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THE EFFECTS OF DESIGN THINKING ON STUDENTS' CAREER SELF-EFFICACY IN CAREER GUIDANCE COURSES

by

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2019

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By

Zhongmiao Sun

DEDICATION

This dissertation is dedicated to my parents, my husband, and my children; they gave me courage and self-confidence and supported me throughout this study.

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My Education of Doctor studying career begins at my first baby's coming and will end at my second baby's coming, I love them very much.

My mother always tells me "never give up easily" since my childhood, and I insist so I complete this hard work. I am grateful to my mother and hope my children remember it in their future life.

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The Effects of Design Thinking on Students' Career Self-Efficacy
in Career Guidance Courses

Abstract

By Zhongmiao Sun

University of the Pacific
2019

The present study focuses on integrating design thinking into career guidance courses to test whether students' career self-efficacy is increased by comparing the experiment group (by using design thinking method) and the general group (by using traditional teacher-centered method). The basic theoretic framework is Bandura's self-efficacy theory (Bandura, 1977). Students will achieve career self-efficacy after experiencing repeatedly success (Bandura, 1977) in the career activities through design thinking method. Then students will have more confidence to make more appropriate career choices in their employment environment.

This study used AMOS and path analysis to analyze a just-identified model. The model included five endogenous variables as well as six exogenous variables to control for age, sex and GPA. The data met all statistical assumptions of path modeling. In sum, all the five paths between design thinking and the other five endogenous variables were significant positive ($p <.001$), which indicates that using the design thinking method to teach students' career courses can improve students' goal selection, problem solving, occupational information, planning, and self-appraisal scores.

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Chapter 1: Introduction

The number of students who graduate each year is increasing since the graduated students were 1, 140, 000 in 2001, and after ten years later, the increasing numbers were broke through 5,000,000 (China Education Online). Approximately 6, 082,000 students graduated in 2011, and 6, 247,000 students graduated in 2012, and 6, 990, 000 students graduated in 2013, and 7, 270, 000 students graduated in 2014 and 7,500,000 graduated students in 2015 in China (China Education Online). This increasing rate of students with degrees makes current employment problems worse (Wang, 2012). Because college students currently meet employment difficulties in the Chinese labor market, many universities provide career guidance courses to help increase career self-efficacy and the capability to make appropriate and effective career choices (Wang, 2012). The employment rate was 72.2% in 2010 (ChinaNews), 72.2 % in 2011(Yue, 2012), and 71.9%in 2013 (Xinhua Net), there are no related statistics about 2012 employment rate. In general, the employment rate decreased from 2010 to 2013 as the numbers of graduated students increased.

Career self-efficacy influences students' career choices directly and indirectly, and affects the process of seeking employment (Wang, 2012). Thus, it is important for students to have high career self-efficacy to increase the probability of attaining a satisfying and appropriate job (Wang, 2012). Many students, however, still have low career self-efficacy (Cheng, 2010; Qin, 2010; Wang, 2012; Yuan, 2012) due to gender (Cheng, 2010; Li & Zhang, 2011; Yuan, 2012), grade (Wang, 2012), and low problem-solving ability (Peng & Long, 2001; Yuan, 2012; Lin and Zhu, 2007). Additional research is needed to understand variables that improve career self-efficacy among college students.

This study will examine whether a specific method of career guidance instruction, design thinking, increases career self-efficacy among college students. The next section of this paper will discuss three central concepts of this research: career self-efficacy, design thinking, and career guidance instruction.

Background

Career guidance. Career guidance has been used often in China as a means of developing a clear plan for career development and vocational choice (Tong, 2009). Based on Parsons's trait-factor theory, Super and Ginzberg's career development theory, Hilton, Gelatt and Osipow's decision-making theory, Bordin, Roe and Holland's personality theories, Krumboltz(1983)'s social-learning theory and other sociological theories (Wang, 1998) career guidance courses consist of self-realization, understanding occupations, person-environment matching, decision-making, and career planning(Wan, 2008; Xu, 2007).

Self-efficacy. According to Bandura's (1977) theory, self-efficacy refers to one's belief in one's own ability to complete tasks and reach goals. Self-efficacy has been shown to be a strong predictor of academic achievement and persistence and influences personal tasks, problems, and activities (Hackett, 1995a). Self-efficacy, however, cannot exist by itself. Rather, it is specific to certain activities and areas (Guan & Liu, 2007; Hao, Liu & Jia, 2011; Patrick & Joseph, 1999); thus, there are no general assessments to measure self-efficacy—different areas have different scales (Dang & Wei, 2011; Guan & Liu, 2007).

The concept of career self-efficacy or occupational self-efficacy is the application of self-efficacy to career decisions (Hackett, 1995a).

Crites's career maturity theory consists of five competencies that are closely related to career self-efficacy: accurate self-appraisal, gathering occupational information, goal selection, making plans for the future, and problem solving (Crites, 1981; Hackett, 1995a; Luzzo, 1996). Self-appraisal includes understanding one's ability, vocational interests and related vocational needs, and career self-concept. Gathering occupational information refers to one's understanding of vocational responsibilities and duties. Goal selection includes one's ability to match personal aptitudes with work characteristics. Making plans for the future refers to one's capability to implement a decision, and problem-solving ability is the ability to solve problems or overcome barriers during the process of making a decision (Long & Peng, 2000). When a person has mastered the above five competencies, the person will be deemed to have high career self-efficacy. When a person is not clear about where he or she stands with regard to these five characteristics, then the person will be deemed to have low career self-efficacy.

Design thinking. Design thinking refers to, "the way designers think, the mental processes they use to design objects, services or systems," (Dunne & Martin, 2006) and can be "integrated into an academic or practical management discourse" (Johansson-Sköldberg et al., 2013, p. 123). Design thinking operationalizes the process of putting cloudy ideas of products into concrete words about how the product should look and how it should work (Razzouk & Shute, 2012), so the designer can clarify and elaborate on the ideas (Dörner, 1999; Razzouk & Shute, 2012).This process includes five steps: discovery, interpretation, ideation, experimentation and evolution (Fierst, Murray, Randolph, Schurr, Diefenthaler, Geremia, Sitkin, Soffer, Speicher & Steck, 2011) described in Table 1.

Table 1: IDEO Toolkit design thinking process

Design thinking process				
Discovery	Interpretation	Ideation	Experimentation	Evolution
Purpose				
I have a challenge. How do I approach it?	I learned something. How do I interpret it?	I see an opportunity. What do I create?	I have an idea. How do I build it?	I tried something new. How do I evolve it?
Explanation				
Discovery means opening up to new opportunities, and getting inspired to create new ideas.	Interpretation transforms your stories into meaningful insights, such as through storytelling, as well as sorting and condensing thoughts to find a clear direction for ideation.	Ideation means generating lots of ideas.	Experimentation can bring ideas to life. Building prototypes means making ideas tangible, learning while building them, and sharing them with other people.	Evolution is the development of your concept over time. It involves planning next steps, communicating the idea to people who can help you realize it, and documenting the process.
Steps				
Define the challenge; prepare research; gather	Tell stories; search for meaning; frame opportunities	Generate ideas; refine ideas	Make prototypes; get feedback	Evaluate learnings; build the experience

inspiration				
Methods				
Understand the challenge: create a common understanding of what you are working toward.	Share inspiring stories: share what you learned from your research as stories so as to create a common knowledge of opportunities and ideas for completing the project or task.	Facilitate Brain-storming: generate fresh thoughts and new energy, which include different wild ideas.	Create a prototype: share your idea with others and discuss how to further refine it.	Identify what's needed: specify whether various resources and capabilities, materials, money, time and people will help you and make your idea come to life.

Note. Design thinking for educators is from Fierst, K., Murray, P., Randolph, D., Schurr, M., Diefenthaler, A., Geremia, A., Sitkin, E., Soffer, S., Speicher, S., & Steck, J. (2011).

Description of the Research Problem

Students' low career self-efficacy and career choices. Wang, Liu and Liu (2012) found that individuals with low career self-efficacy have difficulty finding a suitable job when they make a vocational choice. Such individuals preclude themselves from vocational opportunities by avoiding jobs that seem too difficult (Wang et al., 2012). Students with low career self-efficacy do not have enough confidence to seek challenging vocational choices; however, students who can accurately assess their skills, gather occupational information, engage in goal selection, make a good plan for the future, and learn advanced forms of problem-solving skills will increase the likelihood of obtaining a fulfilling career. Thus, high career self-efficacy predicts appropriate decision making, and low career self-efficacy predicts a lack of confidence and difficulty making occupational decisions (Zhou & Xu, 2005).

Research regarding the relation between career self-efficacy and college student characteristics indicates that vocational college students do not have high career self-efficacy, especially among freshmen and graduated students (Yuan, 2012). Additionally, university students do not have high career self-efficacy and there are no differences in career self-efficacy among different grades (Cheng, 2010). Other research suggests that female career self-efficacy is significantly higher than male career self-efficacy for traditionally female-dominated occupations and significantly lower than male career self-efficacy for traditionally male-dominated occupations (Hackett, 1995a).

Teacher-centered career guidance course and students' career self-efficacy. In China, there is little research about interventions designed to improve students' career self-efficacy (Zhou, 2010). Many universities narrowly define career guidance course as employment instruction and adopt traditional teacher-centered methods which might not address self-efficacy (Wang, Zhang & Zeng, 2012). Other teaching methods for career guidance courses include special lectures provided by enterprise managers and school-wide career guidance competitions (Wang et al., 2012). Therefore, there is no consensus regarding career guidance teaching methodology (Wang et al., 2012), and students in such courses might not increase in career self-efficacy (Wan, 2008).

Design thinking for solving problems. Design thinking has been demonstrated to be important relative to the promotion of students' problem-solving skills (Razzouk & Shute, 2012). Razzouk & Shute (2012) believed students can learn design thinking skills through different pedagogical approaches and enhance their problem-solving ability by learning to face problems, think outside of the box, and come up with innovative solutions (Razzouk & Shute, 2012). Razzouk & Shute (2012) suggested that researchers should study the effects of the design thinking process on various learning outcomes. Yet, there is no research directly related to the relationship between design thinking and career guidance courses, and between career self-efficacy and design thinking. The current study will adopt a design thinking intervention to address problems with the current teaching methods of career guidance courses and the resulting concerns of students' career self-efficacy (Cheng, 2010).

Purpose of the Study

The purpose of this study is to determine whether integrating design thinking into career guidance courses will increase career self-efficacy.

Research Questions/Hypotheses

The research question is: Do students who take career guidance courses that teach design thinking score higher on measures of self-efficacy than students who take career guidance courses without design thinking after controlling for preexisting career self-efficacy.

The hypothesis is: Students who take career guidance courses that teach design thinking will score higher on measures of self-efficacy than students who take career guidance courses without design thinking after controlling for preexisting career self-efficacy.

Significance of the Study

In China, college students generally do not have high career self-efficacy (Cao, Song, Zhu & Ding, 2006) particularly in regards to career planning and problem-solving (Zhou, 2010), career self-efficacy predicts whether an individual will find employment (Wang et al., 2012). Students can improve their career self-efficacy, but current research suggests that the teaching methods used in career guidance courses in China are teacher-centered and lack sufficient content and, thus, are not likely to increase career self-efficacy (Wan, 2008). Design thinking, however, is a learner-centered teaching method (Fierst et al., 2011) and can address the shortcomings of teacher-centered teaching (Wan, 2008) by teaching students how to solve problems by themselves using the design thinking process (Fierst et al., 2011). Because design thinking focuses on developing skills, such as problem solving, career guidance courses that incorporate design thinking should increase career self-efficacy. Accordingly, this study will provide useful information about improving career self-efficacy by adding design thinking to the curriculum for career guidance courses and how to influence the employment rate indirectly.

Theoretical Framework

Self-efficacy influences behaviors through efficacy expectations (Bandura, 1977). That is, higher self-efficacy generally leads to increased efforts in a given domain because of perceived success (Bandura, 1977). Or, self-efficacy is the mediator between behavior and behavior change (Betz & Luzzo, 1996). Thus, one’s career self-efficacy can enhance their career decision making process and their eventual career path (Hackett, 1995a). Or, career self-efficacy should be the mediator between career behavior and behaviors change.

Making a career choice can be seen as a behavior when one faces different career choices, and higher career self-efficacy will increase the probability of making an appropriate choice (Betz & Luzzo, 1996). This study focuses on influences of career self-efficacy and whether these influences predict subsequent career self-efficacy.

Description of the Study

By exploring the relationship between design thinking, career self-efficacy, and career guidance, this study seeks to find out whether incorporating design thinking into a career counseling course can influence students' career self-efficacy. This investigation will use two career guidance courses, one in which a traditional teacher-centered approach is employed and another in which design thinking is taught, and will, thus, be use a quasi-experimental research design. The researcher will use a pretest-posttest design to account for preexisting differences in career self-efficacy. The method used for data analysis will be multiple regression through SPSS and structural equation modeling through AMOS.

Conclusion

This chapter introduced career self-efficacy, career guidance course, and design thinking, and explained why using design thinking in career guidance courses for improving career self-efficacy is important. According to the current literature, design thinking is student-centered and encourages students to solve problems by themselves (Fierst et al., 2011) while traditional teaching methods for career guidance courses are teacher-centered and do not address increasing career self-efficacy (Wan, 2008). If students lack career self-efficacy, they are less likely to have the confidence to make appropriate career choices (Wan, 2008).

Chapter 2: Review of Literature

The purpose of this study is to discuss how design thinking can be integrated into career guidance courses and why it will influence career self-efficacy. This chapter will: 1) state how Bandura's self-efficacy theory can be applied to the field of career development; 2) discuss how design thinking can be applied to career guidance courses; 3) discuss the problems that can be solved by combining career guidance courses with design thinking instruction; 4) and, address how career guidance courses influence career self-efficacy.

Bandura's Self-efficacy Theory

Efficacy expectations are a mediator between person and behavior (Bandura, 1977). When one has enough conviction to entertain some activities or actions without doubting whether they can perform them well, that individual is more likely to complete the activity or action, and then the desired outcome will likely be produced (Bandura, 1977). But if one knows that completing and activity or action will produce an outcome, and that individual has doubts as to whether that individual can perform the activity, then that individual is less likely to complete the activity or action (Bandura, 1977). However, avoiding feared activities can be eliminated and a sense of efficacy can be reinforced with persistence to the activity (Bandura, 1977). If they cease their coping efforts prematurely and without persistence, they will retain the fear and continue to lack self-efficacy (Bandura, 1977). Thus, perceived self-efficacy not only influences the initial choice of activities and settings directly, but also affects one's coping efforts (Bandura, 1977).

Efficacy expectations can be assessed in terms of their magnitude, generality, and strength (Bandura, 1977). Magnitude refers to the levels of efficacy expectations based on the tasks' difficulty (Bandura, 1977). For example, simpler tasks, moderately difficult tasks, and the most taxing tasks lead to different efficacy expectations for different individuals (Bandura, 1977). Generality refers to how one's mastery experiences may or may not generalize to other similar situations (Bandura, 1977). Strength refers to the degree to which individuals will persevere in their coping efforts during disconfirming experiences (Bandura, 1977). Self-efficacy is based on four major sources of information: performance accomplishments or mastery experience, vicarious experience, verbal persuasion, and physiological states (Bandura, 1977, 1995a). Performance accomplishments refer to repeated successes that lead strong efficacy expectations (Bandura, 1977). Vicarious experience is the product of inferences from social comparisons and may lead to a weaker efficacy expectations (Bandura, 1977). Verbal persuasion is another source of self-efficacy that is widely used to influence human behavior, but its effectiveness on creating an enduring sense of personal efficacy is limited due to the lack of authentic experiences (Bandura, 1977). Emotional arousal, especially in regards to coping with threatening situations, also influences self-efficacy (Bandura, 1977). High arousal will debilitate performance so as to reduce a person's perceived self-efficacy, and when one feel relaxed while completing a task they are more likely to form high self-efficacy (Bandura, 1977). In this study, performance accomplishments are assumed to be the main source of career self-efficacy because the intervention is designed to help students repeatedly experience success while attending a career guidance course and completing different career activities (Hackett, 1995a).

Career Self-efficacy

Hargrove, Creagh and Burgess (2002) studied career self-efficacy and found that family-of-origin interaction patterns such as quality of family relationships, family-supported goal orientations, and degree of control and organization in the family can be predictors in the formulation of clear and stable career goals and the promotion of self-efficacy with regard to completingcareer planning activities. Montgomery (2006) predicted career decision-making self-efficacy by certain Black and White racial identity attitudes. Jin et al. (2009) examined career decision self-efficacy as a mediator between the Five-Factor Model of personality and the career commitment process and found that career decision self-efficacy mediates or partially mediates the relationship between five-factor personalities and career commitment (Jin et al., 2009). Koumoundourou et al. (2012) also explored career decision self-efficacy as a mediator between core self-evaluations and adolescents' vocational identity. They found that there is significant relationship between core self-evaluations and career decision self-efficacy for both genders and there is a mediating role of career decision self-efficacy between core self-evaluations and vocational identity.

Zhou (2010) investigated how career self-efficacy from freshmen to graduate students relates to demographic statistics and found that there are significant differences between grades, sex, origin, and desired occupation. Jiang and Guo (2004) found that career self-efficacy predicts male and female students' career choices. There are, however, some contradictions in the investigation of students' career self-efficacy level. Yuan (2012), Li and Zhang (2011) found freshmen and graduate students have lower career self-efficacy than other grades, but Lin and Zhu (2007) found freshmen and graduate students have higher career self-efficacy than other grades, and Cheng (2010) found there is no significant difference in the different grades. Additionally, Cheng (2010) and Yuan (2012) found that college students do not have high career self-efficacy, but Qin (2010) mentioned that the general career decision-making self-efficacy level is normal. Other studies have found significant differences between gender (Peng & Long, 2001; Yuan, 2012; Cheng, 2010; Li & Zhang, 2011), problem-solving ability scores (Peng & Long, 2001; Yuan, 2012; Lin and Zhu, 2007), goal selection, and origin of students (Lin and Zhu, 2007; Zhou, 2010).

Career Maturity

Super's career development theory synthesizes the knowledge of differential psychology, developmental psychology, personality psychology, sociology, economics, and other related disciplines to study the career development process (Zhu, 2003). In Super's career development theory, career maturity includes six goal domains: career choice direction, goal selection information and planning, consistency of career choice, personality confirmation, independence on occupation, and wisdom and justice of career choice (Zhu, 2003). Based on this research, Crites developed a career maturity model which includes career choice ability and career choice attitude (Zhu, 2003). Career maturity theory is contrast to Parsons' "trait-and-factor" theory, which emphasized career decision making is a developmental process in one's lifelong (Crites, 1972-1973). Ginzberg also proposed that career decision-making process should be seen as "part of the process of developing career maturity rather than a once-in-a-lifetime event" and is irreversible (Crites, 1972-1973, p. 1).

Career Self-Efficacy and Career Guidance Courses

It has been shown that career self-efficacy has been improved and strengthened by career guidance courses and career counseling. Parks, Rich and Getch (2012) mentioned that 16 college students who were in an academic and career planning courses thought that the one-on-one career consultation from 15 graduate students who were in an advanced career counseling course was beneficial to their academic and career planning and served to build their career self-efficacy for career choices. The graduate students helped the undergraduate students improve their career goals and validate their current career path, and open doors to other options or areas they had not previously considered by providing career counseling services for one semester (Parks et al., 2012). Parks et al.'s (2012) study combined the effectiveness of career development courses with individual career consultation, which combination provides a conceptual practice path that may serve as a standard for future career planning and career guidance courses. Grayson (1994) found that setting and completing short term goals can help students reinforce their career self-efficacy and help them focus on their intermediate and long term career goals. Thus, these research studies show that career self-efficacy can be influenced by career counseling and career guidance course.

Career Guidance Course in China

The employment competition is intense in Chinese labor market, so career guidance courses have become one of the most important ways to instruct students on obtaining employment (Zhao, 2008); therefore, career guidance courses have been an optional course in public universities (Ni, Guo & Zhou, 2007) for improving students' career self-efficacy (Wan, 2008). Zhou and Xu (2005) suggested that career guidance course should be provided to all freshmen so as to cultivate high career decision making self-efficacy. Because employment pressures have increased over time, more and more students do not have enough confidence to make appropriate career choices or work for an occupation for more than one or two years (Wan, 2008). Additionally, over 50% of students cannot appraise themselves accurately, and 82% of students feel high employment pressure even though they have received a career guidance course (Ni et al., 2007). Accordingly, providing more efficient instruction in career guidance courses is an important task for many universities (Wang, 2012).

Although career guidance courses can relieve the pressure on students to find employment, 82.2% of freshmen still report confusion regarding their future career development (Ni et al., 2007). Accordingly, the current methods of teaching career guidance courses may not be effective and may need to be adjusted in terms of the course content and traditional teacher-centered teaching method (Wang et al., 2012). Students lack knowledge in the following areas: career goals, self-perception, work environment and occupational requirements, professional knowledge, and gathering occupational information (Xu, 2007).

Design Thinking and Education

Design thinking has demonstrated success in a variety of domains including management, business (Dunne and Martin, 2006), and engineering (Kwek, 2011). It has also shown promise in education (Fierst et al., 2011). Kwek (2011) introduced design thinking as a new learning model and applied it to k-12 classroom learning. Teachers' responses were positive about this new pedagogical tool and adapted it for multiple purposes, learning contexts, and subjects (Kwek, 2011). Tan and Wong (2012) proposed using a design thinking in schools to acknowledge and welcome the student diversity in regards to spirituality. Given its success in education and other disciplines, design thinking may be able to be applied to career guidance courses as well.

Design thinking supports students to "try things" (Kwek, 2011, p. 7). Design thinking has the potential to both engage and transform students by creating student-centered learning experiences (Welsh & Dehler, 2012). Therefore, integrating design thinking into course content is good for the development of a student-centered learning experience (Welsh & Dehler, 2012). When design thinking is used as a teaching method, it can be used in any discipline. The aim of design thinking as a teaching method is to adopt design thinking processes in order to cultivate students' problem-solving ability. Hence, design thinking links the transformation of knowledge to the development of individual potentials (Scheer et al., 2012). The next section introduces how design thinking can be used in career guidance courses.

Design thinking in general education. Design thinking has been used broadly in higher education, effectively in industry, and across multiple discipline areas, but the application to school-based settings is a relatively new phenomenon (Anderson, 2012). Carroll et al. (2010) integrated design thinking processes into geography learning. After design thinking became part of the classroom learning environment, students' ability to imagine more freely – without boundaries and constraints – was fostered (Carroll et al., 2010). Results yielded several expected outcomes including the acquisition of design thinking skills involving problem solving and collaboration, embedding design thinking skills across the curriculum, applying a design thinking model to classrooms, developing a learning model, increasing engagement with schooling, increasing competence in print and multimodal literacies, and designing illustrative multimedia presentations or computer games (Anderson, 2012). Therefore, design thinking can successfully influence school-based education in a number of ways.

Design thinking as thinking style practice. Kangas, Seitamaa-Hakkarainen and Hakkarainen (2013) explored the collaborative design process of one team of elementary students in order to better understand how they implemented design thinking during a lamp design project. Through defining an eight session flow chart (e.g. ideation, elaborating ideas, defining constraints, making drawings, constructing the model, making a poster, process organizing, and off-topic activity) in order to track students' activities, the students' design thinking was shown to be collaborative, materially mediated, and embodied in nature (Kangas et al., 2013).

Design thinking in management education. Dunne and Martin (2006) found that design thinking can change management education significantly if added into the curriculum. Design thinking requires of inductive, deductive, and abductive thinking skills (Dunne & Martin , 2006; Wang & Wang, 2008). For management education, inductive and deductive reasoning are particularly important (Dunne & Martin, 2006). Through adopting the clinical instruction methods related to inductive thinking for teaching knowledge management, students can learn more practical knowledge and first-hand experiences than through a non-clinical method (Wang & Wang, 2008). For example, Welsh and Dehler (2012) experimented for thirteen years during which they combined management education with design thinking. The students in the experiments felt both competent and confident after they graduated and had their first work experience (Welsh & Dehler, 2012). Therefore, the induction model can serve to guide the clinical module so as to develop students' design thinking skills (Wang & Wang, 2008).

Design thinking in creative education. Anderson (2012) used design thinking as a framework to solve problems. Results indicated that students develop competence in using the steps of "understand, observe, visualise, evaluate, refine and implement" (Anderson, 2012, p. 45). Kwek (2011) also found that design thinking is an approach that can develop children's creative confidence.

Comparison of Design Thinking and Constructivist Method

Scheer et al. (2012) opined that design thinking supports the transformation from constructivist learning to action. In comparing constructivist methods and design thinking, the former is found to be abstract with no specific instructions, while the latter is more specific and includes concrete implementation phases (Scheer et al., 2012). In other words, design thinking is a concrete teaching method and embodies constructivist theory (Scheer et al., 2012). Research suggests that teachers prefer to use the design thinking process in realizing constructivist teaching and both teachers and students acquire confidence from the design thinking process (Scheer et al., 2012).

Design Thinking Process for Solving Problems about Career Guidance Course and Career Self-Efficacy

Design thinking asks students to think broadly about problems, develop a deep understanding of issues and plan a process to implement good ideas (Dunne & Martin, 2006). Whatever the problems in management or education or some other areas, design thinking provides a mindset to think outside of the box, and come up with innovative solutions (Razzouk & Shute, 2012). Design thinking is a learner-centered method and can be used for educators to design classrooms, curriculum, and learning environments (Fierst, 2011). Kwek (2011) states that design thinking is an approach that can encourage ideation and foster active problem-solving skills and competencies. For example, as a result of combining design thinking with management education, students felt more confident when they got the bachelor and were going to find an appropriate work (Welsh & Dehler, 2012). This seems to indicate that design thinking is relevant to students' competence and confidence in their first vocational choice. Therefore, Welsh and Dehler (2012) said that "the combination of competence and confidence in their collaborative skills is the hallmark of self-efficacious learners" (p. 797). In other words, the combination of management education with design thinking influences students' self-efficacy in their future career development.

Design Thinking and Career Guidance Courses

This section focuses on how career guidance courses that incorporate design thinking might influence students' career self-efficacy.

Career guidance course content. In general, career guidance courses include realizing yourself, understanding the work world, person-environment matching, decision making, and establishing a career development plan (Wan, 2008; Xu, 2007). The course content is generally based on Parsons's trait-factor theory, Super and Ginzberg's career development theory, Hilton, Gelatt and Osipow's decision-making theory, Bordin, Roe and Holland's personality theories, Krumboltz's social-learning theory, and other sociological theories (Wang, 1998).

Parsons's trait-factory proposed that making a career choice involves three factors: 1) to realize yourself accurately; 2) to understand the work environment and requirements; 3) and to match yourself with the work world (Tong, 2009). Parsons's trait-factory is the basic framework for the course content of many career guidance courses. Realizing yourself requires the ability to appraise personal characteristics before making career decisions because the key element of choosing an occupation is to confirm whether personal characters such as career interests and career values match the specific occupation's requirements (Tong, 2009). Understanding the work world is to investigate different occupations' requirements such as work type, salary, working conditions, and the possibility of promotion (Tong, 2009). The person-environment refers to the ability to analyze and compare personal characteristics with occupational requirements and find whether they match each other (Tong, 2009).

Holland's personality theory is based on personality psychology and lots of career counseling practice research, which emphasizes that an individual's personality should match the occupational environment (Li & Zheng, 2013; Tong, 2009) on the following dimensions:

realistic, investigative, social, traditional, entrepreneurial, and artistic (Li & Zheng, 2013; Tong, 2009). This theory is helps students to know their career and personal characteristics.

According to Hilton, Gelatt and Osipow's decision-making is a rational process composed of the decision maker, decision-making items, decision-making content and relative analysis, and decision implementation and takes advantage of the information that is beneficial for making career choices (Wang, 1998). Decision-making theory emphasizes personal career development process and career choice processes and focuses on how to analyze and clarify personal values in career choice process (Li & Zheng, 2013). This theory plays a major role in career guidance courses.

The above career theories are the foundation of career guidance courses. Betz and Taylor's (1983) five subscales of the Career Decision Making Self-Efficacy scale (CDMSE) Self-Appraisal, Occupational Information, Goal Selection, Problem Solving, and Planning, directly relate to the aspects of career guidance course content (see Table 2). Accordingly, students' career self-efficacy or career decision making self-efficacy should be influenced after experiencing career guidance courses under the instruction of the student-centered teaching method.

Table 2: Comparison and relationship between courses content and CDMSE

Activities in Career Guidance Courses Content	**Subscale of CDMSE**
Realizing Yourself	Self-Appraisal assesses the

Activities	Interest Island activity, ability test, value test	ability to accurately appraise one's own abilities, interests, and values as relating to educational and career decisions.
Aim	Understanding personal characteristics	
Understanding the Occupations		Occupational Information measures the ability to locate sources of information about college majors and occupations, including the ability to identify and talk with people employed in the occupations of interest.
Activities	Interview interested professional person; Introduce the basic information of interviewees	
Aim	Gathering information of interested occupations by interviewing professional persons, then analyzing them	
Person-Environment Matching		Goal Selection assesses the ability to match one's own characteristics to the demands and rewards of careers so as to identify one or more majors or careers to pursue.
Activities	Investigation of personal majors in Shanghai and interpersonal circles	
Aim	Matching personal characteristics with occupation's requirements	
Decision-making Methods		Problem Solving measures the ability to figure out alternative plans or coping strategies when plans do not go as intended.
Activities	Decision-making activities	
Aim	Understanding different methods for making decisions and coping with different interested career choices based on personal subjective value and characteristics	
Career Plan		Planning assesses the ability about how to implement an educational or career choice, including enrolling in educational programs, job search, resume writing and job interviewing
Activities	Making a career plan according to above four units' content; simulation of interview; resume writing	
Aim	Understanding how to make and implement a career plan according to your characteristics, majors, interested occupations, social environment, educational or career choice	

Note. Career maturity is from Crites, J.O. (1972-1973); Self-efficacy in career choice and development is from Hackett, G. (1995a); A psychometric evaluation of the Career Decision-Making Self-Efficacy Scale is from Luzzo, D.A. (1996); The research of abroad on difficult career decision-making and its revelation is from Long, L.R., & Peng, Y.X. (2000).

Design thinking process and career guidance course content. The basic design thinking process includes discovery, interpretation, ideation, experimentation and evolution (Fierst et al., 2011). In each step, many methods can be chosen. This study incorporates the basic five design thinking processes into a career guidance course. Specific information about the career guidance course content and structure with design thinking process is in Appendix C.

Conclusion

Career counseling and career counseling courses appear to be beneficial to students' career self-efficacy (Parks et al., 2012; Wright et al., 2008). One of the aims of career counseling is to promote students' career self-efficacy and confidence in making career choices (Parks et al., 2012). High career decision self-efficacy has been shown to be important in cultivating flexible attitudes toward career choices over time (Jin et al., 2009). In other words, making appropriate career choices can make students' feel more confident. Not all students have high career self-efficacy. Design thinking may be able to strengthen career self-efficacy because it is a methodology for problem definition (analysis) and problem solution (synthesis) (Welsh & Dehler, 2012). Specifically, design thinking can be used in solving problems in education or in classrooms and schools (Fierst et al., 2011) and it can address the problem of finding employment. Therefore, design thinking is suitable for addressing lower self-efficacy because design thinking is a learner-centered teaching method (Fierst et al., 2011).

This study intends to improve students' career self-efficacy by integrating design thinking into the career guidance courses. The basic theoretic framework is Bandura's self-efficacy theory (Bandura, 1977). Students will get career self-efficacy after experiencing repeatedly success (Bandura, 1977) in the career activities through design thinking process. Therefore, it is feasible to improve students' career self-efficacy scores by combining design thinking processes into career guidance course instead of using traditional teacher-centered method.

Chapter 3: Methodology

This chapter presents the research methodology used in this study. Described below are the research hypotheses, participant descriptions, measures, data collection procedures, the data analysis strategy, validity and reliability, and threats to validity.

Research Questions and Hypotheses

The research question is: do students who take career guidance courses that teach design thinking score higher on measures of self-efficacy than students who take career guidance courses without design thinking after controlling for preexisting career self-efficacy.

The hypothesis is: students who take career guidance courses that teach design thinking will score higher on measures of self-efficacy than students who take career guidance courses without design thinking after controlling for preexisting career self-efficacy.

Methodology

This quantitative study aims to assess differences in career decision-making self-efficacy between classes that do and do not use design thinking in career guidance instruction after controlling for initial levels of career decision-making self-efficacy. This investigation employed a quasi-experimental research design because such a design is appropriate for studies where random assignment is not possible (Mcmillan & Schumacher, 2006).

Sample

This study focused on the freshmen because it is convenient to recruit freshman for research studies. Freshman also have lower career self-efficacy than more experienced students (Li & Zhang, 2011; Yuan, 2012); additionally, freshmen have recently passed the enrollment exam of higher education, and they feel at a loss for their future career development and career choices (Yuan, 2012). The study recruited participants from a private university in Shanghai, China that offers about 16 weeks' career guidance courses each semester. Each class included 35-50 students wherein students in the same class have the same major because they have been assigned to classes by their major and enrolment scores instead of random allocation. The researcher chose two classes out of 25 classes to conduct the study.

A pretest for the two groups was used to control for initial career self-efficacy. One group (the experimental group) received design thinking instruction in their career guidance course. The control group only received regular career guidance instruction by traditional teacher-centered teaching methods. At the end of career guidance course, both groups received a post test for determining whether there is significant difference between the two groups in terms of career self-efficacy. Therefore, the research question was addressed based on the outcomes of the pretest and posttest.

The method used for data analysis was multiple regression and structural equation modeling through Statistical Package for the Social Sciences (*SPSS*) and Analysis of Moment Structures (*AMOS*) software packages. Many researchers such as Gushue and Whitson

(2006), Jin, Watkins and Yuen (2009), Luzzo (1996) and others adopted multiple regression to analyze the relationship between career self-efficacy and other variables. *AMOS* uses the Full Information Maximum Likelihood (FIML) procedure to deal with missing data (Keith, 2006).

Instrumentation

The data was collected with the Career Decision Making Self-Efficacy scale (CDMSE), which measures an individual's degree of belief that he or she can successfully complete tasks necessary to make career decisions (Benish &Johnson, 1983-1994). The CDMSE consists of five subscales: accurate self-appraisal, gathering occupational information, goal selection, making plans for the future, and problem solving (Crites, 1981; Hackett, 1995a; Luzzo, 1996). The five subscales' interpretations are as follows: Self-Appraisal assesses the ability to accurately appraise one's own abilities, interests, and values as relating to educational and career decisions; Occupational Information measures the ability to locate sources of information about college majors and occupations, including the ability to identify and talk with people employed in the occupations of interest; Goal Selection assesses the ability to match one's own characteristics to the demands and rewards of careers so as to identify one or more majors or careers to pursue; Planning assesses how to implement an educational or career choice, including enrolling in educational programs, job search, resume writing and job interviewing; and Problem Solving measures the ability to figure out alternative plans or coping strategies when plans do not go as intended (Betz & Taylor, 1983).

The CDMSE scale has 50-items with 5 subscales composed of 10 items each, however, there is a short version with 25-items. The CEMSE scale of 50 items needs 15 minutes to complete (Betz & Taylor, 1983). The scale is appropriate for ages 16 through adult, is strongly linked to positive educational and career decisional outcomes, and can be used to inform career interventions (Betz & Taylor, 1983). The items are on a 10-point (from 0 to 9 where a 9 represents the highest confidence) Likert-type scale.

In this study, the modified version of the Career Decision Self-efficacy Scale as developed by Betz and Taylor (1983) was translated into Mandarin based on the three-step translation process (Brislin, 1970). To be specific, after getting all appropriate permissions from the researchers, I invited one native Chinese speaker who is a career guidance specialist to translate the instrument into Mandarin and then I invited another native Chinese speaker who teaches English to translate it back into English. Both of them teach at the college level in China. These translators were chosen because they are not only familiar with both languages involved in the translation process and one of them is familiar with the career major, but also because they understand the two cultures' similarities and differences very well. At last, I compared the Chinese and English versions of the instrument to evaluate if the two-way translation process had led to acceptable equivalence levels with respect to the meaning of the language used in both forms of the instrument.

By using the back-translation strategy, several items were modified slightly in order to make the instrument more culturally appropriate for the Chinese higher educational environment. These include: 1) adding some basic informational items such as age, sex and

GPA at beginning of the instrument according to the requirement of research question; 2) adding a confidence scale to the instrument so students could choose how confident they are from no confidence (0) to complete confidence (9); 3) wording changes to some items to better fit the Chinese context (e.g., because the participants' major is counting, so the term "find information about companies who employ people with college majors in English" in #2, was replaced by "find information about companies who employ people with college majors in counting" and the word "engineering" in #5, was changed to be "counting"; the word "1980s" in #27, was changed to be "2010s"; all of the above items belongs to Occupational Information Subscale.); and 4) delete the five subscale instruction words and add serial numbers before the items.

After making these modifications, two experts, who were teaching career guidance courses, were invited to review the altered items in order to ensure content validity. A pilot test was conducted with a convenience sample of 35 English major students for one semester at the fall of 2014 in order to measure the reliability of the translated modified instrument, so I modified the relevant words in item #5 as "English". At the conclusion of the pilot study and an analysis of the research results, some further modifications for more specific and accurate descriptive Chinese words to the items were made. It was assumed that after having completed these various steps, the properly translated and adapted instrument would serve to minimize the "effects of cultural differences which are not relevant or important to the main purposes of the study" (Van de Vijver & Hambleton, 1996, p.11). See Appendix A & B for both the English and translated Chinese version of the instrument.

Variables

Whether or not students received design thinking instruction is the main independent variable. In general, there were five endogenous variables in the model as well as nine exogenous variables for the experimental group. The exogenous variables included the pretest scores for accurate self-appraisal, gathering occupational information, goal selection, making plans for the future, problem solving, and whether an individual belongs to the experimental group. The endogenous variables included the post-test scores for accurate self-appraisal, gathering occupational information, goal selection, making plans for the future, and problem solving. The model is non-recursive and just-identified.

Procedures

After the researcher received permission from the minister of the university to conduct the study, the data was collected through two phases. First, the control group and the experimental group completed the CDMSE pretest. The researcher then taught career guidance courses, one experimental class and one control class. The treatment course content was divided into five parts including realizing yourself, understanding the work world, person-environment matching, making decisions, and establishing career development plans. Finally, both groups received the CDMSE post-test. A research assistant administered the pretest and posttest and the researcher did not look at the pretest scores until after the post test was administered. The researcher kept the students from knowing whether they were in the experimental group or the control group until the treatment was complete to prevent them from changing their behavior in response to their group assignment. After the experiment, the researcher informed the students whether they received the treatment or not. The experiment lasted one semester, which included 16 weeks.

Regarding how to incorporate design-thinking method into career guidance courses, there are several steps. First, based on the five units of career guidance course content (Realizing Yourself, Understanding the Occupations, Person-Environment Matching, Decision-making Methods, Career Plan) and the five steps of design thinking method (Discovery, Interpretation, Ideation, Experimentation, Evolution), I put the five steps of design thinking process into each unit of career guidance courses. For example, when I taught the decision-making unit, after the warm-up activities, the following content was included: the process of discovery, interpretation, ideation, experimentation, and evolution. See Appendix C for more details.

Data Analysis

Mutiple regression. Statistical assumptions will be tested using multiple regression.

Description of the AMOS model. The six exogenous variables were allowed to correlate with each other and predict the endogenous variables. This model is equivalent to an ANCOVA where the pretest is the covariate (Figure 1). Model fit statistics were considered to determine whether the model provided a reasonable explanation of the data. The important indices of fit included by Keith (2006) are Chi-square, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). When considering the Chi-Square statistic in a single model, a non-significant value indicates better fit. But Chi-Square is often influenced by large sample sizes (i.e., greater than 200 cases), so it may not be the best indicator of fit (Keith, 2006). The CFI and TLI are not influenced by large sample sizes. When their values are larger than 0.9, it means the model has an adequate fit; when their values are larger than 0.95, it means the model has a good fit (Hu & Benter, 1999). The RMSEA value indicates the approximate fit of the model, and values below .05 suggest a good fit of the model, values higher than 0.08 or 0.10 indicate a poor model (Hu & Benter, 1999). In nested models, change in Chi-square is an important index to compare model fit. When Chi-square goes up significantly, the fit of original model is better than the latter model. When Chi-square goes down significantly, the original model fit is worse than the latter model. In non-nested models, the AIC (Akaike information criterion) and BIC (Bayesian information criterion) are key indices to justify the model fit, where the lower the number, the better the model fit. See figure 1 for more details.

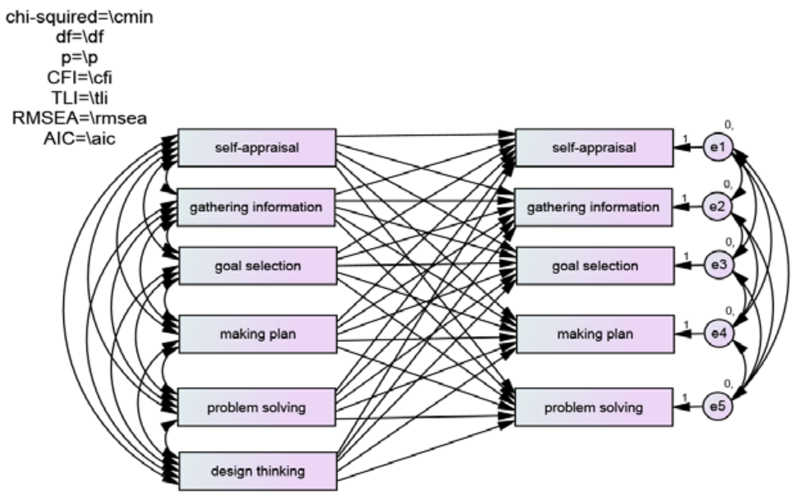

Figure 1: Nonrecursive path analysis just-identified model

Validity and Reliability

Concurrent validity. The CDMSE scores were found to have statistically significant nonzero correlations with scores from Holland, Daiger, and Powers' (1980) My Vocational Situation, with values ranging from .28 to .40 (Benish&Johnson, 1983-1994).

Discriminant validity. Research studies show low correlations between CDMSE scores and career decision-making skills (as opposed to attitudes), SAT scores, and ACT scores (Benish&Johnson, 1983-1994).

Internal consistency. The reliability of scores was estimated with coefficient alpha on the five subscales of the CDMSE. These values for Self-Appraisal, Occupational Information, Goal Selection, Planning, and Problem-Solving were .88, .89, .87, .89, and .86 respectively (Benish&Johnson, 1983-1994). The total reliability for scores from the 50-item test was .97, and the accompanying journal article reported the 25-item alpha value of .94 (Benish&Johnson, 1983-1994). The Chinese version of CDMSE is based on Betz and Taylor's (1983) CDMSE. Long and Peng (2001) revised it from 50 items to 39 items according to cultural differences and popularity analysis, discriminant analysis, and total correlation analysis. The scale is on a 5-point scoring scale from 0 to 5 where 5 point represents the highest confidence. The internal consistency reliability of the five subscales (Cronbach's α) of the Chinese version are .75, .80, .81, .77, and .68 for self-appraisal, gathering information, goal selection, making plans, and problem-solving respectively (Peng & Long, 2001). The total Cronbach's α for the Chinese version is 0.93 (Peng & Long, 2001).

Test-retest reliabilities. The test-retest reliability over a one and one-half month interval was .83 for the original CDMSE (Benish&Johnson, 1983-1994). The test-retest reliability for the Chinese version ranged between 0.51 and 0.65 over a four month interval (Peng & Long, 2001).

Threats to Validity

Internal validity. The experimenter was the teacher in the career guidance class, so experimenter effects could be a threat.

Construct validity. Because the design thinking method is only used in one class, and there are not any other interventions for comparison, mono-operation bias could be a threat. This study is also only used one instrument, so mono-method bias could also be a threat.

Limitations

There are some limitations in this study, which have been expressed in the threats to the validity. The first limitation is that the subjects are only from two classes of one university, so the generalization of the findings could be limited. Second, there is only one treatment group. Third, the posttest outcomes may be influenced by having taken the pretest.

Assumptions

There are statistical assumption, experimental assumptions, and substantives assumption in this study.

The statistical assumptions are:

1. There are linear relationships between dependent variables and independent variables.

2. The observations are independent of each other.

3. The variance of errors is evenly spread across all levels of the independent variables.

4. The sample mean is a normal distribution (Keith, 2006).

For the experimental assumptions, there are as follows:

1. Design thinking method will have influence on students' career self-efficacy.

2. Sex will influence students' career self-efficacy (Hackett, 1995a).

3. The students of the two classes will be honest as they answer the questionnaire.

4. The instrument will be valid and reliable.

For the substantive assumptions, it is assumed that the design thinking method integrated into the career guidance course is consistent with Bandura's (1977) efficacy theory. Students will increase in career self-efficacy by experiencing repeated success in a career guidance course, their personal mastery experiences about career decision making and career choice will improve, and their efficacy beliefs will be enhanced (Bandura, 1977). Therefore, students' career self-efficacy will be improved by integrating the design thinking method into the career guidance course.

Ethical Considerations

The data were stored in a computer with a personal password. All the subjects were anonymous when filling out the questionnaire. The experiments were allowed by the minister of the university in Shanghai. The students were informed whether they were in the experimental group or control group after the experiment.

Conclusion

This study used quantitative methods to investigate whether there is an influence of design thinking on students' career self-efficacy. Specifically, the study determined whether design thinking helps students develop the potential to make appropriate career decisions when they face career choices and whether design thinking increased their ability to gather information, select career goals, appraise themselves objectively and accurately, solve problems in career development, and make an appropriate career plans for their future career life.

Chapter 4: Results

Independent t-test and Chi-square Analysis

Comparisons between the treatment and comparison groups were made on demographic variables. Results indicated that there were no significant differences between the design thinking group and comparison group in age (t[79]=.988, p=.326), GPA (t[78]=-.412, p=.681), or gender (χ^2=.004, p=.949).

Statistical Assumptions

SPSS software was used to examine the data for any violations of statistical assumptions before conducting any SEM analyses. The assumptions include linearity, homoscedasticity, normality of residuals and some regression diagnostics such as distance, leverage, influence (Keith, 2006).

Linearity. The dependent variables should be a linear function of the independent variables. This assumption was examined by plotting the unstandardized residuals against the independent variable(s) and examining the lowess fit line along the mean of the residuals (Keith, 2006). For this study, design thinking is the independent variable and the five post test scores are the dependent variables. The five pretest scores are control variables. Through running the linearity assumptions for each of the five dependent variables separately, when the five groups of unstandardized residuals were plotted against the independent variables, the lowess fit lines were horizontal at zero and approximated a straight line (see APPENDIX D, E, F, G, H).

Homoscedasticity. One rule of thumb is that the ratio of largest variance to the smallest variance is less than 10, the violation of this assumption affects standard errors and thus statistical significance (Keith, 2006).

Goal selection homoscedasticity assumption. In this present sample, the highest variance (90.56) was divided by the lowest variance (48.26), and resulted in a value of 1.87, which is less than 10. This value indicated that this assumption was not violated (see APPENDIX I).

Problem-solving homoscedasticity assumption. In this present sample, the highest variance (80.66) was divided by the lowest variance (23.08), and resulted in a value of 3.49, which is less than 10. This value indicated that this assumption was met (see APPENDIX J).

Occupational information homoscedasticity assumption. In this present sample, the highest variance (136.03) was divided by the lowest variance (61.61), and resulted in a value of 2.21, which is less than 10. This value indicated that this assumption was met (see APPENDIX K).

Planning homoscedasticity assumption. In this present sample, the highest variance (170.59) was divided by the lowest variance (45.25), and resulted in a value of 3.77, which is less than 10. This value indicated that this assumption was met (see APENDIX L).

Self-appraisal homoscedasticity assumption. In this present sample, the highest variance (144.64) was divided by the lowest variance (42.30), and resulted in a value of 3.41, which is less than 10. This value indicated that this assumption was met (see APPENDIX M).

Normality of residuals. The residuals should be normally distributed (Keith, 2006).

Goal selection normality of residuals assumption. The residuals are distributed normally (see APPENDIX N), and in the p-p plot of the residuals, the residuals' adhere to a nearly straight line, so the normality of residuals assumption of goal selection was met (see APPENDIX O).

Problem-solving normality of residuals assumption. The residuals are distributed normally (see APPENDIX P), and in the p-p plot of the residuals, the residuals' adhere to a nearly straight line, so the normality of residuals assumption of problem-solving was met (see APPENDIX Q).

Occupational information normality of residuals assumption. The residuals are distributed normally (see APPENDIX R), and in the p-p plot of the residuals, the residuals' adhere to a nearly straight line, so the normality of residuals assumption of occupational information was met (see APPENDIX S).

Planning normality of residuals assumption. The residuals are distributed normally (see APPENDIX T), and in the p-p plot of the residuals, the residuals' adhere to a nearly straight line, so the normality of residuals assumption of planning was met (see APPENDIX U).

Self-appraisal normality of residuals assumption. The residuals are distributed normally (see APPENDIX V), and in the p-p plot of the residuals, the residuals' adhere to a nearly straight line, so the normality of residuals assumption of self-appraisal was met (see APPENDIX W).

Distance. The values of z scores should be close to the regression line.

Goal selection distance assumption. In this sample, all the values of standardized residuals are less than the absolute value of 3. Four values of standardized residuals are greater than the absolute value of 2, which indicates high distance.

Problem-solving distance assumption. In this sample, all the values of standardized residuals are less than the absolute value of 3. Six values of standardized residuals are greater than the absolute value of 2, which indicates high distance.

Occupational information distance assumption. In this sample, all the values of standardized residuals are less than the absolute value of 3. Two values of standardized residuals are greater than the absolute value of 2, which indicates high distance.

Planning distance assumption. In this sample, all the values of standardized residuals are less than the absolute value of 3. One value of standardized residuals is greater than the absolute value of 2, which indicates high distance.

Self-appraisal distance assumption. In this sample, all the values of standardized residuals are less than the absolute value of 3. Three values of standardized residuals are greater than the absolute value of 2, which indicates high distance.

Leverage. An average leverage value is calculated as $(k+1)/n$ where k is the number of independent variables (Keith, 2006). In this case, the average leverage value is (2+1)/81=0.04. The "high" leverage value for this study would be more than twice the calculated leverage value, which is 0.07.

Goal selection leverage assumption. In this sample, there were two cases (case 6, 0.10; case 24, 0.16) that were considered to have "high" leverage values.

Problem-solving leverage assumption. In this sample, there were three cases (case 17, 0.08; case 41, 0.086; case 71, 0.09) that were considered to have "high" leverage values.

Occupational information leverage assumption. In this sample, there was one case (case 52, 0.08) that was considered to have "high" leverage values.

Planning leverage assumption. In this sample, there were no cases that were considered to have "high" leverage values.

Self-appraisal leverage assumption. In this sample, there were two cases (case 4, 0.08; case 35, 0.11) that were considered to have "high" leverage values.

Influence. Influence means what the name suggests: a case that is highly influential on the intercept or the regression line (Keith, 2006).

Goal selection influence assumption. The largest five cases from COO_1 are case 6 (0.18608), case 24 (0.11700), case 81 (0.09061), case 19 (0.06109), case 7 (0.05740). The largest five cases from SDB0_1 are case 6 (0.73735), case 7 (0.35775), case 81 (-0.51060), case 79 (-0.38274), case 24 (-0.37665). The largest five cases from SDB1_1 are case 81 (0.39844), case 24 (0.54965), case 6 (-0.66231), case 79 (0.28075), case 19 (0.35818). The five largest cases from SDB2_1 are case 6 (-0.37111), case 7 (-0.30255), case 81 (0.31085), case 80 (0.25178), case 79 (0.24904).

Problem-solving influence assumption. The largest five cases from COO_2 are case 81 (0.05779), case 80 (0.05645), case 71 (0.05473), case 6 (0.04963), case 77 (0.04857). The largest five cases from SDB0_2 are case 80 (0.36325), case 73 (0.35425), case 75 (0.35069), case 6 (-0.33038), case 77 (-0.28883). The largest five cases from SDB1_2 are case 71 (0.34987), case 12 (-0.30107), case 73 (-0.29579), case 75 (-0.27777), case 77 (0.26286). The five largest cases from SDB2_2 are case 80 (-0.26269), case 81 (0.25492), case 79 (0.23466), case 4 (-0.23387), case 6 (0.25267).

Occupational information influence assumption. The largest five cases from COO_3 are case 81 (0.20240), case 8 (0.07842), case 10 (0.04997), case 6 (0.04844), case 13 (0.04309). The largest five cases from SDB0_3 are case 81 (0.77930), case 13 (-0.34625), case 8 (-0.47209), case 9 (-0.29534), case 10 (0.28745). The largest five cases from SDB1_3 are case 81 (-0.65905), case 8 (0.38429), case 77 (0.28239), case 10 (-0.27864), case 13 (0.26479). The five largest cases from SDB2_3 are case 81 (-0.43886), case 8 (0.27719), case 6 (-0.26409), case 9 (0.23528), case 10 (-0.22886).

Planning influence assumption. The largest five cases from COO_4 are case 81 (0.11471), case 79 (0.08443), case 9 (0.08316), case 10 (0.07635), case 8 (0.05384). The largest five cases from SDB0_4 are case 81 (0.57664), case 79 (0.49193), case 9 (-0.48724), case 74 (0.26318), case 10 (-0.46661). The largest five cases from SDB1_4 are case 81 (-0.48881), case 79 (-0.40101), case 9 (0.37869), case 10 (0.37478), case 76 (0.34605). The five largest cases from SDB2_4 are case 81 (-0.33898), case 79 (-0.30210), case 8 (-0.25924), case 9 (0.31418), case 10 (0.29108).

Self-appraisal influence assumption. The largest five cases from COO_5 are case 50 (0.15605), case 10 (0.07879), case 11 (0.06352), case 79 (0.06200), case 81 (0.07009). The largest five cases from SDB0_5 are case 81 (0.44639), case 10 (-0.45446), case 79 (0.41789), case 50 (0.38771), case 78 (0.33925). The largest five cases from SDB1_5 are case 50 (-0.59287), case 81 (-0.35422), case79 (-0.32601), case 11 (0.30390), case 10 (0.29865). The five largest cases from SDB2_5 are case 50 (0.25260), case 10 (0.29630), case 8 (-0.25526), case 81 (-0.22356), case 5 (-0.22704).

Descriptive Statistics

Participants. The sample consisted of 81 participants, of whom 40 participants were in the regular group (without design thinking method) and 41 participants were in the experiment group (with design thinking method). Of those participants, 20 were male and 61 were female.

Variables. The variables used for SEM analyses consisted of five endogenous variables (outcomes) that were the post-tests of Goal selection, Problem-solving, Occupational information, Planning, Self-appraisal as well as six exogenous variables (predictors) that were the five pretests of Goal selection, Problem-solving, Occupational information, Planning, Self-appraisal and design thinking method. The mean score for Goal selection pretest was 48.28 (SD=12.84) while the mean score for Goal selection post test was 64.21 (SD=10.66); the mean score for Problem solving pretest was 48.53 (SD=9.88) while the mean score for Problem solving post test was 61.62 (SD=9.94); the mean score for Occupation information pretest was 49.68 (SD=15.46) while the mean score for Occupation information post test was 66.97 (SD=12.82); the mean score for Planning pretest was 47.95 (SD=14.08) while the mean score for Planning post test was 67.14 (SD=12.01); the mean score for Self appraisal pretest was 56.58 (SD=12.55) while the mean score for Self appraisal post test was 73.06 (SD=10.70).

Structural Equation Modeling (SEM)

The data was analyzed using AMOS software.

The SEM model was just-identified. Because it is a just-identified model, there is no need to discuss model fit. For the missing data, full information likelihood estimation was used. Also, the design thinking variable was an independent dummy-variable. The research hypothesis was interpreted by examining model estimates such as standardized direct effects, standardized indirect effects, and standardized total effects.

Research question. The purpose of this research is to examine whether students who take career guidance courses that teach design thinking score higher on measures of self-efficacy than students who take career guidance courses without design thinking after controlling for preexisting career self-efficacy. Because career self-efficacy includes five parts, which are Goal selection, Problem-solving, Occupational information, Planning, and Self-appraisal, the research question should be extended as to examine whether students who take career guidance courses that teach design thinking score higher on measures of Goal selection, Problem-solving, Occupational information, Planning, Self-appraisal than students who take career guidance courses without design thinking after controlling for preexisting career self-efficacy.

Results indicate that the negative correlations between the design thinking variable and the other five exogenous variables (the five pretests of Goal selection, Problem-solving, Occupational information, Planning, Self-appraisal) are not significantly different than zero, so the two groups were not significantly different on those variables before the class started. All the correlations between the five pretests were significant ($p<0.5$). Additionally, the correlations between the five residuals of the five post-tests were significant (>0.5).

All the five paths between design thinking and other five endogenous variables were significant and positive ($p<0.001$), which indicates that using the design thinking method to teach students' career courses can improve Goal selection (β=0.38), Problem-solving (β=0.39), Occupational information (β=0.31), Planning (β=0.37), and Self-appraisal (β=0.38). So, the design thinking method influences students' career self-efficacy in the areas of Goal selection, Problem-solving, Occupational information, Planning, and Self-appraisal.

Regarding the direct effects from the Goal selection pretest score to the five post-test scores, only the path from Goal selection pretest to Goal selection post-test was significant (p<0.001, β =0.671). This result indicates that for every standard deviation increase in Goal selection pretest scores, Goal selection post test scores increased by 0.671 standard deviations.

Regarding the direct effects from the of Problem-solving pretest score to the five post-test scores, only the path from the Problem-solving pretest to the Problem solving post-test was significant ($p<0.001$, $\beta=0.624$). This result indicates that for every standard deviation increase in Problem-solving pretest scores, Problem solving post-test scores increase by 0.624 standard deviations.

Regarding the direct effects from the pretest of Occupational information to the five post-tests, three path coefficients are significant, which are the paths from Occupational information pretest to Goal selection post-test ($p=0.03$, $\beta=0.34$), Occupational informational post-test ($p<0.001$, $\beta=0.60$), and Planning post-test ($p=0.01$, $\beta=0.39$). The results indicate that for every standard deviation increase in Occupational information pretest scores, the Goal selection post test score increases by 0.341 standard deviations, the Occupational information post test score increases by 0.598 standard deviations, and the Planning post test score increases by 0.390 standard deviations.

Regarding the direct effects from the Planning pretest to the five post-tests, there were no significant path coefficients, which means the Planning pretest score does not influence any post test scores of the five sub scales in this case.

Regarding the direct effects from the Self-appraisal pretest to the five post-tests, only the direct effect of Self-appraisal pretest score to Self-appraisal post-test score was significant ($p=0.001$, $\beta=0.51$). The result indicates that for every standard deviation increase in Self-appraisal pretest score, the post-test score increases by 0.51 standard deviations.

Conclusion

In summary, the data meets all the assumptions. The paths from design thinking to the five dependent variables were positive, significant effects. Otherwise, there were six significant paths, which were the paths from Goal selection pretest to Goal selection post-test, the path from Problem-solving pretest to Problem-solving post-test, the paths from Occupational information pretest to Occupational information post-test, Goal selection post-test, and Planning post-test, and the path from Self-appraisal pretest to Self-appraisal post-test. There were no significant paths between the Planning pretest and the five post-tests.

Chapter 5: Discussion

Overall Findings

This study adopted a design thinking intervention to address problems with the current teaching methods of career guidance courses and the resulting concerns of students' career self-efficacy. The data were collected by a quasi-experiment through 16 weeks career courses, and then analyzed by AMOS. All the assumptions of linearity, homoscedasticity, normality of residuals, distance, leverage, and influence were met. There were no significant differences between the two groups for age, GPA, or gender. The different paths between six exogenous variables and five endogenous variables were interpreted and analyzed. Results indicate that applying design thinking to career guidance course instruction promotes students' career self-efficacy.

Findings by Research Question

All the five paths between design thinking and the other five endogenous variables were significant positive ($p < .001$), which indicates that using the design thinking method to teach students' career courses can improve students' goal selection, problem solving, occupational information, planning, and self-appraisal scores. These results support previous studies wherein design thinking has been demonstrated to be important relative to the promotion of students' problem-solving skills (Razzouk & Shute, 2012). Further, results suggest that students can enhance their problem-solving ability by learning to face problems, thinking of how to solve the problems from other aspects instead of the original style, and coming up with innovative solutions (Razzouk & Shute, 2012). So, students have enough ability to make suitable career decisions when plans do not go as intended.

The Self-appraisal subscale measures the extent to which one learns about his or her own abilities, interests and values when he or she makes educational and career decisions. As one of the five steps of the design thinking method, the purpose of “Interpretation” in design thinking is to make clear what a person has learned through storytelling, as well as sorting and condensing thoughts to find a clear direction (Fierst et al., 2011). In this study, students shared their experiences or stories about their abilities, interests and values in class after using the design thinking method. Then students formed their career directions of themselves. Accordingly, “Interpretation”may have enhanced students’ meaningful insights about themselves leading to higher Self-appraisal scores.

Two elements of the design thinking method, “Discovery” and “Brainstorming,” may explain why design thinking improved scores on occupational information. The process of “Discovery” requires students to define the challenge, prepare research and gather different kinds of information from different fields (Fierst et al., 2011). And, “Brainstorming” which is part of the “Ideation” step, entails generating and refining ideas (Fierst et al., 2011). These two elements of design thinking come together as students are required to gain information about occupations in groups by identifying a company or employer they wish to work for, generating or brainstorming a list of questions for the company, and identifying a time and place for an interview. The group members then interviewed a professional from the company to gain information about that occupation. Thus, after applying the design thinking practices of “Discovery” and “Brainstorming” in the career guidance course, students' occupational information gathering ability was strengthened.

Goal selection begins after one understands their personal aptitudes and occupational options and involves matching personal characteristics with the occupations in which students are interested. To accomplish this match, the design thinking step "Experimentation" can be used. Specifically, "Experimentation" entered into the career guidance course when students made physical prototypes that represented the potential matches between their abilities and careers. They then shared the prototypes with others and discussed how to further refine them. Thus, design thinking methods may have improved students' Goal selection score by helping them critically analyze the match between their abilities and career goals.

Evolution, which is the development of one's idea over time is the fifth step in the design thinking process. Within a career guidance course "Evolution" involves planning how to implement an educational or career choice, communicate the idea to others, and identify needed resources. Additionally, during this phase, students engage in activities such as in interview simulations and then submit a career document about how to make and implement a career plan that accounts for personal characteristics, majors, desired occupations, social environment, and educational choices. They also seek a mentor to help them realize their goals (Fierst et al., 2011). One of the steps in this process that is, perhaps, most affected by design thinking is the risk assessment because the principals of "Evolution" can help students reevaluate their plans if they cannot be implemented. Accordingly, students should leave the career guidance course with increased career self-efficacy.

In summary, the five steps of design thinking consist of Discovery, Interpretation, Ideation, Experimentation and Evolutionand can be applied to various activities in career guidance courses. These elements of design thinking, when effectively implemented, affect the various areas of career self-efficacy including goal selection, problem solving, occupational information, planning, and self-appraisal.

Implications of This Study

The findings of this study have implications for researchers, teachers, students, and policy makers. First, for the researchers, this study opens new areas of research related to the integration of design thinking and course instruction. Specifically for career guidance courses, researchers may want to focus on how design thinking enhances realizing oneself, understanding the work world, person-environment matching, decision making, and establishing a career development plan (Wan, 2008; Xu, 2007).

Second, for the career guidance teachers, this study provides a new student-centered teaching method for the classroom. Compared to the traditional teacher-centered method, design thinking based instruction is a learner-centered method and can be used for educators to design classrooms, curriculum, and learning environments (Fierst, 2011). Integrating design thinking into course content is an effective way to create a more student-centered learning experience (Welsh & Dehler, 2012).

Third, for students, career guidance courses have become one of the most important ways to cultivate high career decision making self-efficacy (Zhou & Xu, 2005) and to instruct students on obtaining employment (Zhao, 2008). Design thinking based instruction may be better than other forms of instruction in helping develop students' creative confidence and problem-solving skills (Kwek, 2011). Thus, students may seek courses that offer this form of instruction.

Fourth, for the policy makers, this study provides an effective indirect method to improve the qualified employment rate by increasing students' career self-efficacy and the capability to make appropriate and effective career choices (Wang, 2012). Additionally, high career self-efficacy can increase the probability of attaining a satisfying and appropriate job (Wang, 2012) and lead to a more satisfied workforce. Accordingly, policy makers may decide to promote more instruction using design thinking.

Suggestions for Future Research

First, in this study, all the subjects are freshmen, so there are many items in the Career Decision Making Self-efficacy Scale that the students may not answer accurately or may answer differently over the course of their academic career. Future studies may examine the effect of design thinking from freshmen to senior year. Additionally, because this is a quasi-experiment, the study should be repeated with other research designs.

Second, future studies should be designed specifically to avoid experimenter effects. In this study, the researcher was the teacher because the researcher was the only person who taught career guidance courses and could implement the design thinking process. Training a teacher to teach career guidance courses using a design thinking approach will require time and cost but would fill a need in this area of research.

Third, there is only one comparison to traditional teaching in this study, and the design thinking method was only used in one class; so, mono-operation bias and mono-method bias could be a threat to the validity of this study. In future research, other teaching methods should be studied in conjunction with design thinking, and the experiment should include additional classrooms.

Fourth, in this study, the subjects are only from two classes of one university and they are at the same major limiting the generalization of findings. Future studies may broaden the scope of the survey to include students from two or more universities and from different majors.

Fifth, some changes happened after this study in my teaching process. For example, I now like to ask students what they need and then find out their key problems as they relate to career guidance. I do this by engaging brainstorming so the students will think out the solutions themselves and apply it in a real study environment.

Sixth, I wish that I would have known some more formal training about the design thinking process at least one year before this study. If I was trained long-term by a formal design thinking instructor before this study, I would be more fluent when I used the five steps of the design thinking process.

Conclusion

Design thinking has been used in a variety of domains including management, business (Dunne and Martin, 2006), and engineering (Kwek, 2011), but the application to school-based settings is a relatively new phenomenon (Anderson, 2012). Previous research demonstrated that design thinking links the transformation of knowledge to the development of individual potential (Scheer et al., 2012). And when combining design thinking with management education, students felt more confident when they got their bachelors degree and were going to find appropriate work (Welsh & Dehler, 2012). There was no literature, however, about how design thinking based instruction in career guidance courses influences career self-efficacy. The results of this study provides evidence that design thinking based instruction can promote students' career self-efficacy by influence students' goal selection ability, problem-solving ability, occupational information ability, planning ability and self-appraisal ability.

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APPENDIX A: MANDARIN OF CAREER DECISION-MAKING SELF-EFFICACY SCALE

(职业决策自我效能感问卷)

第一部分：基本信息

年龄：__________ 性别：___________ 入学成绩：____________ 学号：____________

第二部分：请根据左面表格中的内容根据你自我了解的程度在右面数字 0 至 9 中选择一个，0 代表没有信心，9 代表超有信心。数字 0 至 9 代表拥有信心的程度。

	条目	信心程度
1	能做出生涯决策，并且不担心这个决策是否正确。	0 1 2 3 4 5 6 7 8 9
2	能找出关于公司的资料，公司雇佣的人都是英语专业。	0 1 2 3 4 5 6 7 8 9
3	能想出办法去改善自己在学校中的考试不及格	0 1 2 3 4 5 6 7 8 9
4	会在离开学校5-10年后再回到学校进修。	0 1 2 3 4 5 6 7 8 9
5	能寻找英语相关工作中的教育项目信息。	0 1 2 3 4 5 6 7 8 9
6	为了目标有自己的五年规划。	0 1 2 3 4 5 6 7 8 9
7	选择了一个你父母不认可的专业或者职业。	0 1 2 3 4 5 6 7 8 9
8	能准备一份好的简历。	0 1 2 3 4 5 6 7 8 9
9	如果你对自己所从事的职业不满意就改变职业。	0 1 2 3 4 5 6 7 8 9
10	即使在就业市场中你喜欢的专业领域已逐渐变为冷门，你仍选择这个专业。	0 1 2 3 4 5 6 7 8 9
11	能准确评估你的能力。	0 1 2 3 4 5 6 7 8 9
12	能从你的老师那里得到推荐信。	0 1 2 3 4 5 6 7 8 9
13	如果你在专业的某一方面有学业困难，能决定所采取的步骤。	0 1 2 3 4 5 6 7 8 9
14	会选择一份职业，里面大多数员工都是异性。	0 1 2 3 4 5 6 7 8 9

15	如果你不能得到第一选择，那么可以鉴别出某些合理的专业或者职业选择。	0 1 2 3 4 5 6 7 8 9
16	如果你不喜欢你的第一选择，会改变专业。	0 1 2 3 4 5 6 7 8 9
17	能弄清楚是否你有能力成功的完成数学课。	0 1 2 3 4 5 6 7 8 9
18	能弄清楚为了实现你的目标，你能够贡献的和不具备的东西。	0 1 2 3 4 5 6 7 8 9
19	能找到并且会去使用学校就业办公室。	0 1 2 3 4 5 6 7 8 9
20	能确定你的理想工作是什么。	0 1 2 3 4 5 6 7 809
21	能从你正在考虑的潜在职业清单中选择一份职业。	0 1 2 3 4 5 6 7 8 9
22	能够描述你想去从事的这份职业的工作职责。	0 1 2 3 4 5 6 7 8 9
23	能成功地掌控求职面试流程。	0 1 2 3 4 5 6 7 8 9
24	能从你正在考虑的潜在专业清单中选择一个专业。	0 1 2 3 4 5 6 7 8 9
25	第一次被拒绝之后能够再次向研究生学校提出申请。	0 1 2 3 4 5 6 7 8 9
26	能在图书馆搜寻你所感兴趣的职业信息。	0 1 2 3 4 5 6 7 8 9
27	能够找出80年代的一项职业的就业趋势。	0 1 2 3 4 5 6 7 8 9
28	能列出几个你感兴趣的专业名称。	0 1 2 3 4 5 6 7 8 9
29	会为了你真正喜欢的工作搬家到另外一个城市去。	0 1 2 3 4 5 6 7 8 9
30	能在一份职业中判断什么是你珍视的东西。	0 1 2 3 4 5 6 7 8 9
31	能够坚持从事于你的专业或职业目标即使你受到挫折。	0 1 2 3 4 5 6 7 8 9
32	选择一份适合你喜爱的生活方式的职业。	0 1 2 3 4 5 6 7 8 9
33	会计划不属于你专业内容的课程作业，从而能够在未来的职业中帮助你。	0 1 2 3 4 5 6 7 8 9
34	能确定你能力最强的学业科目。	0 1 2 3 4 5 6 7 8 9
35	能识别出与你职业发展潜力有关的老板、公司和单位。I	0 1 2 3 4 5 6 7 8 9
36	会反抗你的父母或者朋友想让你从事超出你能力范围的职业或者专业。	0 1 2 3 4 5 6 7 8 9
37	为了完成你所选择的专业能确定你所需要的步骤。	0 1 2 3 4 5 6 7 8 9

38	能列出几个你感兴趣的职业名称。	0	1	2	3	4	5	6	7	8	9
39	能选择出适合你能力的专业或者职业。	0	1	2	3	4	5	6	7	8	9
40	为了达到职业目标能确定你是否需要在研究生或者职业学校进修	0	1	2	3	4	5	6	7	8	9
41	选择一份适合你兴趣的专业或者职业。	0	1	2	3	4	5	6	7	8	9
42	会选择最好的专业即使它会花费你更长的时间去获取学位证书。	0	1	2	3	4	5	6	7	8	9
43	会参与一项工作并获取有关于你未来职业目标的工作经验。	0	1	2	3	4	5	6	7	8	9
44	能搜寻有关于研究生学校或者职业学校的信息。	0	1	2	3	4	5	6	7	8	9
45	能弄清楚一份职业中人们的平均年收入。	0	1	2	3	4	5	6	7	8	9
46	会向老师询问研究生学校和你专业的工作机会。	0	1	2	3	4	5	6	7	8	9
47	在系里跟老师讨论你正在考虑的一个专业。	0	1	2	3	4	5	6	7	8	9
48	能定义出你想要的生活方式。	0	1	2	3	4	5	6	7	8	9
49	能确定你是否更喜欢与人打交道还是更喜欢与信息打交道。	0	1	2	3	4	5	6	7	8	9
50	能与一位已经在你感兴趣的领域中工作的人交谈。	0	1	2	3	4	5	6	7	8	9

APPENDIX B: CAREER DECISION-MAKING SELF-EFFICACY SCALE

Part I: Basic information:

Age:____________

Sex:____________

GPA:____________ or College Entrance Examination Score:______________________

Part II: choose the degree ranging from No Confidence (0) to Complete Confidence (9).

Item	**Degree**
Make a career decision and then not worry about whether it was right or wrong.	0 1 2 3 4 5 6 7 8 9
Find information about companies who employ people with college majors in English	0 1 2 3 4 5 6 7 8 9
Come up with a strategy to deal with flunking out of college.	0 1 2 3 4 5 6 7 8 9
Go back to school to get a graduate degree after being out of school 5-10 years.	0 1 2 3 4 5 6 7 8 9
Find information about educational programs in engineering.	0 1 2 3 4 5 6 7 8 9
Make a plan of your goals for the next five years.	0 1 2 3 4 5 6 7 8 9
Choose a major or career that your parents do not approve of.	0 1 2 3 4 5 6 7 8 9
Prepare a good resume.	0 1 2 3 4 5 6 7 8 9
Change occupations if you are not satisfied with the one you enter.	0 1 2 3 4 5 6 7 8 9
Choose the major you want even though the job market is declining with opportunities in this field.	0 1 2 3 4 5 6 7 8 9

Accurately assess your abilities.	0	1	2	3	4	5	6	7	8	9
Get letters of recommendation from your professors.	0	1	2	3	4	5	6	7	8	9
Determine the steps to take if you are having academic trouble with an aspect of your chosen major.	0	1	2	3	4	5	6	7	8	9
Choose a career in which most workers are the opposite sex.	0	1	2	3	4	5	6	7	8	9
Identify some reasonable major or career alternatives if you are unable to get your first choice.	0	1	2	3	4	5	6	7	8	9
Change majors if you did not like your first choice.	0	1	2	3	4	5	6	7	8	9
Figure out whether you have the ability to successfully take math courses.	0	1	2	3	4	5	6	7	8	9
Figure out what you are and are not ready to sacrifice to achieve your career goals.	0	1	2	3	4	5	6	7	8	9
Find and use the placement office on campus.	0	1	2	3	4	5	6	7	8	9
Determine what your ideal job would be.	0	1	2	3	4	5	6	7	8	9
Select one occupation from a list of potential occupations you are considering.	0	1	2	3	4	5	6	7	8	9
Describe the job duties of the career/occupation you would like to pursue.	0	1	2	3	4	5	6	7	8	9
Successfully manage the job interview process.	0	1	2	3	4	5	6	7	8	9
Select one major from a list of potential majors you are considering.	0	1	2	3	4	5	6	7	8	9
Apply again to graduate schools after being rejected the first time.	0	1	2	3	4	5	6	7	8	9
Find information in the library about occupations you are interested in.	0	1	2	3	4	5	6	7	8	9
Find out the employment trends for an occupation in the 1980s.	0	1	2	3	4	5	6	7	8	9
List several majors that you are interested in.	0	1	2	3	4	5	6	7	8	9

Move to another city to get the kind of job you really would like.	0	1	2	3	4	5	6	7	8	9
Decide what you value most in an occupation.	0	1	2	3	4	5	6	7	8	9
Persistently work at your major or career goal even when you get frustrated.	0	1	2	3	4	5	6	7	8	9
Choose a career that will fit your preferred lifestyle.	0	1	2	3	4	5	6	7	8	9
Plan course work outside of your major that will help you in your future career.	0	1	2	3	4	5	6	7	8	9
Determine the academic subject you have the most ability in.	0	1	2	3	4	5	6	7	8	9
Identify employers, firms, institutions relevant to your career possibilities.	0	1	2	3	4	5	6	7	8	9
Resist attempts of parents or friends to push you into a career or major you believe is beyond your abilities.	0	1	2	3	4	5	6	7	8	9
Determine the steps you need to take to successfully complete your chosen major.	0	1	2	3	4	5	6	7	8	9
List several occupations that you are interested in.	0	1	2	3	4	5	6	7	8	9
Choose a major or career that will suit your abilities.	0	1	2	3	4	5	6	7	8	9
Decide whether or not you will need to attend graduate or professional school to achieve your career goals.	0	1	2	3	4	5	6	7	8	9
Choose a major or career that will fit your interests.	0	1	2	3	4	5	6	7	8	9
Choose the best major for you even if it took longer to finish your college degree.	0	1	2	3	4	5	6	7	8	9
Get involved in a work experience relevant to your future goals.	0	1	2	3	4	5	6	7	8	9
Find information about graduate or professional schools.	0	1	2	3	4	5	6	7	8	9
Find out about the average yearly earnings of people in an occupation.	0	1	2	3	4	5	6	7	8	9

Ask a faculty member about graduate schools and job opportunities in your major.	0 1 2 3 4 5 6 7 8 9
Talk to a faculty member in a department you are considering for a major.	0 1 2 3 4 5 6 7 8 9
Define the type of lifestyle you would like to live.	0 1 2 3 4 5 6 7 8 9
Determine whether you would rather work primarily with people or with information.	0 1 2 3 4 5 6 7 8 9
Talk with a person already employed in the field you are interested in.	0 1 2 3 4 5 6 7 8 9

APPENDIX C: LESSON PLAN FOR CAREER GUIDANCE COURSE IN ONE SEMESTER ON 90-MINUTE, 2-PERIOD BLOCK SCHEDULE, 16 WEEKS

Course goal

Students will improve their career self-efficacy and learn to make career decisions and career choices.

Unit 1: Realizing Yourself (90 minutes per week for 3 weeks)

This is a three week series of class sessions for 90 minutes once a week. The aim of the first unit is to let students appraise themselves more objective and confident about their own abilities, interests, and values as relating to educational and career decisions.

Materials

We should prepare interest island activity, paper, pen, ability test, value test, CDMSE (career decision making self-efficacy) scale.

Procedures

Class section 1. The students should complete pretest, warm-up activities and two steps of design thinking process in 90 minutes at this section, which includes discovery and interpretation.

Pretest (15 minutes). Let the students finish CDMSE (career decision making self-efficacy) scale in 15 minutes.

Warm-up (25 minutes). Let the students do interest island activity, ability test and value test in 25 minutes.

Discovery (30 minutes). The students should understand the challenge: who are you? What are your interests? What are your abilities?

Interpretation (20 minutes). The teacher should interpret the main question that how might we let students realize themselves? Then help the students search for the interest, ability and value's meaning.

Class section 2. The students should complete two steps of design thinking process in 90 minutes at this section, which includes ideation and experimentation.

Ideation (50 minutes). At this step, the students should answer the following questions such as how to realize yourself, which is core elements of interests, abilities, and value for you by brainstorming.

Experimentation (40 minutes). This step is called prototype. The students should build one or several knowledge systems for realizing oneself, e.g. combining interests and values together can make one realizing oneself or how to combine interests and values together for realizing oneself.

Class section 3. The students should complete the last step of design thinking process in 90 minutes at this section, which is evolution.

Evolution (90 minutes). Each group (9 groups) should find a best method of realizing oneself to present in the class, which is called to find the solutions.

Unit 2: Understanding the Occupations (90 minutes per week for 3 weeks)

This is a three week series of class sessions for 90 minutes once a week. The aim of the second unit is to let students gather information of interested occupations by interviewing professional persons and analyze them.

Materials

We should prepare the investigation report of interested professional persons, paper, pen.

Procedures

Class section 1. The students should complete warm-up activities and two steps of design thinking process in 90 minutes at this section, which includes discovery and interpretation.

Warm-up (45 minutes, 9 groups). The students of 9 groups should introduce the basic information of interviewees who have been interviewed out of class.

Discovery (25 minutes). At this step, the students should understand the challenge: what can you learn from the interviewees?

Interpretation (20 minutes). At this step, the teacher should help students interpret and search for the occupations' meaning, and answer the question: what are occupations?

Class section 2. The students should complete two steps of design thinking process in 90 minutes at this section, which includes ideation and experimentation.

Ideation (50 minutes). The students should answer the following questions such as how many occupations are suitable for students and how to gather vocational information by brainstorming.

Experimentation (40 minutes). The most important step of experimentation is prototype. At this step, the students should build one or several ways to understand the occupations from the vocational qualification, skills, development prospect, searching and managing information.

Class section 3. The students should complete the last step of design thinking process in 90 minutes at this section, which is evolution.

Evolution (90 minutes). Each group (9 groups) should find a best method of understanding the occupations to present in the class, which is called to find the solutions.

Unit 3: Person-Environment Matching (90 minutes per week for 3weeks)

This is a three week series of class sessions for 90 minutes once a week. The aim of the third unit is to let students learn to match personal characteristics with occupations' requirements.

Materials

We should prepare personal characters reports, labor market information, relative social policies, the report of "my major in Shanghai" and "my interpersonal circles", paper, pen.

Procedures

Class section 1. The students should complete warm-up activities and two steps of design thinking process in 90 minutes at this section, which includes discovery and interpretation.

Warm-up (45 minutes). The teacher should introduce the basic trends of the relative major in Shanghai.

Discovery (25 minutes). The students should understand the challenge: how to match your interests, abilities, values, characters to the labor market's requirements.

Interpretation (20 minutes). At this part, the teachers should know how might we let students make person-environment matching well. And the students should search for the meaning of person-environment matching and answer the question: what is person-environment matching.

Class section 2. The students should complete two steps of design thinking process in 90 minutes at this section, which includes ideation and experimentation.

Ideation (50 minutes). The students should answer the following questions such as how to make person-environment matching well and what are the criteria based on your understandings by brainstorming.

Experimentation (40 minutes). For this prototype process, students should build one or several ways to make person-environment well.

Class section 3. The students should complete the last step of design thinking process in 90 minutes at this section, which is evolution.

Evolution (90 minutes). Each group (9 groups) should find a best method of person-environment matching to present in the class, which is called to find the solutions.

Unit 4: Decision-Making Methods (90 minutes per week for 3weeks)

This is a three week series of class sessions for 90 minutes once a week. The aim of the third unit is to let students understand different methods for making decisions and coping with different interested career choices based on personal subjective value and characteristics.

Materials

We should prepare three kinds of decision making methods, paper, pen.

Procedures

Class section 1. The students should complete warm-up activities and two steps of design thinking process in 90 minutes at this section, which includes discovery and interpretation.

Warm-up (40 minutes). The teacher should conduct students to do decision-making activities.

Discovery (30 minutes). The students should understand the challenge: how to make a decision.

Interpretation (20 minutes). The teachers should know how might we let students make an appropriate decision among the different career choices. The students should can search for the meaning of decision-making methods and answer the question: why should one know decision-making methods?

Class section 2. The students should complete two steps of design thinking process in 90 minutes at this section, which includes ideation and experimentation.

Ideation (50 minutes). Students should discuss the following questions such as how to make an appropriate career decision and what is the best method for you to make a career decision by brainstorming.

Experimentation (40 minutes). For this prototype process, each group should build one or several ways to make an appropriate career decision.

Class section 3. The students should complete the last step of design thinking process in 90 minutes at this section, which is evolution.

Evolution (90 minutes). Each group (9 groups) should find a best method of career decision-making methods to present in the class, which is called to find the solutions.

Unit 5: Career Plan (90 minutes per week for 4 weeks)

This is a four week series of class sessions for 90 minutes once a week. The aim of the third unit is to let students understand how to make and implement a career plan according to your characteristics, majors, interested occupations, social environment, educational or career choice.

Materials

We should prepare all the previous materials, paper, pen, CDMSE (career decision making self-efficacy) scale.

Procedures

Class section 1. The students should complete warm-up activities and two steps of design thinking process in 90 minutes at this section, which includes discovery and interpretation.

Warm-up (40 minutes). Students should introduce their career plan and how wo implement it.

Discovery (25 minutes). Students should understand the challenge: how to make a career plan?

Interpretation (25 minutes). The teachers should know how might we let students make a career plan? And the students should search for the career plan's meaning, answer the question: what is career plan?

Class section 2. The students should complete two steps of design thinking process in 90 minutes at this section, which includes ideation and experimentation.

Ideation (50 minutes). Each group should discuss the following questions such as how to make a career plan, what are the core factors of a career plan and what is the effect of a career plan by brainstorming.

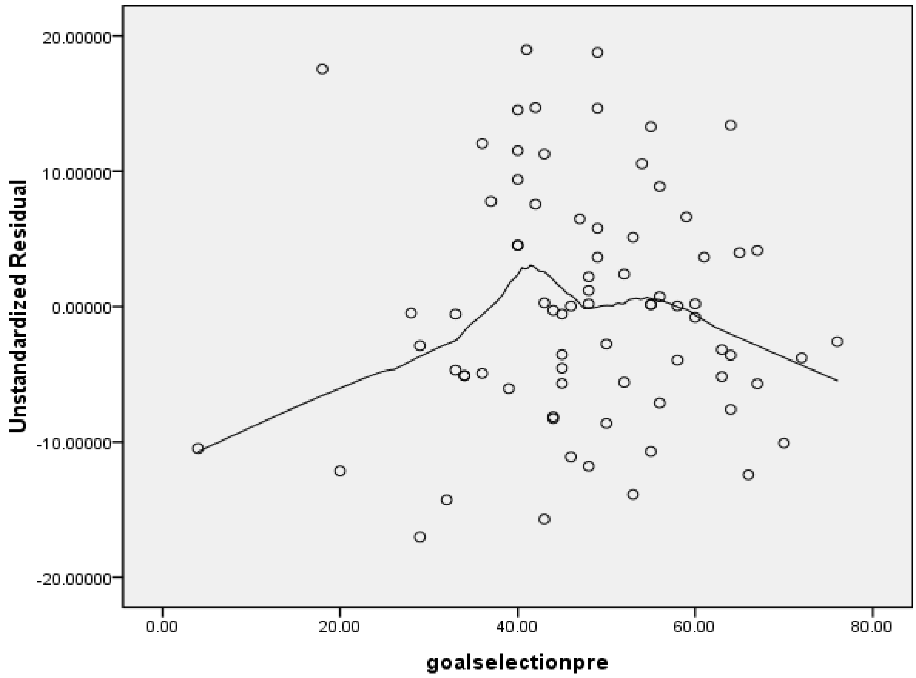
Experimentation (40 minutes). For this prototype process, each group should build one or several ways to make a career plan.

Class section 3 and 4. The students should complete the last step of design thinking process and post test of CDMSE scale in 180 minutes at this section.

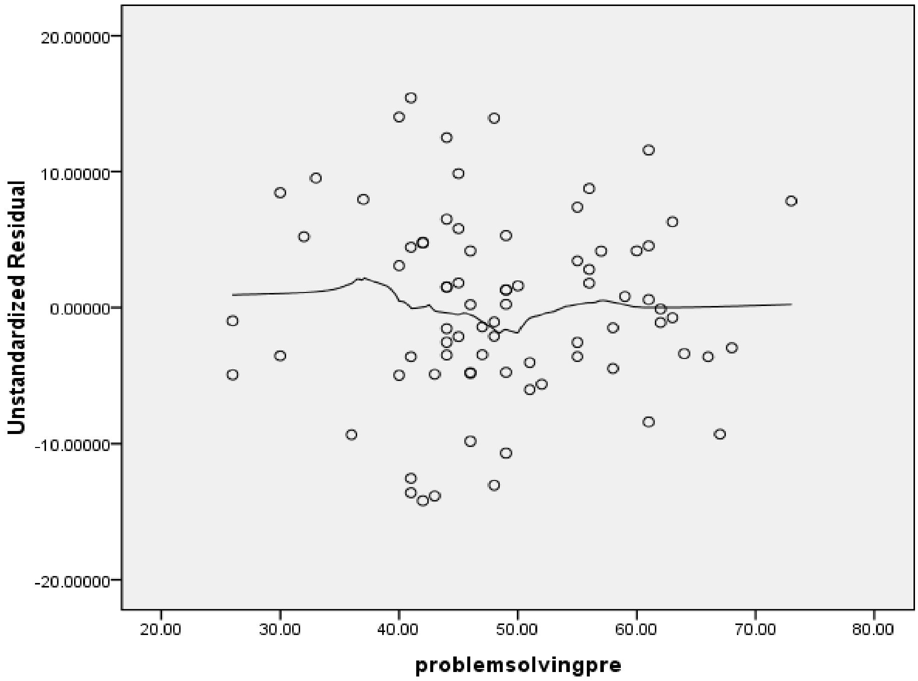
Evolution (165 minutes). Each student should present the career plan in the class one by one in 165 minutes, which is call to find the solutions.

Post test (15 minutes). Each student should complete career decision making self-efficacy scale in 15 minutes after experiencing one term career guidance courses.

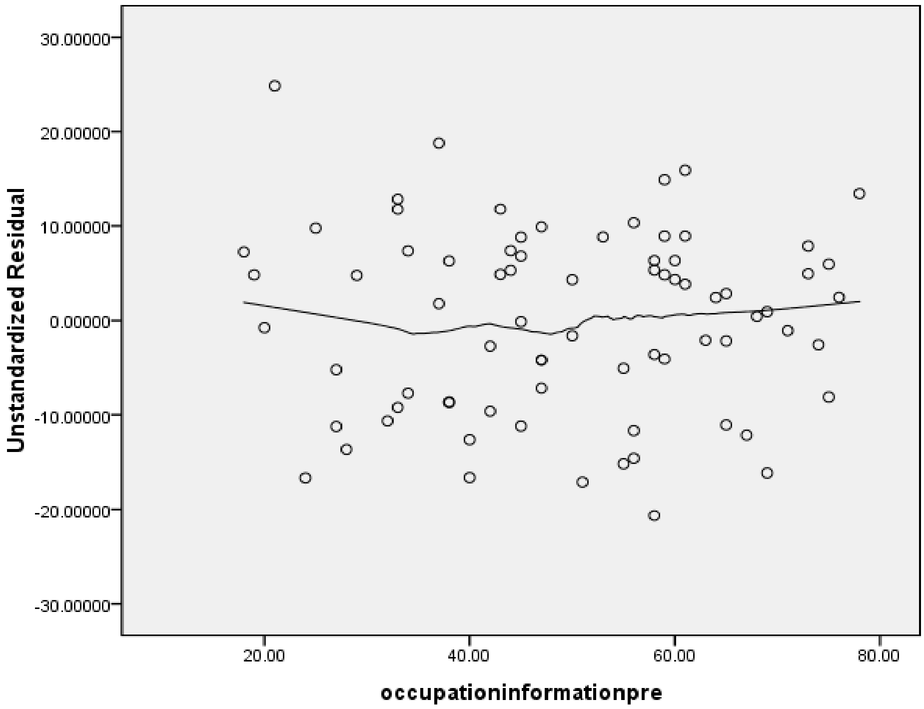
APPENDIX D: UNSTANDARDIZED RESIDUAL PLOTTED AGAINST GOAL SELECTION PRETEST (LINEARITY ASSUMPTION)



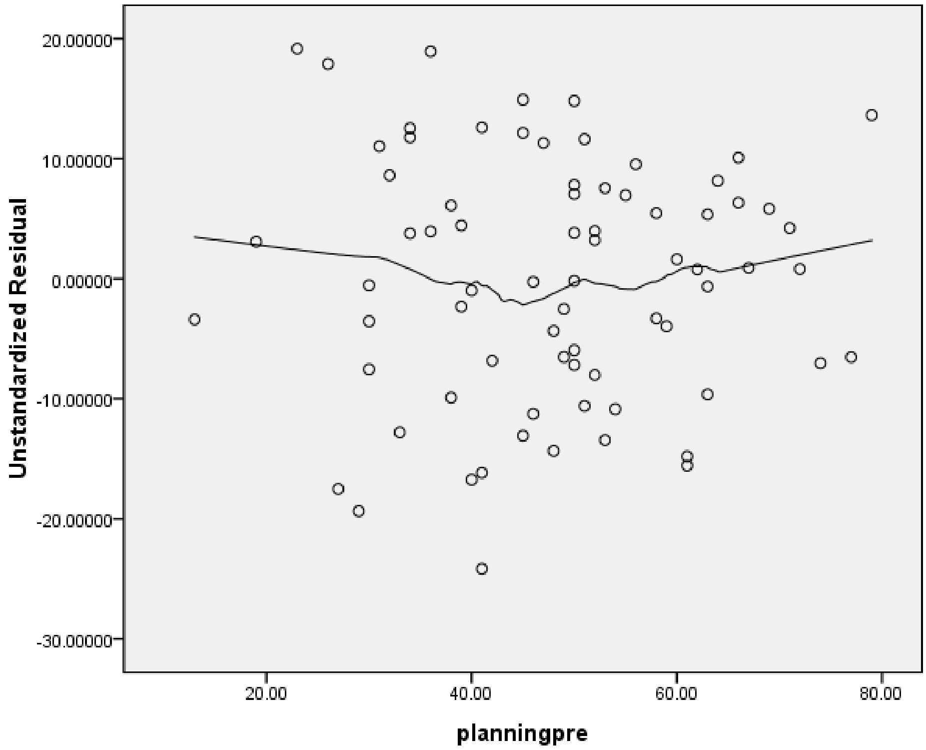
APPENDIX E: UNSTANDARDIZED RESIDUAL PLOTTED AGAINST PROBLEM SOLVING PRETEST (LINEARITY ASSUMPTION)



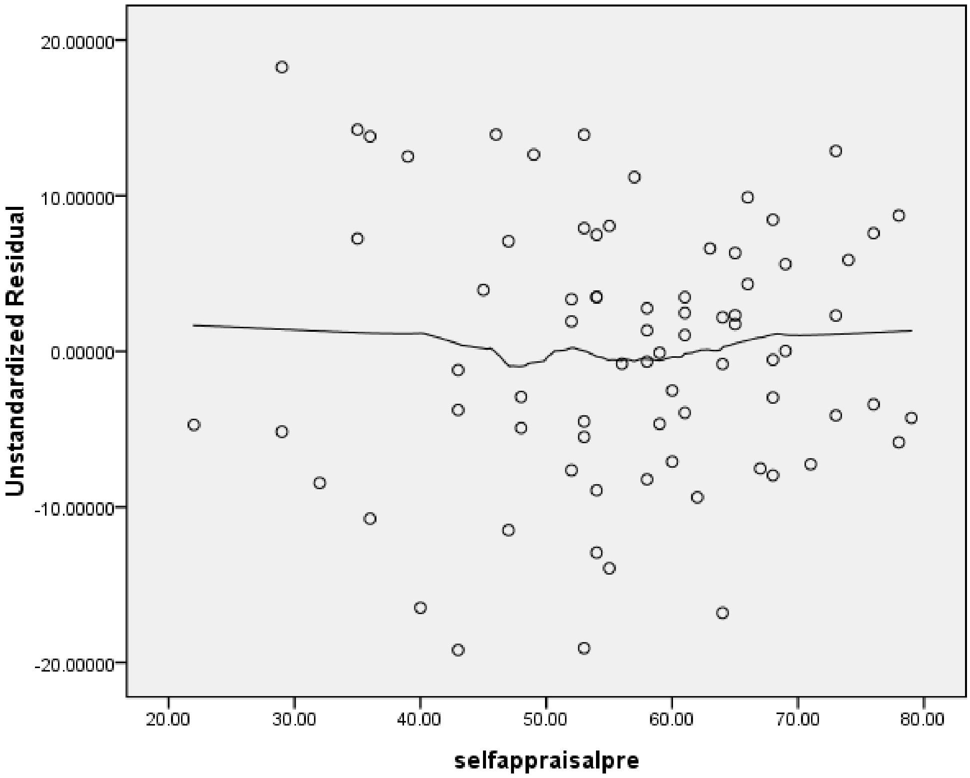
APPENDIX F: UNSTANDARDIZED RESIDUAL PLOTTED AGAINST OCCUPATION INFORMATION PRETEST (LINEARITY ASSUMPTION)



APPENDIX G: UNSTANDARDIZED RESIDUAL PLOTTED AGAINST PLANNING PRETEST (LINEARITY ASSUMPTION)

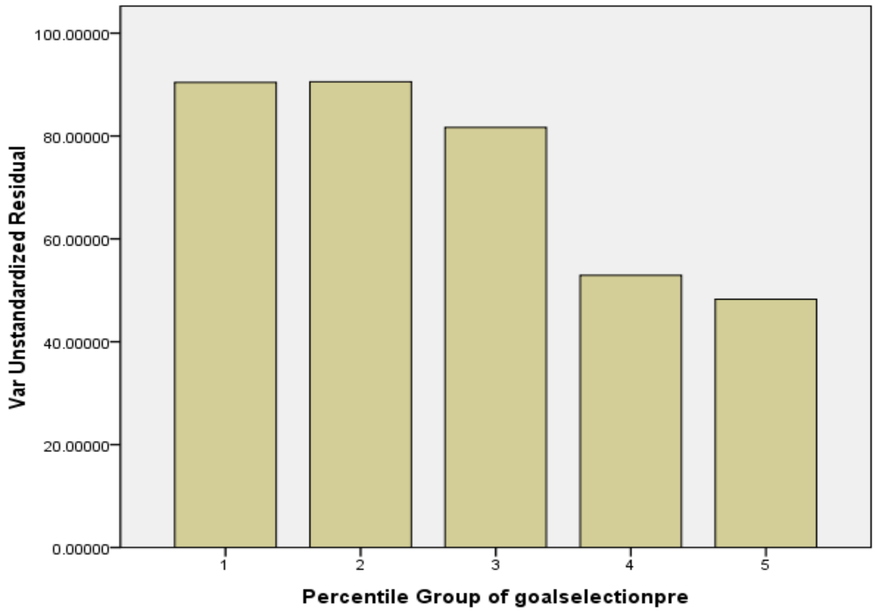


APPENDIX H: UNSTANDARDIZED RESIDUAL PLOTTED AGAINST SELF-APPRAISAL PRETEST (LINEARITY ASSUMPTION)



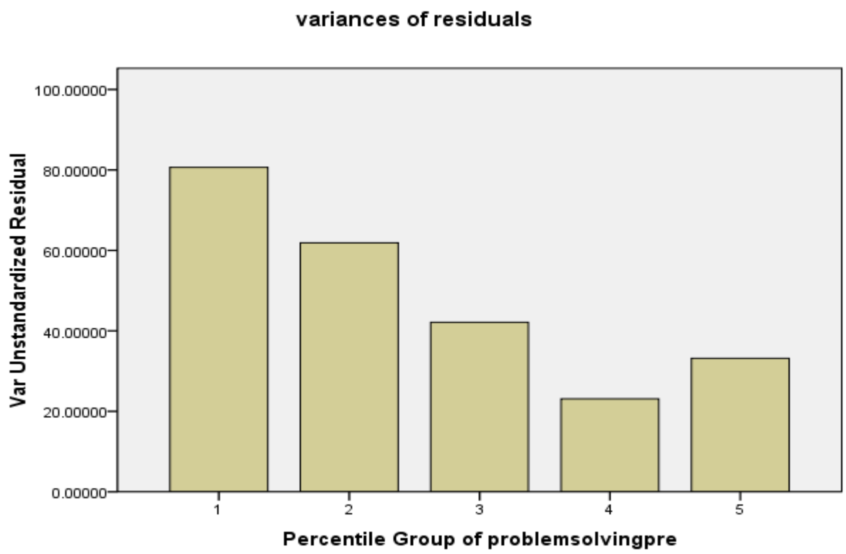
APPENDIX I: VARIANCE OF RESIDUALS @GOALSELECTIONPRE

(HOMOSCEDASTICITY ASSUMPTION)



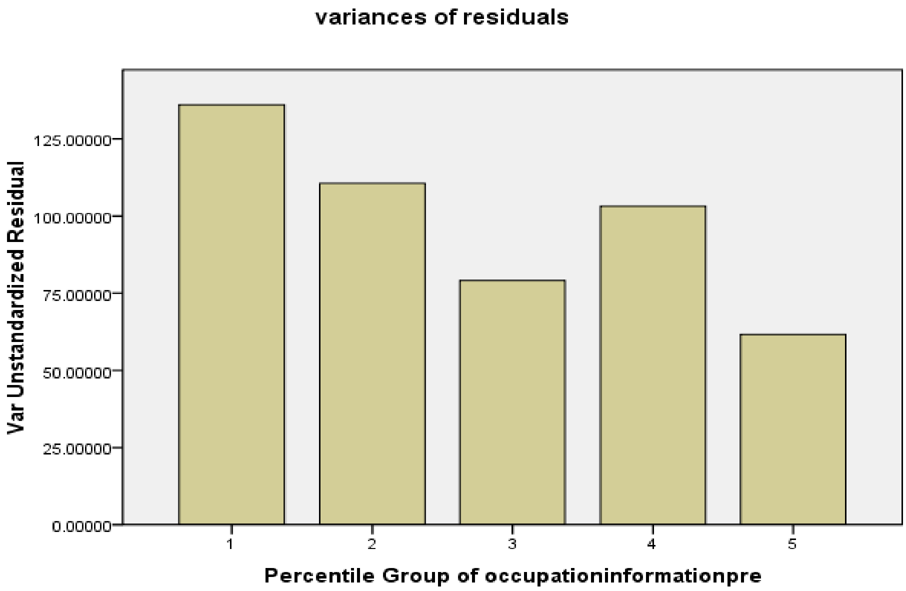
APPENDIX J: VARIANCE OF RESIDUALS @PROBLEMSOLVINGPRE

(HOMOSCEDASTICITY ASSUMPTION)



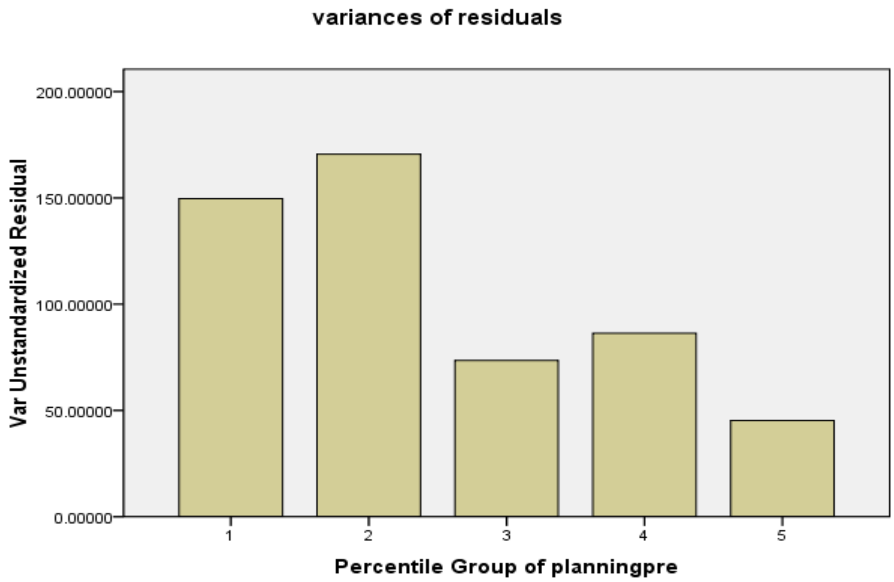
APPENDIX K: VARIANCE OF RESIDUALS @OCCUPATIONINFORMATIONPRE

(HOMOSCEDASTICITY ASSUMPTION)



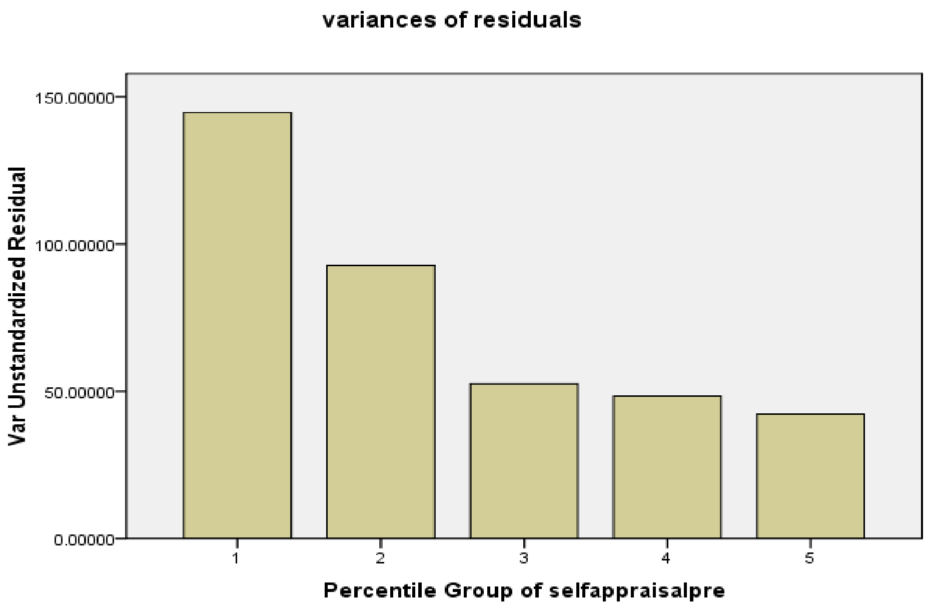
APPENDIX L: VARIANCE OF RESIDUALS @PLANNINGPRE

(HOMOSCEDASTICITY ASSUMPTION)

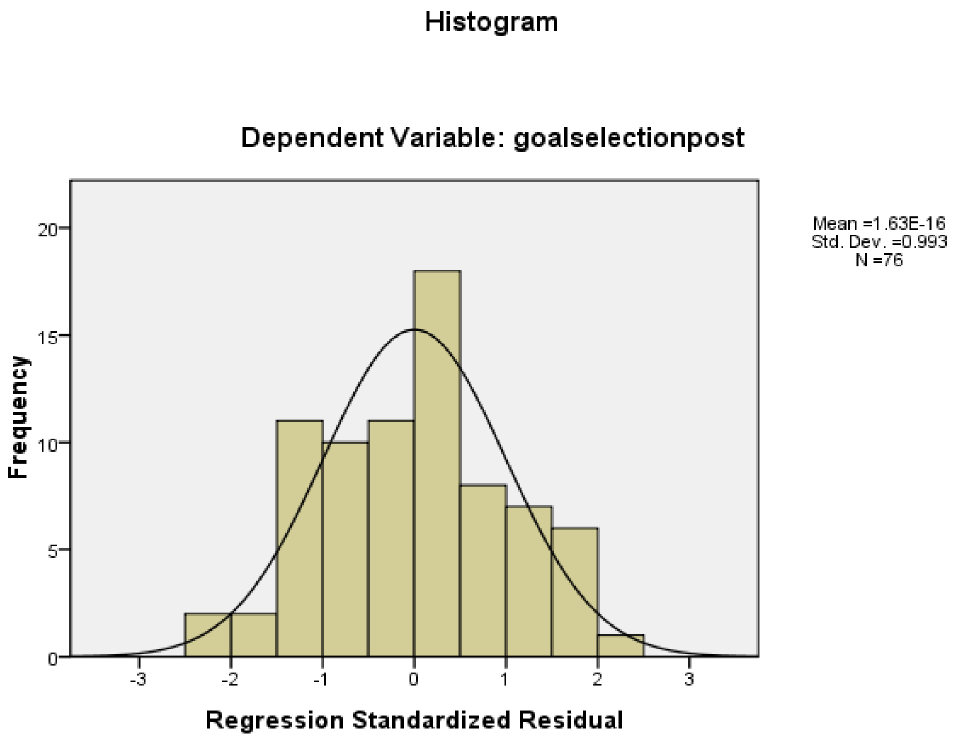


APPENDIX M: VARIANCE OF RESIDUALS @SELFAPPRAISALPRE

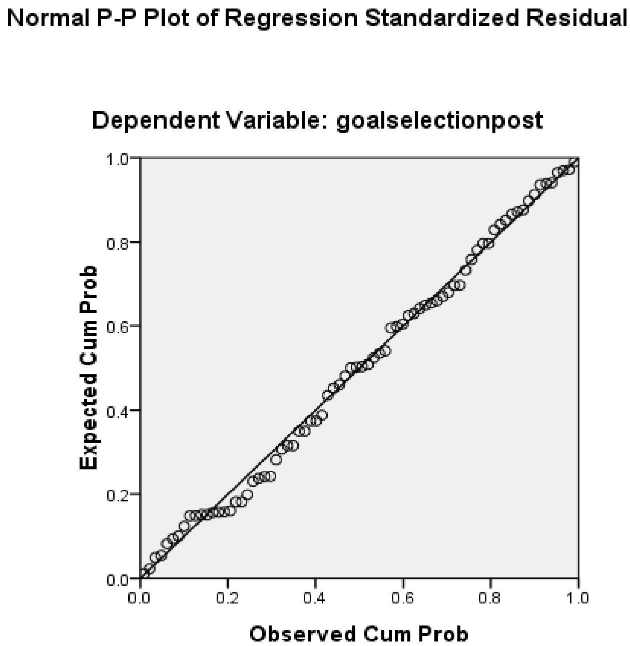
(HOMOSCEDASTICITY ASSUMPTION)



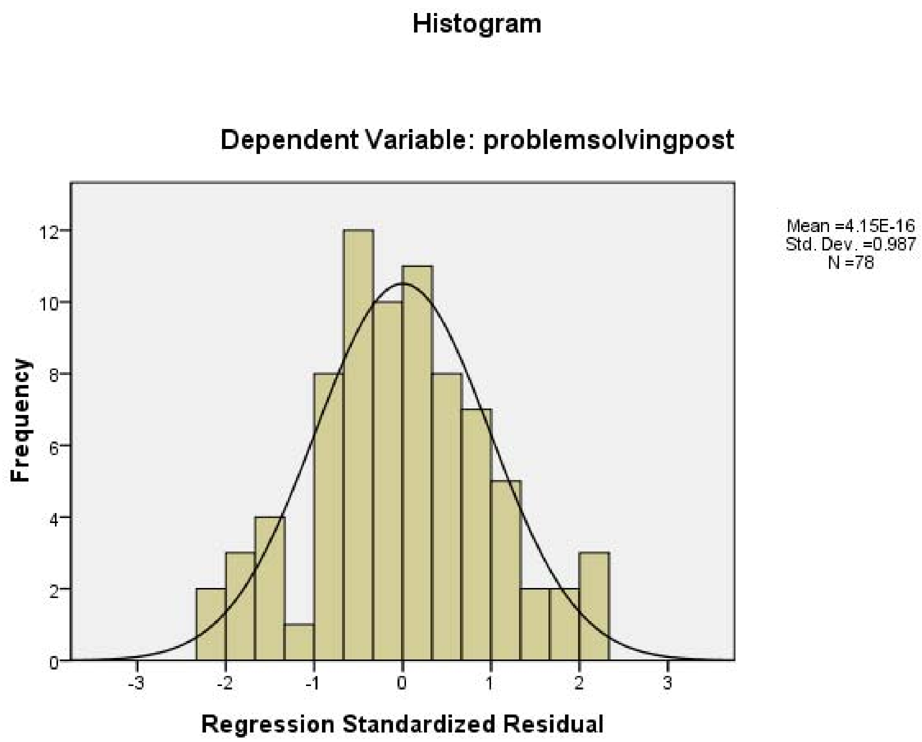
APPENDIX N: DISTRIBUTION OF RESIDUALS @GOALSELECTION (NORMALITY OF RESIDUALS ASSUMPTION)



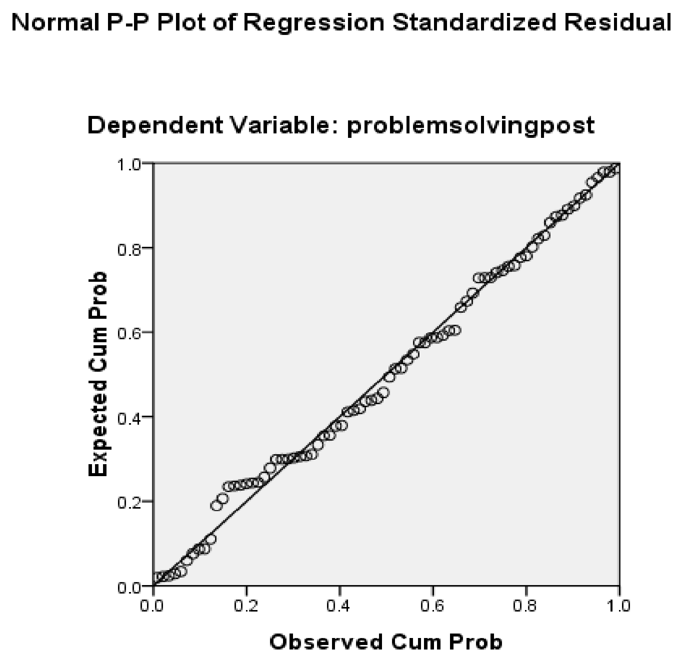
APPENDIX O: P-P PLOT @GOALSELECTION (NORMALITY OF RESIDUALS ASSUMPTION)



APPENDIX P: DISTRIBUTION OF RESIDUALS @PROBLEMSOLVING (NORMALITY OF RESIDUALS ASSUMPTION)

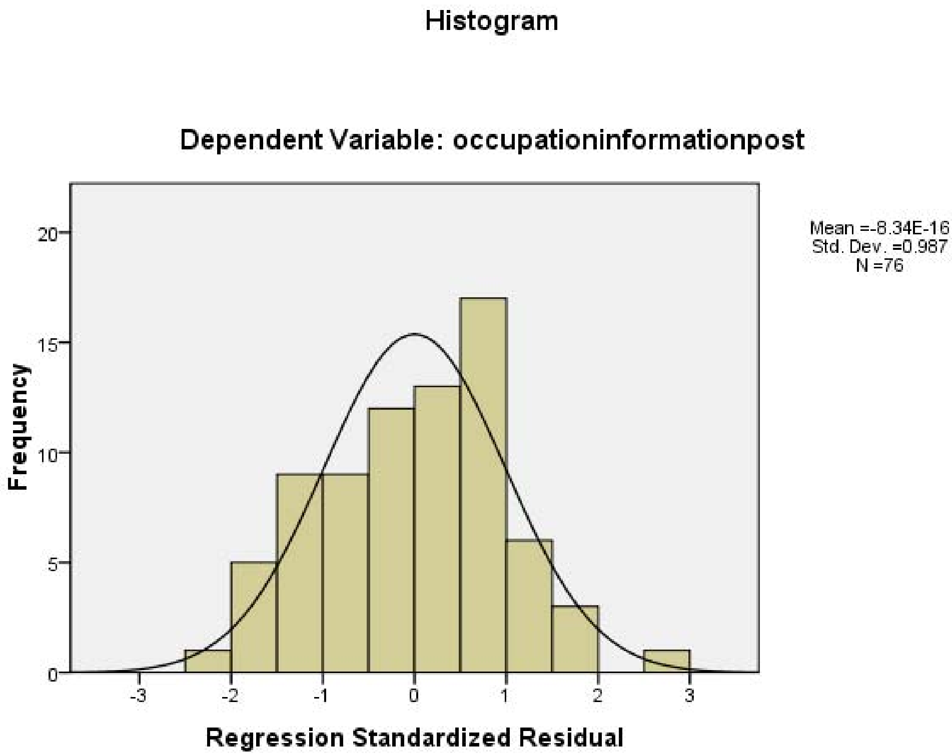


APPENDIX Q: P-P PLOT @PROBLEMSOLVING (NORMALITY OF RESIDUALS ASSUMPTION)

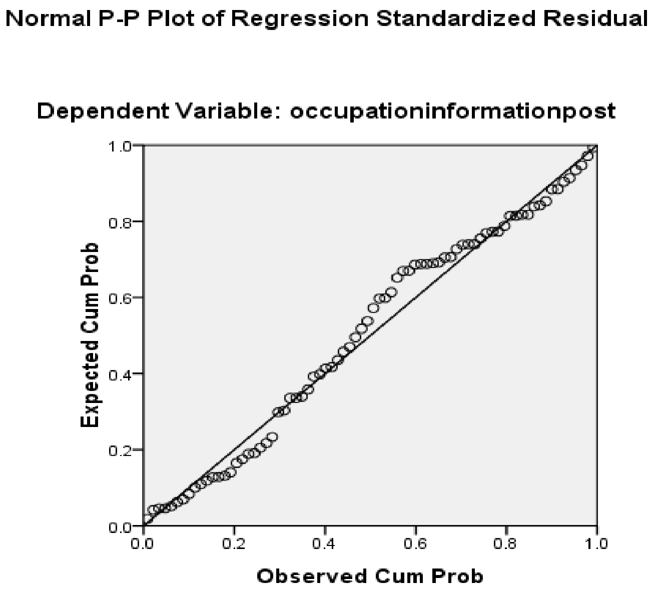


APPENDIX R: DISTRIBUTION OF RESIDUALS @OCCUPATIONINFORMATION

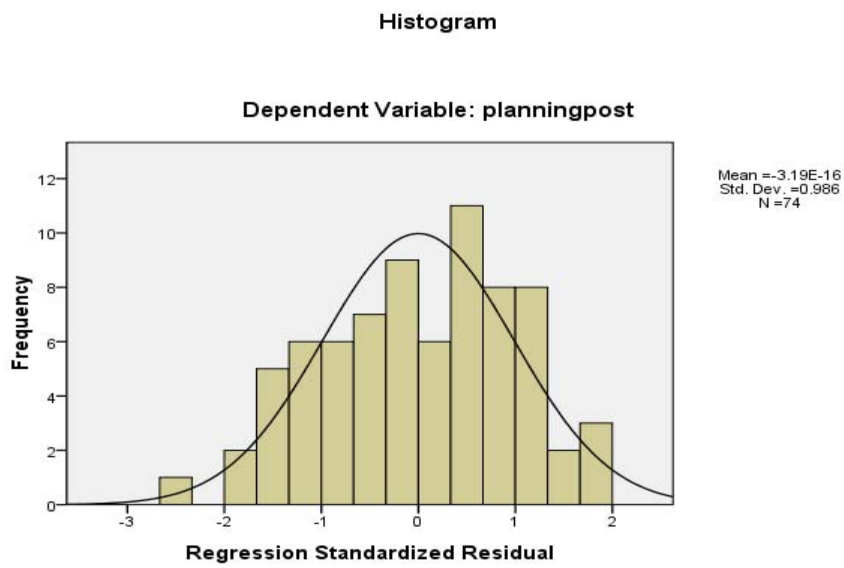
(NORMALITY OF RESIDUALS ASSUMPTION)



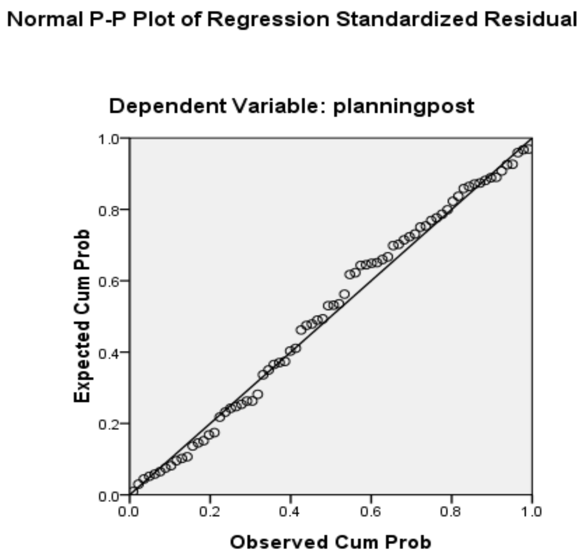
APPENDIX S: P-P PLOT @OCCUPATIONINFORMATION (NORMALITY OF RESIDUALS ASSUMPTION)



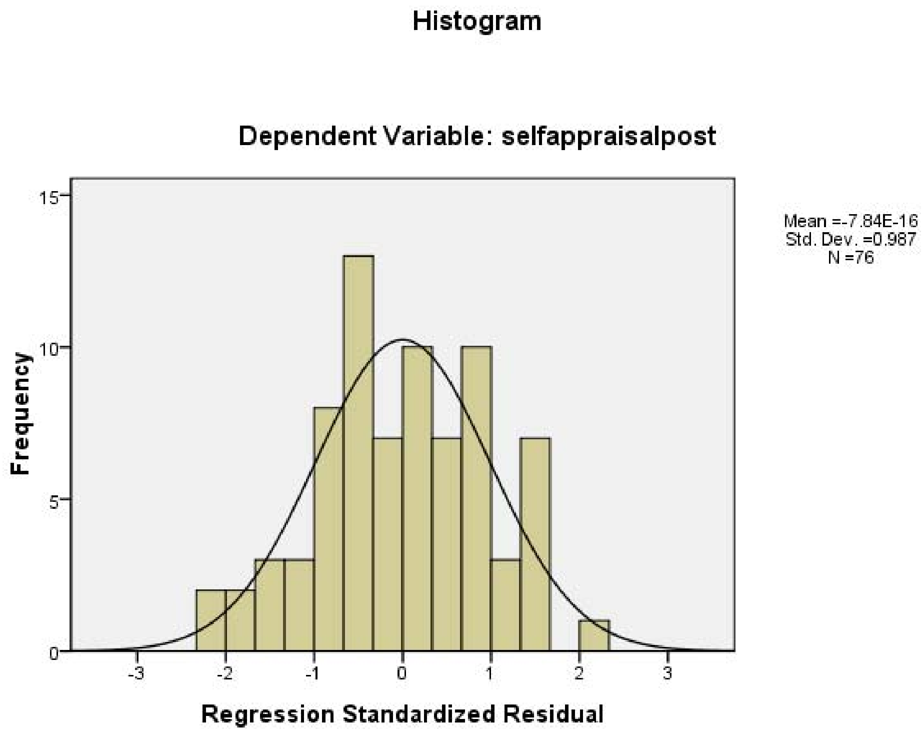
APPENDIX T: DISTRIBUTION OF RESIDUALS @PLANNING (NORMALITY OF RESIDUALS ASSUMPTION)



APPENDIX U: P-P PLOT @PLANNING (NORMALITY OF RESIDUALS ASSUMPTION)



APPENDIX V: DISTRIBUTION OF RESIDUALS @SELFAPPRAISAL (NORMALITY OF RESIDUALS ASSUMPTION)



APPENDIX W: P-P PLOT @SELFAPPRAISAL (NORMALITY OF RESIDUALS ASSUMPTION)