>5,303</td>
<td>15%</td>
</tr>
<tr>
<td>West</td>
<td>46,108</td>
<td>14%</td>
<td>45,658</td>
<td>14%</td>
<td>4,778</td>
<td>14%</td>
</tr>
<tr>
<td>Mountain/Plains</td>
<td>20,221</td>
<td>6%</td>
<td>19,920</td>
<td>6%</td>
<td>2,088</td>
<td>6%</td>
</tr>
<tr>
<td>Family Income</td>
<td>24,817</td>
<td>7%</td>
<td>24,608</td>
<td>7%</td>
<td>2,610</td>
<td>7%</td>
</tr>
<tr>
<td>Less than $24,000</td>
<td>21,730</td>
<td>7%</td>
<td>21,541</td>
<td>7%</td>
<td>2,318</td>
<td>7%</td>
</tr>
<tr>
<td>About $24,000 to $36,000</td>
<td>21,055</td>
<td>6%</td>
<td>20,847</td>
<td>6%</td>
<td>2,149</td>
<td>6%</td>
</tr>
<tr>
<td>About $36,000 to $50,000</td>
<td>16,160</td>
<td>5%</td>
<td>15,994</td>
<td>5%</td>
<td>1,621</td>
<td>5%</td>
</tr>
<tr>
<td>About $50,000 to $60,000</td>
<td>25,430</td>
<td>8%</td>
<td>25,148</td>
<td>8%</td>
<td>2,625</td>
<td>8%</td>
</tr>
<tr>
<td>About $60,000 to $80,000</td>
<td>28,411</td>
<td>9%</td>
<td>28,051</td>
<td>9%</td>
<td>2,964</td>
<td>8%</td>
</tr>
<tr>
<td>About $80,000 to $100,000</td>
<td>27,713</td>
<td>8%</td>
<td>27,331</td>
<td>8%</td>
<td>2,872</td>
<td>8%</td>
</tr>
<tr>
<td>About $100,000 to $120,000</td>
<td>20,902</td>
<td>6%</td>
<td>20,670</td>
<td>6%</td>
<td>2,332</td>
<td>6%</td>
</tr>
<tr>
<td>Father Education Level</td>
<td>Target Population</td>
<td>Sampled Population</td>
<td>Sample</td>
<td>Valid Responses</td>
<td>Wave 1</td>
<td>Wave 2</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------</td>
<td>--------------------</td>
<td>--------</td>
<td>-----------------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Pct</td>
<td>N</td>
<td>Pct</td>
<td>N</td>
<td>Pct</td>
</tr>
<tr>
<td>About $120,000 to $150,000</td>
<td>23,024</td>
<td>7%</td>
<td>22,685</td>
<td>7%</td>
<td>2,511</td>
<td>7%</td>
</tr>
<tr>
<td>More than $150,000</td>
<td>49,052</td>
<td>15%</td>
<td>48,273</td>
<td>15%</td>
<td>5,167</td>
<td>15%</td>
</tr>
<tr>
<td>Unknown</td>
<td>96,785</td>
<td>29%</td>
<td>95,149</td>
<td>29%</td>
<td>10,163</td>
<td>29%</td>
</tr>
<tr>
<td>Less than high school</td>
<td>21,483</td>
<td>6%</td>
<td>21,355</td>
<td>6%</td>
<td>2,233</td>
<td>6%</td>
</tr>
<tr>
<td>High school graduate/GED</td>
<td>48,648</td>
<td>15%</td>
<td>48,185</td>
<td>15%</td>
<td>5,034</td>
<td>14%</td>
</tr>
<tr>
<td>Business/technical school or certificate program</td>
<td>12,909</td>
<td>4%</td>
<td>12,754</td>
<td>4%</td>
<td>1,340</td>
<td>4%</td>
</tr>
<tr>
<td>Some college, no degree or certificate</td>
<td>32,603</td>
<td>10%</td>
<td>32,244</td>
<td>10%</td>
<td>3,403</td>
<td>10%</td>
</tr>
<tr>
<td>Associate's degree (2 years)</td>
<td>23,607</td>
<td>7%</td>
<td>23,292</td>
<td>7%</td>
<td>2,552</td>
<td>7%</td>
</tr>
<tr>
<td>Bachelor's degree (4 years)</td>
<td>87,081</td>
<td>26%</td>
<td>85,801</td>
<td>26%</td>
<td>9,147</td>
<td>26%</td>
</tr>
<tr>
<td>One or two years of graduate study (MA, MBA, etc.)</td>
<td>39,882</td>
<td>12%</td>
<td>39,177</td>
<td>12%</td>
<td>4,183</td>
<td>12%</td>
</tr>
<tr>
<td>Doctorate or professional degree (PhD, MD, JD, etc.)</td>
<td>17,602</td>
<td>5%</td>
<td>17,298</td>
<td>5%</td>
<td>1,819</td>
<td>5%</td>
</tr>
<tr>
<td>Unknown</td>
<td>50,362</td>
<td>15%</td>
<td>49,518</td>
<td>15%</td>
<td>5,289</td>
<td>15%</td>
</tr>
<tr>
<td>Mother Education Level</td>
<td>17,913</td>
<td>5%</td>
<td>17,803</td>
<td>5%</td>
<td>1,868</td>
<td>5%</td>
</tr>
<tr>
<td>Less than high school</td>
<td>40,858</td>
<td>12%</td>
<td>40,503</td>
<td>12%</td>
<td>4,333</td>
<td>12%</td>
</tr>
<tr>
<td>High school graduate/GED</td>
<td>9,481</td>
<td>3%</td>
<td>9,366</td>
<td>3%</td>
<td>989</td>
<td>3%</td>
</tr>
<tr>
<td>Business/technical school or certificate program</td>
<td>27,398</td>
<td>8%</td>
<td>27,095</td>
<td>8%</td>
<td>2,894</td>
<td>8%</td>
</tr>
<tr>
<td>Associate's degree (2 years)</td>
<td>24,410</td>
<td>7%</td>
<td>24,141</td>
<td>7%</td>
<td>2,526</td>
<td>7%</td>
</tr>
<tr>
<td>Bachelor's degree (4 years)</td>
<td>102,071</td>
<td>31%</td>
<td>100,575</td>
<td>31%</td>
<td>10,691</td>
<td>31%</td>
</tr>
<tr>
<td>One or two years of graduate study (MA, MBA, etc.)</td>
<td>49,769</td>
<td>15%</td>
<td>48,970</td>
<td>15%</td>
<td>5,165</td>
<td>15%</td>
</tr>
<tr>
<td>Doctorate or professional degree (PhD, MD, JD, etc.)</td>
<td>39,882</td>
<td>12%</td>
<td>39,072</td>
<td>12%</td>
<td>4,195</td>
<td>12%</td>
</tr>
<tr>
<td>Unknown</td>
<td>39,882</td>
<td>12%</td>
<td>39,072</td>
<td>12%</td>
<td>4,195</td>
<td>12%</td>
</tr>
<tr>
<td>High School GPA</td>
<td>101</td>
<td>0%</td>
<td>101</td>
<td>0%</td>
<td>12</td>
<td>0%</td>
</tr>
<tr>
<td>(D- to D) 0.5-0.9 or lower</td>
<td>408</td>
<td>0%</td>
<td>408</td>
<td>0%</td>
<td>37</td>
<td>0%</td>
</tr>
<tr>
<td>(D to C-) 1.0-1.4</td>
<td>2,041</td>
<td>1%</td>
<td>2,019</td>
<td>1%</td>
<td>224</td>
<td>1%</td>
</tr>
<tr>
<td>(C- to C) 1.5-1.9</td>
<td>8,902</td>
<td>3%</td>
<td>8,806</td>
<td>3%</td>
<td>916</td>
<td>3%</td>
</tr>
<tr>
<td>(C to B-) 2.0-2.4</td>
<td>23,184</td>
<td>7%</td>
<td>22,915</td>
<td>7%</td>
<td>2,443</td>
<td>7%</td>
</tr>
<tr>
<td>(B to B+) 3.0-3.4</td>
<td>67,386</td>
<td>20%</td>
<td>66,569</td>
<td>20%</td>
<td>7,053</td>
<td>20%</td>
</tr>
<tr>
<td>(A- to A) 3.5-4.0 or higher</td>
<td>201,425</td>
<td>60%</td>
<td>198,655</td>
<td>60%</td>
<td>21,131</td>
<td>60%</td>
</tr>
<tr>
<td>Target Population</td>
<td>Sampled Population</td>
<td>Sample</td>
<td>Valid Responses N=4052</td>
<td>Wave 1 N=2444</td>
<td>Wave 2 N=1608</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------</td>
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<td>------------------------</td>
<td>--------------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Pct</td>
<td>N</td>
<td>Pct</td>
<td>N</td>
<td>Pct</td>
<td>N</td>
</tr>
<tr>
<td>Unknown</td>
<td>30,730</td>
<td>9%</td>
<td>30,151</td>
<td>9%</td>
<td>3,184</td>
<td>9%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>334,177</td>
<td>100%</td>
<td>329,624</td>
<td>100%</td>
<td>35,000</td>
<td>100%</td>
</tr>
</tbody>
</table>

The target population is defined as national ACT registrants, grades 9-12, who reported that they were residing in the US.
The sampled population excludes registrants who are on ACT's master opt out list. It also excludes registrants with foreign email addresses and students included in the sample for AKOPL post-test survey.
Ethnicity was recoded from 8 groups to 5 groups to reduce the number of further dummy variables: Black/African American=1, White=2, Hispanic/Latino=3, Asian=4, American Indian/Alaska Native/Native Hawaiian/Other Pacific Islands/Two or more races=5, Prefer not to respond=missing.
Father and mother’s education levels were merged to “parents’ highest education level” in the further analysis.
Appendix B: List of Factors and Items

Wave 1 Factors and Items

Factor 1: Creative Self-Efficacy
1. I have confidence in my ability to come up with new ideas.
2. I use my imagination to create new ideas.
3. I have difficulty using my imagination (reverse).
4. It is easy for me to come up with new ideas.
5. I have confidence in my ability to come up with new ways to find solutions to problems.
6. I have confidence in my ability to be creative.
7. I can think of many different uses for objects.
8. I can generate new ideas quickly.
9. I have original ideas.
10. I am good at quickly making up stories.

Factor 2: Intellect
1. I enjoy discussing complex problems.
2. I enjoy solving complex problems.
3. I enjoy learning new things in school.
4. I like school work that is challenging.
5. I enjoy thinking about new ways to solve problems.
6. I ask questions to learn how things work.
7. I like discussing abstract concepts.
8. I ask questions in class to help me understand complex concepts.
9. I am interested in hearing others' opinions of my ideas.
10. I like hearing different people's opinions.
11. I like learning new words.
12. When I hear about something interesting, I try to learn more about it.
13. I have an extensive vocabulary.

Factor 3: Openness
1. I enjoy the beauty of nature.
2. I would enjoy spending time in nature.
3. I am interested in new experiences.
4. I would like to travel to new places.
5. I see beauty in everyday things.
6. I am willing to try new things.

Factor 4: Academic
1. I easily learn the material I am taught in school.
2. Most of my school assignments are easy for me.
3. I am a fast learner.
4. I don't need a lot of help from my teachers.
5. I can finish my school assignments quickly.
6. New things come easily to me.
7. I can solve problems quickly.
8. My schoolwork is challenging for me (reverse).

Factor 5: Art
1. I enjoy creating art.
2. I enjoy artistic activities.
3. I express myself through art.
4. I like looking at art.
5. Doing something creative makes me happy.
6. I enjoy doing creative projects.

**Wave 2 Factors and Items**

*Factor 1: School Environment of Creativity*

1. In my school, everyone is given a chance to express his or her ideas.
2. My school encourages students to think for themselves.
3. The activities we do in my classes make me think about new ways to solve problems.
4. Class activities teach me how to test all possible approaches to a problem.
5. I am allowed to be creative on my assignments.
6. The activities we do in my classes make me come up with new ideas.
7. My teachers give me enough time to come up with creative solutions on assignments.
8. In my classes, I learn multiple strategies to help me solve problems.
10. The activities we do in my classes make me evaluate my own ideas.
11. Class activities teach me how to fully understand problems before trying to solve them.
12. Students are encouraged to come up with ideas for school events.
13. Students in my school are accepting of creative ideas.
14. My assignments require me to integrate multiple topics we've learned about.
15. Creative solutions to problems are usually given good grades.
16. There are people in my school who encourage me to think unconventionally.
17. My peers are open to creative ideas.
18. Rather than giving them to us, our teachers ask us to identify problems to be solved.
19. In my classes, I am asked to give feedback about other students' ideas.
20. In my classes, I am asked to compare and contrast topics we've learned about.

*Factor 2: STEM Creativity*

1. I enjoy solving complex problems.
2. I have confidence in my ability to come up with new ways to find solutions to math problems.
3. I can solve problems quickly.
4. I have confidence in my ability to come up with new ways to find solutions to science problems.
5. I like school work that is challenging.
6. I have confidence in my ability to come up with new ways to find solutions to problems.

*Factor 3: Writing Creativity*

1. I am good at quickly making up stories.
2. I have confidence in my ability to come up with new ideas.
3. I have confidence in my ability to write something creative.
4. I have confidence in my ability to come up with good ideas.
5. I can generate new ideas quickly.
6. I have original ideas.
7. I am interested in new experiences.

*Factor 4: Art Creativity*

1. I have confidence in my ability to make a creative work of art.
2. I have confidence in my ability to draw something creative.
3. I like looking at art.
4. I enjoy doing creative projects.