

Parental and Student Factors Associated with Future College Major Preference
in Two Provinces of China

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Abstract

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The present study investigates the effects of parental characteristics, including parental education level, occupation level, engagement, perceived expectation, as well as student gender, on 10th graders' preference for future college academic fields. Logistic regression models were used with $N = 642$ 10th graders from two provinces in China. Results indicate that higher parental education and occupation level did not predict a students' academic preference in nontraditional fields for their gender group. In most academic fields, the effects of parental engagement were significantly associated with the males' preferences, not females'. Study findings suggest that parental expectation was a strong predictor of students' college academic fields preferences. In addition, results suggest that gender stratification still existed in the academic domains, but no interaction between gender and parental characteristics were found.

Key words: academic field preference, parental characteristics, gender

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Introduction

Horizontal stratifications of subgroups in academic fields have spurred considerable research over the past several decades. A specific concern facing educators, policymakers, and researchers is the underrepresentation in some fields of particular groups such as women, racial minorities, students with low socioeconomic status (SES), or students with a disability (Diekman et al., 2010; Dutta & Chiu, 2013; Ma, 2011; Trusty et al., 2000; Wang, 2013; Ware & Lee, 1988). Such underrepresentation has attracted a fair amount of research interests. One focus of such research is on identifying factors that inspire students' interest in particular academic fields, reinforce their expectations of success, and eventually persuade them to declare a related major in those fields in college. To date, such research has focused primarily on students' individual characteristics, academic achievement, or learning experience in high school or early college to explain the field choice of high school graduates (Allen & Robbins, 2008; Bottial et al., 2015; Diekman et al., 2010; Lapan et al., 1996; Leppel, Williams & Waldauer 2001; Liao & Ji, 2015; Musu-Gillette et al., 2015; Schnabel et al., 2002; Trusty et al., 2000; Wang, 2013). Family is also one of the most important learning settings for adolescents, and parents have been regarded as the main source for adolescents to turn to for help on educational decision making (Davis-Kean & Kazak, 2005; Hall et al., 2010; Leppel, Williams & Waldauer 2001; Liu, Hung & Chung, 2013; Pearson & Dellmann-Jenkins, 1997). Although much research has revealed the impacts of family and parental characteristics on students' successful transition to and achievement in college (Chapman, 2010; Datcher, 1982; Davis-Kean & Kazak, 2005; Utomo, 2017; Wojtkiewicz, 1993), fewer studies have examined the effects of parental characteristics on

academic field preference and choice in the phase of higher education. Among those few studies, most have focused on a college attendee's major choice (Dutta et al., 2015; Mullen, 2014; Trusty et al., 2000; Wang, 2013; Workman, 2015). In addition, the majority of the studies to date have been conducted within the context of Western society. These studies provide insights helpful for teasing out family and parent influence on major choice in the West. However, we cannot generalize these results to other social contexts, as the differences in social and cultural context could strongly shape students' educational choice and related values. Among the few studies focused on East Asian cases, most of them have highlighted the effects of the track placement (following either the social science-oriented or natural science-oriented track) and the effects of the highly centralized national exams on major choice (Paik & Shim, 2013; Ross & Wang, 2010). The uniform training and testing in most of the Asian secondary educational settings have been criticized as responsible for enlarging academic segregation. The examination uniformity is somewhat stacked against diversity at the individual level and the goal of cultivating diverse talent (Ross & Wang, 2010). With the aim of providing education geared to the needs of diverse individuals and to restructuring the workforce, reforms in college entrance exams have been implemented across Asian societies. This study was conducted to respond to a policy innovation on college entrance exams in the context of Chinese society.

Chinese Case

China is renowned worldwide for its large student body, with up to 24.55 million students enrolled in general senior secondary schools in 2013 (The Ministry of Education of the People's Republic of China [MOE], 2015). Among this huge number of students, only 34.5% of them go on to enroll in higher education institutions, including 3-year and 4-year colleges. According to the MOE data for 2015, approximately one quarter (3.81 million) of the 12th graders were

matriculated by 4-year colleges. For the majority of students in China, the National College Entrance Examinations (NCEE) is the primary gateway to pursuing higher education. Even though there are alternative ways that enable students to enter college, such as taking the independent test offered by top-tier universities or opting out of the system by attending universities abroad, these alternatives only apply to the minority groups with extraordinary achievement or from high SES families.

The NCEE is a nationwide academic examination held in June annually. Traditionally, students take compulsory subjects (Chinese, math, foreign language) and choose one selective content area (either social or science studies) in the NCEE. During the past decade, to ease the tension between examination uniformity and individual diversity, a series of reforms have been carried out to allow an individualized combination of subjects on the national test. In most of the newly introduced subjects' choice systems, students are still separated into two academic domains. However, the 3+3 subject system that was introduced in 2014 aims to break down the boundary between academic domains by allowing students to customize their test subjects across content areas.

The 3+3 subject system indicates that students have to take 3 compulsory subjects (Chinese, mathematics, English) and 3 selective subjects (out of history, civics, geography, physics, chemistry, and biology) in the NCEE. Annually, the admission office of colleges would announce only 1 or 2 required test subjects for a particular major based on both the prerequisite for that major and the specific requirements of a program. Students can choose their test subjects accordingly in order to earn the possibility of being considered as a qualified candidate for a particular college program. While enjoying more flexibility in constructing personalized secondary school learning under this system, students may feel more pressure and take greater

risk in selecting a college major, and even a career path, at the end of the first year in high school. The uncertainty and difficulty in educational planning become even more challenging, considering that school counseling is not well established to make students aware of various options of major and career. In this sense, resources outside of the campus, such as parents, become extremely important for Chinese students when it comes to educational choice.

The effects of family background and parental characteristics on academic field choice have attracted less research attention than the impacts of academic achievement, learning experience, and personal-environment fit. Nonetheless, results from the few existing studies that have investigated the role of parents in shaping students' behavior and choice in education suggested that parents have considerable influence on their offspring's academic track exploration and field choice through providing financial and psychological support, endorsing values, and cultivating motivational beliefs (Hackett, Esposito & Halloran, 1989; H. Hoffman, Louis & J. Hoffman, 2010; Lent et al., 2008; Wang & Degol, 2013). Fewer studies have examined the influence of family and parents in Asian societies. Among the few, Liao and Ji (2015) emphasized that family play a salient role in determining high school graduates' college major, especially in the influence of Asian culture. Other studies have detected that Asian Americans are more likely to be influenced by their parents' values and expectations than other racial groups in the United States (Saw, Berenbaum & Okazaki, 2013; Shen et al., 2014; Leung et al., 2011).

Gender is another influencing factor in academic field choice, according to previous research. Specifically, even though social and political efforts have made to shrink the gender gap and other demographic segregation in educational fields, in general, people still choose an academic field consistent with their gender and social class (Diekman et al., 2010; Ma, 2011;

Trusty et al., 2000). Besides, gender can interact with parental characteristics, and in turn shape the student's tendency to major in a particular field (Leppel, Williams & Waldauer 2001; Wang & Degol, 2013). Wang and Degol (2013) proposed that parents provide gender-specific experience to their children, "leading to" (p. 317) the different field preferences for their sons and daughters. However, the interaction between parental characteristics and gender has not been adequately investigated. To address the limitations in current research, this study first focuses on the effects of variables related to parental characteristics and gender on college academic field preference for Chinese high school students. Next, the study investigates the interaction between parental characteristics and gender. Findings of this study may carry implications for school counselors, teachers, and parents with respect to the potential measures that they can take in order to assist student's college academic field choice. Moreover, public policymakers can refer to this study regarding resource allocation in assisting educational planning in the secondary school system.

Literature Review

Academic Field Choice in General

Academic achievement and pre-collegiate preparation during secondary education have been widely considered as predictors of academic field choice (Leppel, Williams & Waldauer 2001; Musu-Gillette et al., 2015; Schnabel et al., 2002; Trusty et al., 2000; Wang, 2013). Wang (2013) reported that a student's intention to major in STEM fields is directly affected by 12th-grade math achievement. Trusty et al. (2000) reported that the 8th-grade reading achievement is predictive of major choice for females and math achievement for males. However, some studies cautioned that pre-collegiate academic achievement is not a decisive factor of field choice

(Correll, 2001; Mullen, 2014; Trusty et al., 2000; Wang & Degol, 2013). When exploring reasons for the underrepresentation of female students in STEM fields, Wang and Degol (2013) proposed that it is the “aptitude patterns” (p. 308) that shape female students’ educational choice. Given comparable math achievement, females are more likely to outperform males in verbal achievement, allowing “greater flexibility” to devote to “equally ambitious careers” (p. 308) in non-STEM fields.

Moreover, many studies have emphasized the influence of psychological factors and their interaction with academic achievement on student’s learning experience in secondary school and their subsequent decision regarding college academic field (Correll, 2001; Dutta et al., 2015; Leppel, Williams & Waldauer 2001; Musu-Gillette et al., 2015; Trusty et al., 2000; Wang, 2013; Wang & Degol, 2013). Generally speaking, academic achievement positively associates with self-efficacy and self-concept of ability, and in turn, predicts student’s choice and persistence in a field (Lent et al., 2008; Musu-Gillette et al., 2015; Wang, 2013). Scholars have emphasized the role of psychological factors in field choice by pointing out that confidence, interest, and values developed for a particular discipline or domain and the trajectory of changes would ultimately predict a student’s field choice in higher education (Musu-Gillette et al., 2015; Wang & Degol, 2013). After tracing the academic trajectory of students from 4th grade to college, Musu-Gillette et al. (2015) contended that students who kept a high self-concept of ability, high interest, and steady utility in math throughout the years showed more than half of the chance of majoring in math-intensive fields than their counterparts. Correll (2001) argued that compared to males, females are less likely to keep a high self-concept of their math ability throughout their pre-college education, and that this is associated with their opting out of math-intensive fields.

However, as Wang and Degol (2013) stressed, self-conception of ability in one field is “a necessary but not a sufficient predictor” (p. 309) for educational and occupational options. “Role congruity principles” (Diekmann et al., 2010, p. 1052) underlie the discrepancies in the educational choice between females and males. Specifically, gender roles that are shaped and enhanced in the process of socialization have been shown to mediate the relationship between academic performance and academic field choice between males and females (Mullen, 2014; Trusty et al., 2000; Wang & Degol, 2013). Correll (2001) claimed that widely shared but biased cultural beliefs about gender transmitted by social expectations modify and bias students’ self-perception of task competence, in turn, channeled females and males into different activities, such as course enrollment, and different sequential trajectories of education and occupation. For example, mathematics is stereotypically regarded as a “masculine task” (Correll, 2001, p. 1696). When the culture favors males over females in mathematical tasks, both gender groups would “unconsciously use a lenient standard” (Correll, 2001, p. 1700) to measure their mathematical competences. Specifically, even when performing equally well in math tasks, male students tend to overestimate, and female students tend to underestimate their competence in math (Correll, 2001). Also, biased self-assessment of math capability decreases female’s interests in math-related tasks, such as taking calculus courses and discourages them from persisting on an educational track leading to math-intensive fields, such as natural science and engineering (Correll, 2001; Wang, 2013).

In addition, the divergent choices of males and females regarding academic field could be accounted for by gender-associated subjective task values, such as interest, utility, attainment, self-efficacy, and cost (Balsamo, Lauriola & Saggino, 2013; Davies & Guppy, 2018; Trusty et al., 2000; Schnabel et al., 2002; Wang & Degol, 2013). In general, because females are

communally oriented and altruistic, they are more inclined to pursue a degree in “people fields” (Wang & Degol, 2013, p. 309), allowing them to extend their contributions to the well-being of the society and to serve people (Diekman et al., 2010; Wang & Degol, 2013). Males are power oriented and are more likely motivated by money, social status, and power (Davies & Guppy, 1997; Mullen, 2014; Wang & Degol, 2013; Wiswall & Zafar, 2014). STEM fields are usually regarded as incompatible with communal goals, which could somewhat discourage females from getting involved in these fields academically or occupationally. Such factors may help explain why males follow a pathway toward STEM fields more often than females do, especially given that gender differences in subjective task values persist and exert their influence on academic field choice, even for those females with a high level of self-efficacy and capability in mathematics (Diekman et al., 2010; Trusty et al., 2000; Wang & Degol, 2013).

These psychological factors are not generated by themselves. An individual's learning experience is embedded in the sociocultural context. “Socialization experience” (Trusty et al., 2000, p. 465) necessarily interacts with the achievement in the academic setting, and nurtures beliefs, values, and expectation for success in educational activities, which, in turn motivates or impedes a student's further involvement in content areas and the subsequent academic field choice. A system of interdependent ecological contexts, such as school, family, and society as a whole, prescribe motivational beliefs or attitudinal barriers for educational choice via sending sociocultural signals and messages to adolescents (H. Hoffman, Louis & J. Hoffman, 2010; Lent et al., 2008; Wang & Degol, 2013).

Among the many partners with whom adolescents work on educational decision making, parents are the most active and important partner (Dietrich & Kracke, 2009; Long & Pang, 2016; Schnabel et al., 2002). Parents' beliefs, values, and capabilities in academic fields, which are

largely shaped by parental characteristics, such as parental education and occupation experience, and parental engagement, have been claimed to be highly associated with students' academic field choice (Davis-Kean & Kazak, 2005; Leppel, Williams & Waldauer 2001; Palos & Drobot, 2010; Wang & Degol, 2013). Specifically, parental gender-specific beliefs and behaviors, such as gender stereotypes about academic ability and differential treatment to sons and daughters, could be highly associated with a student's involvement in different academic fields. For example, parental anxiety about a daughter's ability in math is positively associated with a female's negative self-perception and low persistence in STEM fields because typically females are expected to be outperformed by males (Wang & Degol, 2013). Also, a student's academic choice may reflect parental values toward the world. For instance, engineer parents' values about communal good and actions of helping others may "resonate" (H. Hoffman, Louis & J. Hoffman, 2010, p. 244) with their daughters and influence their major path toward, for example, the social sciences rather than STEM fields, even though their math and science learning might benefit more from family resources.

Socioeconomic Status

Among the numerous family-related factors that were discussed in previous studies, SES stood out as one critical factor affecting student's academic field choice (Davies & Guppy, 1997; Niu, 2017; Schnabel et al., 2002; Trusty et al., 2000; Wang & Degol, 2013). As a composite indicator of family social and economic status, SES is highly associated with commonly discussed types of family-related capital, such as financial capital, human capital, social capital, and cultural capital, that work as a backdrop to extend or impede parental influence on adolescents' academic field choice (Hu & Wu, 2017; Niu, 2017; Palos & Drobot, 2010; Schnabel et al., 2002). Wang and Degol (2013) found that SES impacts parental financial and cultural

capital, both of which are crucial to exposing students to particular fields, such as math and science. They proposed a positive association between high SES and the opportunities that parents can provide for their offspring to explore interests in STEM fields by possessing learning materials and attending extracurricular activities.

Leppel, Williams, and Waldauer (2001) claimed that the effect of SES on academic field choice derives from a student's "emotional need for financial security" (p. 378) and financial pressure. Students with no financial pressure are more likely to choose a field, such as the humanities or social science, that is not directly related to high-paying jobs. However, students who do not feel financially well off tend to pursue a pathway leading to a lucrative job, such as business, technology, and engineering (Leppel, Williams, & Waldauer 2001; Wang & Degol, 2013). Other studies have found that different gender groups' inclination toward lucrative fields, such as economics and engineering, are shaped by their roles in family life. While females have little expectation to support a future family, males have traditionally been the one to assume the financial burden in the family (Leppel, Williams & Waldauer 2001; Mullen, 2014). Thus, in all socioeconomic groups, male students tend to start a pathway toward profitable fields, even sacrificing their intellectual interest, while female students are more likely to pursue a major based on their academic interests (Mullen, 2014). In the qualitative studies of Mullen (2014), male students from high SES families justified their choice in lucrative academic fields as a means to maintain their elite life and provide the same level of material and sociocultural advantages that they had in their childhood to their offspring.

Controversies remain about the interaction between SES and gender. An asymmetrical impact of SES on field choice has been found for male and female students (Leppel, Williams & Waldauer 2001; Mullen, 2014; Trusty et al., 2000). Trusty et al. (2000) detected a stronger

relationship between SES and college majors for female students than for males. Specifically, as the SES increased, females' field choices are less connected to traditional gender roles, and they are more likely to make a choice in nontraditional fields, while the financial incentive for males was limited if not at all. This is understandable, as the vast number of social and political events regarding educational equity for female rather for male students (Trusty et al., 2000). Other scholars found the opposite relationship between SES, gender, and field choice (Mullen, 2014; Wang & Degol, 2013). They found that driven by the desire for economic returns, females from lower SES families are as likely as males to choose engineering and computer science majors that are associated with highly paid jobs in order to ease financial struggles. For the majority of males, regardless of SES, they tend to major in fields such as business and engineering in order to find high-status and profitable jobs with the aim of supporting a future family (Mullen, 2014; Leppel, Williams & Waldauer 2001). Since parental education level and occupation level are two primary indicators of SES, I will illustrate their roles in academic field choice and their interaction with gender in the following paragraphs.

Parental Education Level

Previous literature has consistently shown that parents' educational level has an effect on the academic success and its subsequent academic field choice. Parents who are academically successful are often more capable of forming higher expectation for their children (Wang & Degol, 2013), scaffolding academic learning (Davis-Kean & Kazak, 2005), exposing their children to plentiful resources and demanding courses (Kim, Brown & Fong, 2016; Schnabel et al., 2002), creating a productive parent-adolescent relationship (Davis-Kean & Kazak, 2005; Dietrich & Kracke, 2009), and constructing a "cognitively stimulating and emotionally supportive environment" (Davis-Kean & Kazak, 2005, p. 303; Palos & Drobot, 2013), all of

which directly or indirectly associated with students' academic achievement and track choice.

Other studies highlight that parents' education level exerts a modeling effect (Hackett, Esposito & Halloran, 1989; Palos & Drobot, 2010; Schnabel et al., 2002) on their children regarding field choice. Adolescents rely heavily on their parents when making educational decisions, and the attachment is usually stronger when the decision has to be made in their early school years (Long & Pang, 2016; Schnabel et al., 2002). Schnabel et al. (2002) argue that parents claim the appropriate choice based on their own "educational biography," (p. 180) which is independent of a student's actual academic performance. They also emphasized that the influence mechanism is universal across various Western societies and pronounced across most of the educational phases of a student's life.

Parental education level can also have the effect of steering students toward a particular academic field (Schnabel et al., 2002). Kim, Brown, and Fong (2016) suggest that compared to higher SES parents, less educated and working-class parents have fewer resources to help them expose their children to the rapidly changing and newly emerging high-paying fields, such as STEM fields, and to make well-informed decision that help students select a major that provides upward mobility. Schnabel et al. (2002) detected that the father's education level is as strong an indicator as GPA in 10th graders' decisions to pursue a mathematics track. As the parental educational level increases, students were reported to have a higher probability of majoring in business than in engineering and medicine fields (Liu, Hung & Chung, 2013).

Parental education level interacts with gender on academic field choice. Ware et al. (1985) presented a positive association between parent's education level and the probability of female students choosing to major in the sciences (as cited in Leppel, Williams & Waldauer 2001). One explanation for this may be that highly educated parents are less likely to hold

gender-stereotyped beliefs about the gender specificity of academic domains (Dietrich & Kracke, 2009; Wang & Degol, 2013).

Parental Occupation Level

Parental occupation plays its role in shaping a student's field preference and choice through interest fostering, self-efficacy enhancing, and role modeling (Hackett, Esposito & Halloran, 1989; Hall et al., 2011; Leppel, Williams & Waldauer, 2001; Palos & Drobot, 2010). Parents' work experiences enable them to extend contributions to the process of educational and vocational decision making (Hall et al., 2011; Palos & Drobot, 2010). Student's choice of academic field is the joint effects of personal interest; the influence of important others, such as parents, friends, and school counselors; and their study experiences in the early stages of college life (Hall et al., 2011; Pearson & Dellmann-Jenkins, 1997; Wang, 2013). Research has highlighted the critical role of parents in fostering student interest in academic fields, by enabling students to be knowledgeable about these areas and encouraging them to go further in these fields in college. One explanation can be that, as shown by Hall et al. (2011), the level of parents' knowledge and experience about particular academic areas is limiting their ability to encourage and prepare their children to pursue further study in the areas. This is often a case when it comes to STEM fields. As Hall et al. (2011) presented, parents' ratings of their knowledge about STEM programs were weaker compared to other areas they rated.

The parental occupation has been reported to be related to a student's self-efficacy and self-esteem in nontraditional fields for his/her gender group (Hackett, Esposito & Halloran, 1989; Leppel, Williams & Waldauer 2001). As Leppel, Williams, and Waldauer (2001) argued, for students whose parents are in a "professional or executive" (p. 384) occupation, their probability of majoring in a field that is dominated by the opposite gender group increases.

According to their studies, the effect of parents working in a professional occupation is profound on male's choice in nontraditional fields, such as humanities, education, and social science, and on female's choice of entering nontraditional fields, such as science and engineering. Similarly, Hackett, Esposito & Halloran (1989) pointed out that student self-efficacy in math is hypothetically affected by professional modeling by their parents in math-oriented fields, and that having a parent in a STEM field strongly predicts student's major choice of a math and science field.

Parental role modeling in terms of the profession has been found to be related to a student's academic field choice. The effects of occupational role model on field choice can be affected by gender as well, as students select role models "at least partly for personal similarities" (Hackett, Esposito, & Halloran, 1989, p. 165). Betz and Fitzgerald (1987) claimed that having female occupational role models, or a working mother, is related to female student's choice in nontraditional fields (as cited in Hackett, Esposito, & Halloran, 1989). The same effects were not detected in a study by Hackett, Esposito, and Halloran (1989). However, as they reported, male role models, including fathers and male professors, were significantly but negatively associated with a female's choice of a nontraditional academic field. They attributed this negative relationship between male role models and females' academic choice in nontraditional fields to the negative feedback and discouragement that females usually received from male role models for acting "out of role" (p. 176). On the contrary, Leppel, Williams, and Waldauer (2001) contended that male role models have a more significant influence on their offspring's educational choice than female role models do. They asserted that for both female and male students, the influence of having a father who is a professional or executive is greater than that of a mother on the field choice. H. Hoffman, Louis and J. Hoffman (2010) also drew

the similar conclusion. Daughters with an engineer father were more likely to be involved in a male-dominated field such as engineering if they received positive messages from their fathers about their ability in math and science.

Parental Engagement

Engagement is a critical step for parents to assist students in making future plans. While many studies analyzed the role of parental engagement on vocational exploration and decision, few investigate its role in academic field choice. Academic field and career choices are inherently intertwined (Diekman et al., 2010; Leppel, Williams & Waldauer 2001; Ma, 2011; Mullen, 2014; Trusty et al., 2000), as the college major and the training path a student chooses structures the opportunities open to him/her when joining the workforce. Leppel, Williams, and Waldauer (2001) even argued that educational decisions serve as “steps toward implementing career decisions” (p. 373). In this sense, we can borrow points from the existing studies focusing on the relationship between parental engagement and occupational decision making to infer its relationship with academic field decisions.

Palos and Drobot (2010) encouraged us to think of a parent's role in a student's educational and vocational preference and choice from a relational perspective. Social capital, such as the relationship between parent and child and the social support network of the parent, lay the foundation for constructing a favorable social support environment for a student's education and occupation choice (Dietrich & Kracke, 2009; Palos & Drobot, 2010; Schnabel et al., 2002). Along with direct observation, students internalize the knowledge and values about work in general and about the particular profession from their parents through daily communication (Palos & Drobot, 2010). When assisting a student's field choice, parents often provide psychological support, such as giving encouragement, discussing opportunities, and

sharing personal experiences and feelings; and behavior support, such as facilitating skills development, collecting information, and helping students reflect on the ramifications of a particular choice (Dietrich & Kracke, 2009; Dutta et al., 2015; H. Hoffman, Louis and J. Hoffman, 2010; Palos & Drobot, 2010; Perry et al., 2010).

The quality of parental engagement relies on the length of time and availability of parents as well as parent's communication skills, and it is highly associated with a student's motivation and decisiveness of vocational development (Palos & Drobot, 2010; Dietrich & Kracke, 2009). In previous studies, the mother has been found to be more efficient than other significant players, such as the father or counselors, when it comes to supporting a student's field choice because they develop a closer relationship with the child and can transmit field choice related knowledge and information with a higher engagement rate (Palos & Drobot, 2010; Perry et al., 2010).

While Open communication and a child-centered decision-making family climate enable the child to develop an attachment and a securing perception for the surroundings, stimulating him/her to explore opportunities with an open mind, establish a higher career self-efficacy, and build a career identity earlier, parental intrusion and parental disengagement have been linked to low self-efficacy, lack of exploration, late identity development, and indecision (Dietrich & Kracke, 2009; Palos & Drobot, 2010; Workman, 2015). For example, if parents impose their own desires on an adolescent, neglecting the child's wishes, the adolescent generally becomes more passive in the process of career exploration and delays decision making (Palos & Drobot, 2010; Dietrich & Kracke, 2009). Workman (2015) presented findings indicating that students' negative perceptions of family support are associated with decision-making problems about their path choice. Specifically, if students feel uncertainty about, or do not perceive, a parent's support psychologically or financially, they are more likely to feel indecisive about their plans. Similarly,

Dietrich and Kracke (2009) contended that adolescents became less interested and motivated in career exploration once they perceived their parents as indifferent to their career planning.

Parents' ability to create a supportive family climate is highly associated with the SES of the family, the parents' background in education and occupation, and their ability to communicate (Camacho-Thompson et al., 2016; Palos & Drobot, 2010;). Financial constraints faced by low SES families can "compromise" (Camacho-Thompson et al., 2016, p. 1065) parents' ability and availability to get involved in their child's education and other activities. However, the effect of economic difficulties can be "minimized" once the parents are able to ensure "a psychological balance of stimulating and demand" (Davis-Kean, 2005, p. 302) for their outperforming offspring. To my knowledge, the interaction between parental engagement and gender has not been well researched.

Perceived Parental Expectation

The parental expectation has also been found to influence children's academic field choices, but its interaction with gender has not been adequately investigated (H. Hoffman, Louis, & J. Hoffman, 2010; Shen, 2015; Shen et al., 2014;). Hao and Yeung (2015) claimed that parental expectation might "be confounded with psychological dispositions [and] lifestyles" (p. 855). In this sense, parental expectation can be influenced by demographic characteristics, such as parental education and parental occupation. Moreover, parental expectation and its impacts on a student's educational choice are influenced by societal and cultural context (Fang et al., 2018; Leung et al., 2011; Shen et al., 2014). Within a sociocultural context, such as China, the traditional cultural values, including Confucianism, still deeply shape the values, beliefs, and behaviors of family members (Shen et al., 2014). In contrast to Western cultural values emphasizing independent decision making, Chinese culture emphasizes "parental deference and

filial piety” (Shen et al., 2014, p. 243); thus, the offspring tend to live up to their parents’ expectation or even comply with parents’ commands when making choices to “maintain interpersonal harmony” (Leung et al., 2011, p. 12). These cultural factors are in effect within the Asian communities in Western society as well. For example, Leung et al. (2011) reported that parental expectation is associated with Asian Americans’ self-efficacy, outcome expectations, and interests in stereotypical occupations in science and technology fields. Shen (2015) claimed that expectations of Asian-American parents toward particular academic fields may explain the risk of developing internalized stereotyping among their offspring. As there are stereotypes that Asian-American students are more skilled in math and science fields, parental pressure to pursue these fields might strengthen Asian-American students’ beliefs that they will be more successful in these fields (Shen et al., 2014). The stereotyped beliefs about the ability and probability of success in particular areas are highly associated with students’ field choice in “culturally valued majors,” such as physics, biology, and medicine, rather than “nonculturally valued majors” (Shen, 2015, p. 60; Shen et al., 2014), such as social science and humanities. Also, the internalized stereotype of pursuing a high-income career is associated with Asian-American college students’ field choice in business, science, and engineering rather than other fields (Shen, 2015).

Present Study Research Questions

The overarching goal of the present study is to identify associations between parental characteristics--including parental education and occupation level, parental engagement in educational planning, and parental expectation in particular academic field--and a student’s preference for future college academic fields. Gender effects and its interaction with parental characteristics-related variables are also investigated to uncover whether or not the effects of

parental characteristics on academic field preference are associated with gender. To address the limitations in the current research and extend our understanding of parental characteristics' role in future college major choice, I ask the following questions in this study:

1. What are the effects of parental characteristics and gender on Chinese 10th graders' academic field preference for 4-year college?
2. Are parental characteristics effects different for females and males?

The following hypotheses were made to initiate the research:

Hypothesis 1. Student's preference in nontraditional academic fields are positively correlated with parental education and occupation level.

Hypothesis 2. As the parental engagement in educational planning increases, student's preference in particular academic fields increase as well.

Hypothesis 3. Parental expectations of their child's major choice in a particular academic field strongly predict their offspring's preference in this academic fields.

Hypothesis 4. Gender stratification still exists in academic fields.

Hypothesis 5. Parental characteristics would significantly interact with gender, indicating that the effects of parental characteristics on academic field preference depend on the gender group membership.

Method

Setting

Data used for this study were collected from an online educational planning program that was officially released on September 1, 2017 in China. The program is a mini program that can be accessed in WeChat, the most widely used messaging and social media mobile application in

China. At the end of March, 2018, it assisted nearly 100,000 students, mainly 10th graders, regarding their educational planning needs, such as choosing selective test subjects for the NCEE, targeting a college major, and finding the ideal college. Students own their personal accounts, enabling them to adjust decision-making parameters, browse major descriptions, bookmark potential majors, and track their educational planning process.

To narrow down the scope of their college major search, students are asked to fill in a section called the “decision tree,” with multiple predefined filters associated with academic competency, major characteristics, and test subject combinations. This program applies a reverse selection mechanism to help students screen out majors and academic fields in which they may be disinterested or lack competency, and that conflict with their test subject combination. When the student finishes the “decision tree,” the program helps to filter potential majors out of the total 1539 majors and to generate two sets of majors: recommended major and highly recommended major. The recommended major set filter out only those majors that a student is reluctant to get involved in, while the highly recommended major set additionally takes that student's academic competencies into account and provides fewer options for the student to choose. Once they finish the “decision tree,” the students can create a personal educational planning profile by bookmarking potential majors. Potential majors can be found by referring to the two sets of recommended majors or searching for a major by using multiple filters, such as keywords, academic path, competency in subjects, industry preference, and academic field.

To gather parental characteristics information, an online survey (see Appendix B) was developed for this research project and delivered to students in January, 2018. Students had the option to fill in the survey when they register for the account or later at their will. The survey mainly covers parental educational level, parental occupational level, parental engagement in

educational planning, and parental expectation in particular academic field. Presumably, parents would assist with responding to these questions. The completeness of the survey varied across schools, as it was delivered four months after the release of the program, and schools invested different amounts of time and effort into encouraging students to respond to it.

Sample

Three sources of data were used for this study: the personal profile, including student demographic information (gender, region, school, and grade); the educational planning profile consisting of bookmarked majors; and the parental characteristics survey. To fulfill the research objective, only those students who had complete information for all of the three sources were included in the dataset. In addition to that, only 10th graders from Beijing, Shanxi, and Shandong provinces were included in the raw dataset, as they were all part of the generation affected by the NCEE reform of “3+3 test subject choice system.”

From the raw dataset, 1153 students were randomly selected for inclusion. Then, several procedures were used to clean the data. First, students with an academic goal of attending a 3-year college focusing on vocational training were excluded, as they are essentially a different population from those with the goal of attending the 4-year college. Specifically, these two groups of students vary in the admission line of NCEE, educational focus, academic proficiency, and career path (Kim, Brown & Fong, 2016). Second, a total of 181 majors that are only available in 3-year college were deleted from the educational planning profile, leaving 486 majors offered in 4-year-college. Third, as the national standard (GB/T13745-2009), the remaining majors were assigned into five aggregated groups of academic field matching Question 10 in the family background survey (i.e., humanities and social science, natural science, engineering and technology, business and management, medicine and healthcare). Most of the

student bookmarked majors from more than one academic field. While allowing uncertainty of academic field preference, I excluded the records of individuals who bookmarked majors for all the five academic fields, as they did not show any preference. Fourth, students from Beijing were removed from the dataset due to the small sample size. Also, Beijing, the national capital of China, is substantially different from the other two regions, Shanxi and Shandong, with respect to the economic and socio-cultural environment. Thus, the exclusion of Beijing students reduced the variation contributed by region. Then, I excluded individuals who reported “I don't know” or “other” options for parental education and parental expectation, because those two variables were crucial for this study. The final dataset is composed of 642 students from 8 schools in the two regions mentioned above. However, nearly 51.87% of them are from 2 schools in Shanxi province and 46.11% from 1 school in Shandong province. The final sample has a somewhat even gender split, with 47.51% male and 52.49% female.

Measures

The measures used in the study were extracted from the personal profile, educational planning profile, and parental characteristics survey. The descriptive statistics can be found in Table 1.

Academic Field Preference (Outcome Variable). Because participants may bookmark majors from more than one academic fields, I dummy coded their choice as either they show preference in one field or they do not. Five binary variables were created: **SOC**, **SCI**, **ENG**, **BUS**, and **MED**, indicating a student's field preference in humanities and social science, natural science, engineering and technology, business and management, or medicine and healthcare, respectively.

Family Background Survey (Parental Characteristics Predictors). The variable of **Pa_Edu** indicates parental education corresponding to questions 1 and 2 in the survey. The original data was dummy coded separately for father and mother with “less than high school” and “high school diploma or equivalent” as 0 and “bachelor’s degree” and “master’s degree or above” as 1. Because father’s education level and mother’s education level are highly positive correlated ($r = 0.79, p < 0.001$), I created the composite variable Pa_Edu by combining these two variables as: 0 = neither of the parents obtained a bachelor’s degree, and 1 = at least one of the parents obtained a bachelor’s degree.

FOCC and **MOCC** represent father’s occupation level and mother’s occupation level, respectively. The occupation level for each position has been predefined by program designer, Wisecareer Consulting Co. Ltd. Once students select the position title for their parents in the drop-down menu, the parental occupational levels are generated automatically. Two levels have been assigned to the current 307 positions: 0 = entry-level position, and 1 = mid or high-level positions. The entry-level position features labor-intensive tasks, little requirement for industry experience, and low pay, such as farmer, customer service specialist, or instructor. The mid-level position can be characterized by an intermediate level of skill and knowledge, such as coordinating lower and higher levels of employees, and assuming a fair amount of responsibilities, such as a material engineer, simultaneous interpreter, and sculptor. The high-level occupation represents skill-intensive or managerial tasks, and the greatest amount of responsibilities within the organization, for example, principal, architect, and oncologist. Because the sample sizes for mid- and high-level occupations were both small, I collapsed these two levels to achieve balanced group size between levels.

Pa_Engage, which covers questions 5-7, is a composite variable that measures the frequency with which parents “share their study experience,” “discuss college programs and majors,” and “share their work experience, responsibilities, or feelings” with their offspring. A confirmatory factor analysis (CFA) was carried out on these three items to determine if the one-factor model fits the data well. The CFA results shown a good fit to the data (CFI = 1.00, TLI = 1.00, RMSEA = 0.00). Thus, I took the mean of these items and standardized the composite variable to generate Pa_Engage,

Table 1

Frequency Distribution

Dependent Variable	Independent Variables						
	Educational Level of Parents (Pa_Edu)	Father's Occupation Level (FOCC)	Mother's Occupation Level (MOCC)	Parental Engagement (Pa_Engage)	Parental Expectation for Academic Field (Pa_Expect)	Female	Shanxi
Humanities & Social Science (SOC)					No (0): 519(80.84%); Yes (1): 123(19.16%)		
Natural Science (SCI)	Composite variable; None of the				No (0): 596(92.83%); Yes (1): 46(7.17%)		
Engineering & Technology (ENG)	parents obtain a bachelor's degree (0): 307(47.82%); At least one of the parents obtains a	Entry-level (0): 318(49.53%); Mid/High-level (1): 324(50.47%)	Entry-level (0): 420(65.42%); Mid/High-level (1): 222(34.58%)	Standardized composite variable; Mean = 0, Std. dev. = 1, Max = 1.08, Min = - 3.75	No (0): 500(77.88%); Yes (1): 142(22.12%)	Male (0): 305(47.51%); Female (1): 337(52.49%)	Shandong (0): 296(46.11%); Shanxi (1): 346(53.89%) .89%)
Business & Management (BUS)	bachelor's or higher degree: 335(52.18%)				No (0): 482(75.08%); Yes (1): 160(24.92%)		
Medicine & Healthcare (MED)					No (0): 471(73.36%); Yes (1): 171(26.64%)		

representing the average level of parental engagement for one family. A higher score indicates a higher level of parental engagement in educational planning.

The variable of **Pa_Expect** represents parental expectation for five academic fields. The original data has been dummy coded into five variables indicating whether or not the student perceives his/her parent as expecting them to major in particular field.

Shanxi (Region) is a control variable. Because of the economic imbalance in China, parents in different regions may show various levels of education, occupation, and parental expectation.

Gender is dummy coded as 1 for female and 0 for male.

Data Analysis

I applied logistic regression models to each of the five academic fields preferences using the open-source software *R*. Specifically, the **MASS** and **nlme** packages were used to model the data. The generic model can be written as follows:

$$Aca_Field_i \sim Bernoulli(\pi_i)$$

$$\pi_i = \text{logit}^{-1}(\beta_0 + \beta_{Pa_Edu}Pa_Edu + \beta_{FOCC}FOCC + \beta_{MOCC}MOCC + \beta_{Pa_Engage}Pa_Engage + \beta_{Pa_Expect}Pa_Expect + \beta_{Female}Female + \beta_{Shanxi}Shanxi + \beta_{Pa_Edu*Female}Pa_Edu * Female + \beta_{FOCC*Female}FOCC * Female + \beta_{MOCC*Female}MOCC * Female + \beta_{Pa_Engage*Female}Pa_Engage * Female + \beta_{Pa_Expect*Female}Pa_Expect * Female)$$

As indicated in Table A1- A5 (see Appendix A), multicollinearity was not an issue, given the correlation coefficients among the predictors are small in magnitude. Thus, the assumption of logistic regression models was somewhat met. For the purpose of interpretation, I employed a simulation-based method with the **simcf** and **tile** package in *R*. As King, Tomz, and Wittenberg

(2017) claimed, statistical simulation techniques enable us to produce numerically precise estimates of quantities of interest while accounting for uncertainty of estimates. Also, simulation-based results convey information to audiences in a way that requires little specialized knowledge to understand. The parameter estimate for the logistic regression model is assumed to be normally distributed. From the predictive distribution, 10,000 random draws were implemented to predict the coefficient and 95% confidence interval across the 10,000 samples. Relative risk plots for different presumed circumstances were generated by setting up counterfactuals. For each logistic regression model, I simulated relative risk for two gender groups separately in six counterfactual scenarios: whether or not parents shown expectations for their child to major in a particular academic field; their location changing, from the Shandong to Shanxi province; parents' education level changing from lowest level (neither of the parents holding a bachelor's degree) to highest level (at least one of the parents holding a bachelor's degree or above); father's occupation level changing from lowest level (entry-level of occupation) to highest level (mid/high-level of occupation); mother's occupation level changing from lowest level to highest level; parental engagement changing from the mean to one standard deviation from the mean.

Results

Estimated results and model fit indices of the five logistic models are shown in Table 2. Parental education level and occupation level did not show pronounced effects on 10th graders' preferences for five academic fields; thus, hypothesis 1 was not supported. Only parents' years of schooling had a significant unique negative effect on a student's preference for natural science majors ($b = -0.51, p = 0.05$). However, the coefficient estimate was modest in magnitude, suggesting the influence may be subtle. Another counterintuitive finding was the effect of

parental engagement on college academic field preference. For the majority of academic fields, parental engagement showed slightly negative effects on the student's academic preference in the particular field, conflicting with my hypothesis again. Its positive effect existed only for the preference to medicine and healthcare majors. In addition, parental occupation levels did not show significant effects on student's academic preference for any of the fields.

Moreover, it was noteworthy that a positive association between parental expectation in particular academic fields and student's field preference have been detected for most fields. Except for the natural science field, all of the estimated parameters for the parental expectation variable were significantly positive. Gender effects appeared in the fields of humanities and social science, engineering and technology, and medicine and healthcare. Specifically, being female had significantly higher log-odds than male of showing academic preference in humanities and social science, and medicine and healthcare fields across the sample, holding other predictors at their mean, whereas being female had lower log-odds than male of preferring majors in engineering and technology field across the sample holding all other predictors constant. The result was consistent with my hypothesis 4 that gender stratification still exists, as these two fields are the traditional fields for females.

The region effects were not significant for most of the academic fields. However, for the humanities and social science field, regional influence was significant ($b = -0.46, p = 0.02$). It can be explained by the composition of the sample. The majority of Shanxi respondents studied in schools with competitive academic subjects in math, physics, and chemistry while their counterparts in Shandong self-reported to be academic proficiency in history and geography. It's possible that the institutional culture and academic opportunities in these subjects enabled Shanxi

students to be more competitive in STEM fields and in turn drew them away from non-STEM fields.

Although the interaction effects between parental characteristics and gender were not significant for most of the fields, the interaction between mother's occupation level and gender was significant ($b = -0.81, p = 0.02$) for the natural science field, with the effect of mother's occupation level being greater for male students, holding all else constant.

Table 2

Results of Logistic Regression Models

Predictor Variables	Academic Fields Preferences (Outcome Variables)				
	Humanities & Social Science (SOC)	Natural Science (SCI)	Engineering & Technology (ENG)	Business & Management (BUS)	Medicine & Healthcare (MED)
Educational Level of Parents (Pa_Edu)	-0.132 (0.268)	-0.507* (0.258)	-0.391 (0.387)	-0.260 (0.272)	-0.147 (0.308)
Father's Occupation Level (FOCC)	0.363 (0.267)	-0.192 (0.257)	-0.259 (0.385)	0.235 (0.274)	0.139 (0.311)
Mother's Occupation Level (MOCC)	-0.222 (0.264)	0.483 ⁺ (0.256)	0.601 (0.387)	0.386 (0.266)	0.082 (0.303)
Parental Engagement (Pa_Engage)	-0.278* (0.126)	-0.033 (0.120)	0.127 (0.169)	-0.063 (0.125)	0.203 (0.145)
Parent's Expectation for Academic Field (Pa_Expect)	1.823** (0.504)	0.756 (0.478)	1.826** (0.545)	1.221** (0.295)	2.010** (0.311)
Female	1.166** (0.322)	-0.096 (0.276)	-1.537** (0.376)	-0.188 (0.320)	1.097** (0.353)
Shanxi	-0.458* (0.202)	0.035 (0.171)	-0.187 (0.199)	0.175 (0.185)	0.357 ⁺ (0.196)
Pa_Edu*Female	0.810 ⁺ (0.414)	0.166 (0.345)	0.425 (0.450)	0.295 (0.369)	-0.396 (0.396)
FOCC*Female	-0.570 (0.422)	0.285 (0.350)	0.029 (0.455)	0.059 (0.378)	-0.060 (0.406)
MOCC*Female	0.033 (0.421)	-0.807* (0.356)	-0.450 (0.462)	0.060 (0.378)	-0.510 (0.409)
Pa_Engage*Female	0.040 (0.201)	0.032 (0.164)	-0.235 (0.204)	0.019 (0.176)	-0.061 (0.191)
Pa_Expect*Female	-0.394 (0.703)	-0.489 (0.652)	-0.528 (0.701)	0.567 (0.399)	-0.370 (0.407)

Constant	0.286 (0.231)	0.371 ⁺ (0.221)	1.727** (0.339)	-1.093** (0.247)	-1.757** (0.298)
Observation	642	642	642	642	642
Log likelihood	-339.960	-435.702	-337.211	-387.837	-360.820
Akaike Inf.Crit	705.920	897.404	700.421	801.675	747.640
PCP	0.723	0.583	0.707	0.695	0.734
In-sample concordance (null = 0.5)	0.737	0.587	0.748	0.682	0.740
LOO-CV concordance (null = 0.5)	0.709	0.505	0.703	0.635	0.707

Note. Standard errors in parenthesis. ⁺ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$

The goodness of fit for most of the models were satisfactory, apart from the one for natural science. The percent correctly predicted (PCP) was relatively low for natural science, indicating that the model did not predict the data well and more variables should be included. The area under the ROC curve (AUC) was small, meaning that the model did not fit the data well. Because the AUCs for both the in-sample and out-of-sample case were far from 0.50, I moved forward with the current model.

In the next part of the analysis, instead of directly interpreting coefficients on the scale of estimation with log odds, I adopted a simulation method to interpret the results and gender difference with two commonly understood concepts, probability and relative risk, which are more accessible to a broad range of readers. For the simulation analysis, I chose a continuous variable, Pa_Engae, to set the scale for counterfactuals. As my interest lies in revealing gender differences in the predictors' effects, the probability with respect to field preference will depend on the level of parental engagement. Previous studies did not reveal a specific relationship between parental engagement and field preference. Also, in the present study, the effects of parental engagement on the outcome variables were small and relatively consistent across all of the models, which made it suitable to reveal the trend change without distracting us.

Humanities and Social Science Field

The first model aimed at examining factors that predict a student's college academic preference for the humanities and social science field. The estimated coefficient of gender was statistically significant ($b = 1.17, p < 0.001$), indicating that females were more likely to report preferring to major in this field than were males, holding other variables constant. As shown in Figure 1, the expected probability of females preferring humanities and social science majors was higher than that of males across all the levels of parental engagement. This finding is consistent with those of previous studies (Leppel, Williams & Waldauer, 2001; Wang & Degol, 2013). Further, the 95% confidence interval for females was narrower than that for males, meaning that female students exhibited less variation in showing preference of majoring in this field than do their male counterparts.

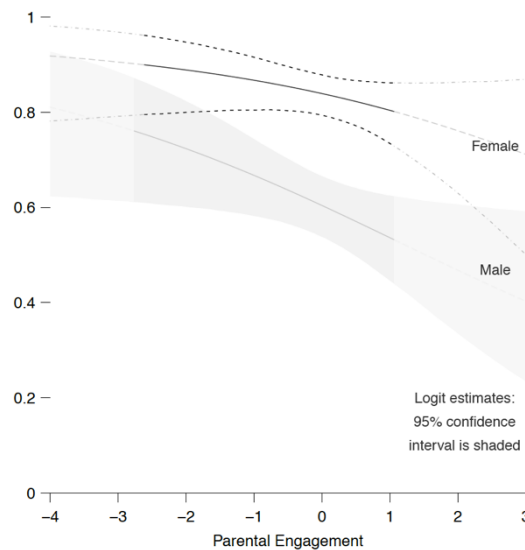


Figure 1. The probability of preferring humanities and social science field across parental engagement levels by gender.

Parental expectation in the field of humanities and social science exerted a significantly positive effect on their offspring's major preference in this field ($b = 1.82, p < 0.001$). It can be observed in Figure 2 that students who perceived the parent's expectation that they pursue humanities and social science major shown higher probability of bookmarking a major in this field. Although there was a sharp decline in the expected probability of majoring in this field for those who did not perceive parental expectation, their counterparts remained relatively persistent in this field, and the variation among individuals was small.

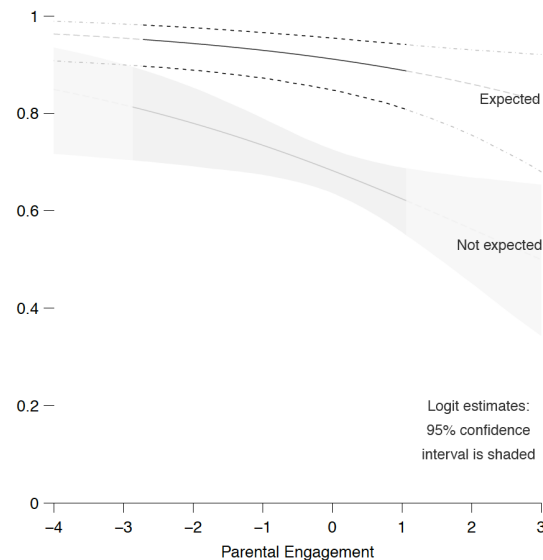


Figure 2. The probability of preferring humanities and social science field across parental engagement levels by parental expectation.

Next, I conducted a gender comparison regarding student's relative risk of preferring in this field under six scenarios. As we can see from Figure 3, holding other covariates constant, for both female and male students, those perceived expectations from parents shown significantly higher probability (37.73% and 26.27%, respectively) of preferring a major in this field. Female

students who had at least one parent obtained a bachelor's degree or higher shown significantly higher probability (23.08%) of showing academic preference in this field than those whose parents had no higher education experience. This result contrasted with the case of male students. Specifically, with at least one parent finished an undergraduate or graduate program, male students were less likely (17.29%) to prefer a major in this field than those with no parents with a bachelor's degree.

Results indicate that neither male nor female students' academic preference in the humanities and social science field were associated with the father's occupation level. Females whose father worked at a higher career level tended to bookmark a major in this field, whereas males did not show the same college academic field preference. While mother's occupation level had little association with a female's major preference in humanities and social science, its role in a male student's preference in this field was significant.

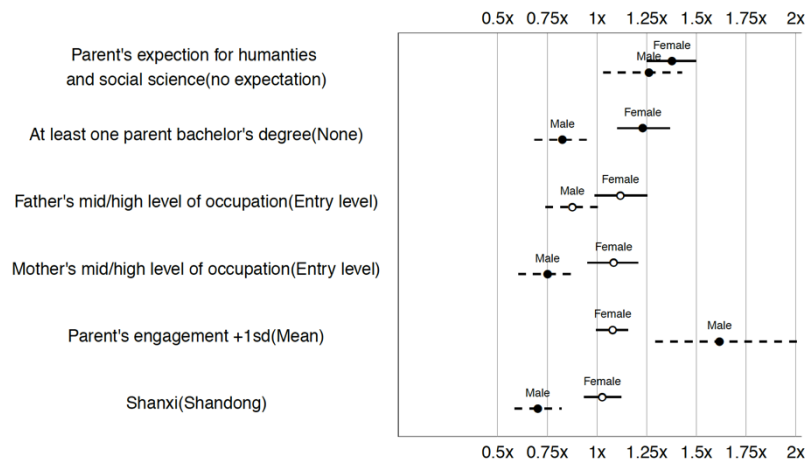


Figure 3. Relative likelihood of preferring humanities and social science field.

Specifically, males with a mother worked at a mid/high occupational level were 24.93% less likely to report a preference for majoring in this field than those whose mother worked at an

entry-level position. When perceived parental engagement level was one standard deviation above the mean, both female and male students were more likely to show a major preference in this field. Male students with parental engagement one standard deviation above the mean shown a significantly higher probability (61.73%) of preferring majors in the field than the base case males.

Region effect was found to be significant for the male group only. Specifically, males from Shanxi were 29.83% less likely to show a preference for majoring in the social sciences field than those from Shandong. The regional difference may be due to the different subjective capability between students of these two regions. While the majority of participants of Shanxi self-reported being competitive in math, physics, and chemistry, many participants from Shandong reported achieving highly in history and geography.

Natural Science Field

The second model aimed at revealing factors that are associated with students' college academic field preference in the natural science field. No gender difference was detected for this field, although more males than females indicated a preference for the natural science field. Figure 4 supported the estimated results in Table 2 that parental education had a significantly negative effect on the outcome variable ($b = -0.51, p = 0.05$), meaning that higher educational attainment of parents was associated with student's lower probability of preferring a major in the natural science field. When neither parent had obtained a bachelor's degree, students were more likely to prefer majors in science than were those with at least one parent had a bachelor's degree or above. This finding somewhat contrasts with other studies (Leppel, Williams & Waldauer, 2001; Schnabel et al., 2002) that demonstrated a positive relation between a parent's years of schooling and student's probability of majoring in science. Also, mother's occupational level had

a significantly positive effect on the outcome at 0.1 significance level, meaning that holding other covariates at their mean, the higher the mother's occupational level, the more likely that a student to prefer majors in the natural science field across the sample.

Probability of preferring natural

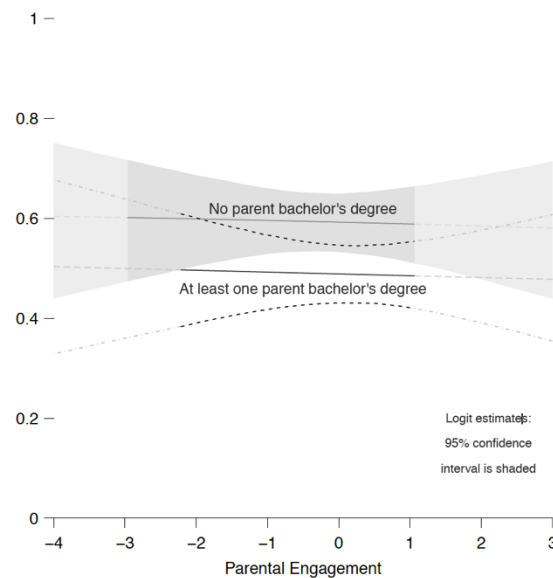


Figure 4. The probability of preferring natural science field across parental engagement levels by parental education.

In line with estimated results of the model, a majority of the predictors did not play a significant role in shaping the gender groups' academic preference in natural science field (see Figure 5). However, under most of the circumstances, the male group had a higher probability than the female group of bookmarking a natural science-related major, a result corresponds to previous studies about the gender gap in science fields (Ma, 2011; Wang & Degol, 2013). Parental expectation played a significant role in preference of majoring in this field for both genders. For females, perceived parent's expectation in science was positively associated with

the student's preference in the field. However, the positive relations between parental expectation and likelihood of bookmarking a major in science was more noticeable for males than females (34.67% and 9.01%, respectively). In addition, male students who had a mother in a mid/high-level position shown a 19.45% higher probability of preferring a major in this field than male students with mothers worked at a lower professional level. This finding is in conflict with the research by Leppel, Williams, and Waldauer (2001) that indicated male students who had mothers in professional or executive occupations were more likely to enter nontraditional fields, such as the humanities and social science, compared to base case students.

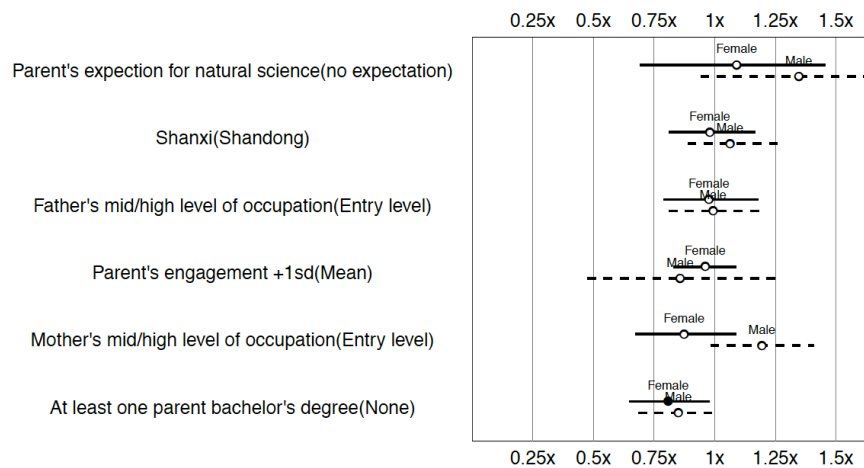


Figure 5. Relative likelihood of preferring natural science field.

Engineering and Technology Field

The purpose of the third model was to reveal factors that predict a student's college academic preference in the engineering and technology field. The gender effect was significant in this field, corresponding with previous findings that STEM fields were dominated by males ($b = -1.54, p < 0.001$). As per Figure 6, males were more likely than females to bookmark majors in this field as the level of parental engagement increased. In addition, the 95% confidence interval

of the male group was narrower than that of the female group, indicating less variation among males regarding their college academic field preference in this field. In contrast to the case of males, the probability of females preferring majors in engineering and technology decreased as parental engagement increased. It may indicate that the family climate did not serve to aid female students' development of self-efficacy and interest in this field.

Probability of preferring engineering

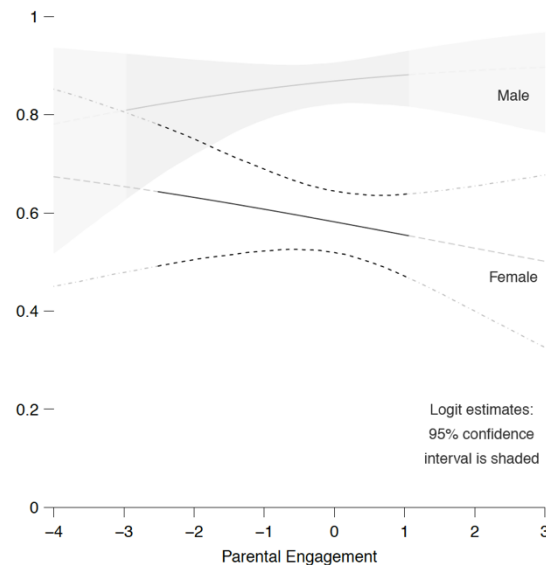


Figure 6. The probability of preferring engineering and technology science field across parental engagement levels by gender.

Similar to other fields, parental expectation had a significantly positive effect on student's major choice in this field ($b = 1.83, p < 0.001$). As Figure 7 presented, holding all other variables constant, students who perceived parental expectation were more likely to major in this field than those who did not, and the higher probability remained persistent across all levels of parental engagement.

As expected, holding other variables at their mean, males under every circumstance shown a higher probability of preferring majors in engineering and technology field than did

females (see Figure 8). Even though both female and male students were more likely to major in this field when perceived parental expectation, male students shown significantly higher probability (42.46%) of doing so than their male cohorts who did not perceive expectation from

Probability of preferring engineering and technology field

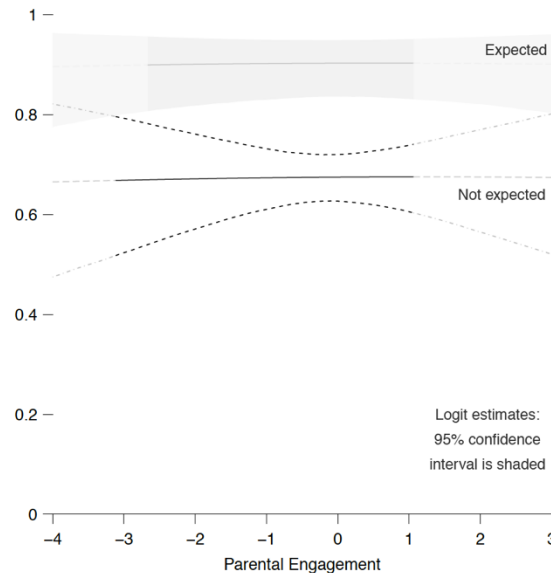


Figure 7. The probability of preferring engineering and technology field across parental engagement levels by parental expectation.

parents. Female students who perceived parental expectation were 16.17% more likely to bookmark majors in this field than those who didn't, even though the effect varied among individuals.

For students with mothers who worked at mid/high career levels, males shown a 25.70% higher probability of majoring in this field than those whose mothers had an entry level job, holding others constant. As the mother's occupation level changed from entry level to mid/high level, females were 16.10% less likely to major in engineering and technology than those whose mother had an entry-level job. Parental education level was significantly negatively associated

with the probability of females majoring in this field, in contrasted to the case of males. Both females and males were negatively associated with parental engagement in this field.

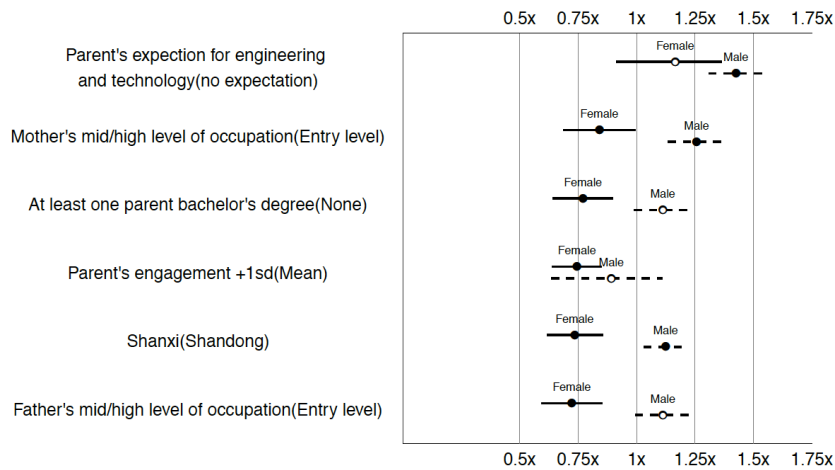


Figure 8 Relative likelihood of preferring engineering and technology field.

Region effect was detected to be significant when splitting the sample into male and female groups. Females in Shanxi province were 26.47% less likely to indicate a preference for this academic field than their counterparts in Shandong province. However, males from Shanxi shown a significantly higher probability of preference for this field than males from Shandong. This can be explained as regional differences in industrial structure. While Shanxi was relatively affluent due to profitable local industry and can provide a huge amount of head accounts for graduates, Shandong was known for its prominence in agricultural and international trade. Father's occupational level had a significant negative effect for females preferring a major in this field. This conflicts with Leppel, Williams, and Waldauer's finding (2001) that female students with a father in a professional occupation were more likely to choose nontraditional fields, such as science and engineering, compared to those with fathers in nonprofessional fields.

Business and Management Field

The purpose of the fourth model was to reveal factors related to a student's college academic preference in the business and management field. Both females and males shown a slight decrease in the probability of prefer majors in this field as parental engagement increased. Females shown more tendency of bookmarking a major in this field, compared to males, but the difference between gender groups was subtle.

Parental expectation had a significantly positive association with a student's college academic field preference for business and management disciplines ($b = 1.22, p < 0.001$). As shown in Figure 9, students who perceived parental expectation were more likely to bookmark majors in this field compared to those who did not, and the estimated probability stayed at a higher level (more than 60%) across all levels of parental engagement, holding other variables constant.

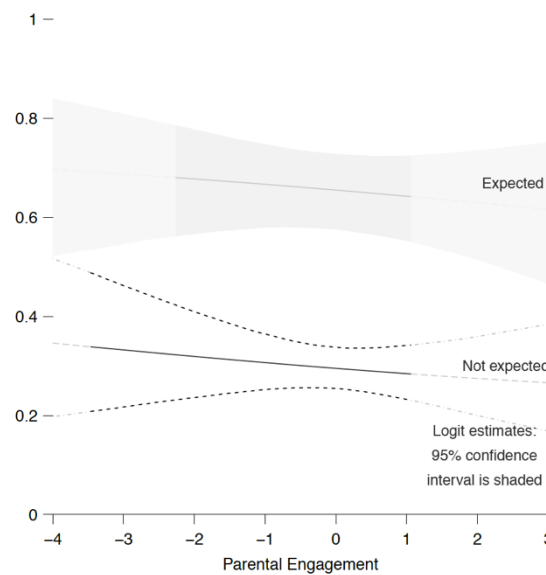


Figure 9. The probability of preferring business and management field across parental engagement levels by parental expectation.

Females under most circumstances shown more probability than did males of bookmarking majors in business and management field (see Figure 10). In this sense, my findings conflict with previous studies that the majority of males, regardless of their SES, tended to prefer majors in business and other lucrative fields to embark on a career related to high status and financial return (Leppel, Williams & Waldauer 2001; Mullen, 2014). The effects of parental expectation were noticeable for both females and males. Males who perceived parental academic expectation in this field were 2 times more likely to prefer majors in business and management field than those who did not, hold other variables constant. Females under the influence of parental expectation were nearly 2.5 times more likely to bookmark a major than those who did

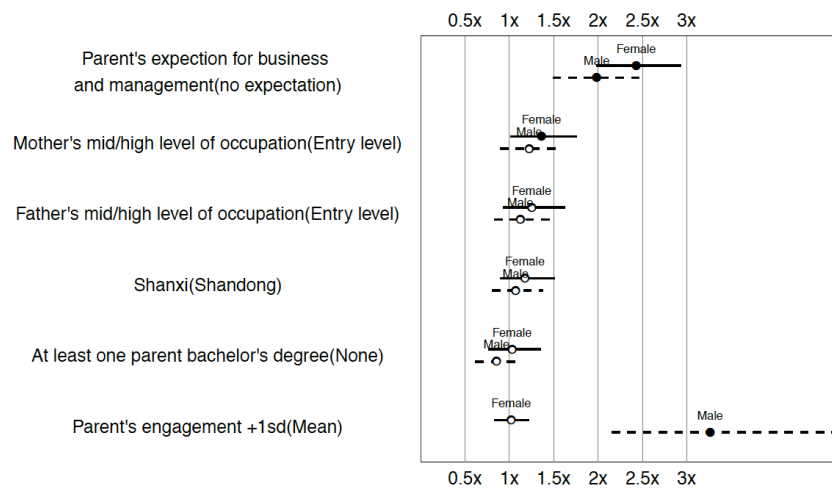


Figure 10. Relative likelihood of preferring business and management field.

not perceive such parental expectation in this field, hold other variables constant. Females with a mother worked at a mid/ high-level occupation shown a significantly higher probability of

preferring than their cohorts whose mother hold entry level jobs, hold other variables constant.

As the parental engagement increased to one standard deviation above the mean, male students were more than 3 times as likely to prefer this field than those base case students.

Medicine and Healthcare Field

The outcome of the fifth model was whether or not students shown preference in medicine and healthcare. As expected, the gender effect was significant in this field ($b = 1.10$, $p = 0.002$). Figure 11 indicated that females were significantly more likely to bookmark a major in the medicine and healthcare field than were males, holding other variables at their mean. This resonates with previous findings that females were inclined to major in fields such as medicine and healthcare that allow them to achieve communal career goal endorsement (Diekman et al.,

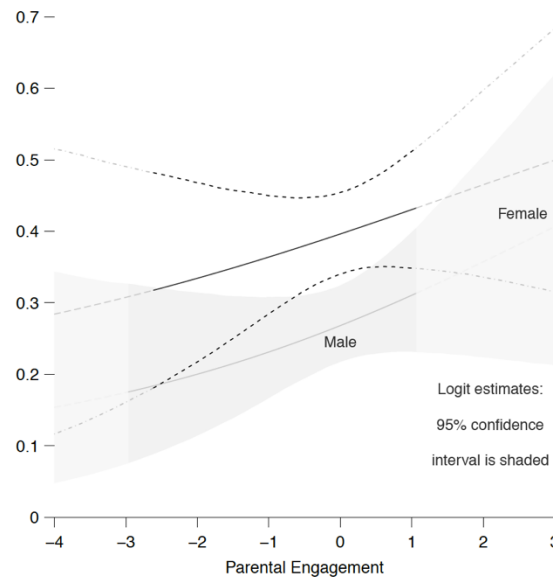


Figure 11. The probability of preferring medicine and healthcare field across parental engagement levels by gender.

2010; Wang & Degol, 2013). Also, as the parental engagement increased, students from both gender groups shown an increasing probability of preferring this academic field, aligning with previous findings that the frequent interaction between parents and child would enable students to internalize and generalize the warm person-to-person relations and parent's value to the broader settings outside of the family, and in turn, stimulate them to involve in fields of helping others (Dietrich & Kracke, 2009; H. Hoffman, Louis & J. Hoffman, 2010).

Parental expectation had a significantly positive effect on student's preference in medicine and healthcare disciplines ($b = 2.01, p < 0.001$). As shown in Figure 12, students who perceived parents' expectations were more likely to bookmark majors in this field than those who did not. Also, students who perceived little parental expectation shown less than a 50% of the chance of preferring majors in this field.

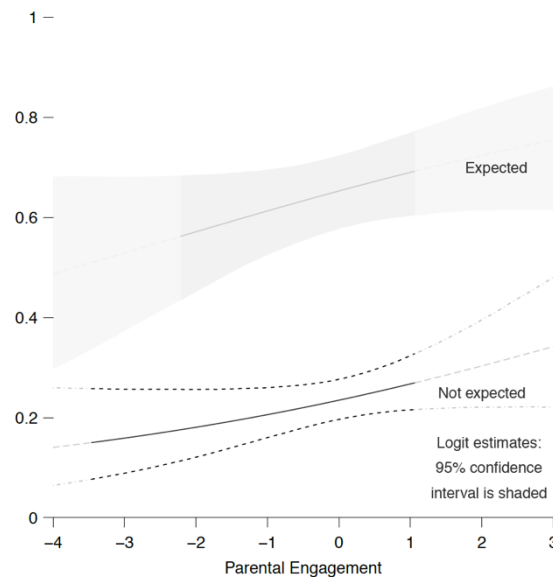


Figure 12. The probability of preferring medicine and healthcare field across parental engagement levels by parental expectation.

As per the Figure 13, females shown more inclination to bookmark majors in medicine and healthcare field than did males. Parental expectation significantly predicted the probability of field preference for both gender groups. Holding other variables constant, females with parental expectation were approximately 3 times more likely to prefer majors in the field than those perceived little parental expectation, and males shown more than 2.5 times the likelihood of bookmarking a major in this field if they perceived parental expectation compared to those who did not perceive this kind of parental expectation. The probability of female students from Shanxi bookmarking majors in medicine and healthcare was 1.5 times higher than those in Shandong. This can be explained by Shanxi's participants possessing higher academic capability in math and science than those in Shandong, so the former were better prepared academically to

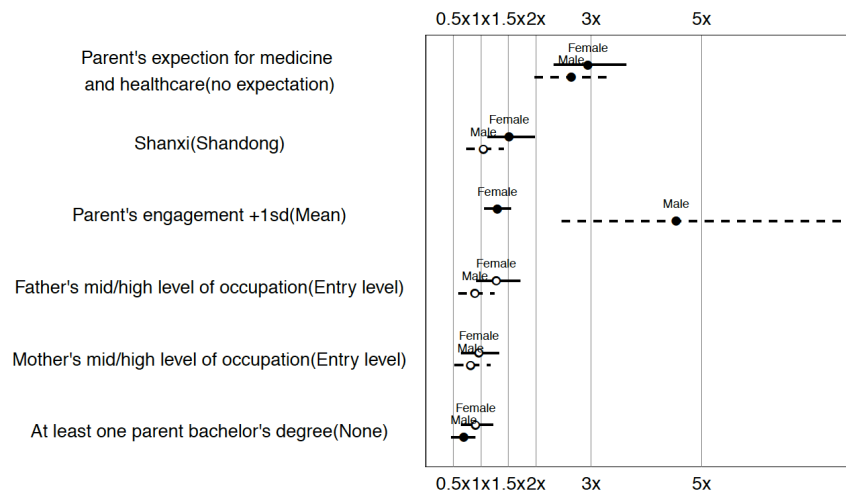


Figure 13. Relative likelihood of preferring medicine and healthcare field.

majoring in this field. Even though parental engagement was significantly associated with the probability of preference for this fields for both genders, males benefited more from the warming parent-child interaction than did females. Specifically, males were 4.5 times more like to major

in medicine and healthcare if parental engagement was one standard deviation above the mean, compared to those whose parents were only involved in educational planning at an average level, holding all else constant. As parental education level increased, both female and male students were less likely to major in this field.

Discussion

Given that decision making in future college major choice begins early for Chinese students, the student's preference for five academic fields in higher education were modeled by parental characteristics and gender. The hypothesis 1 that, student's preference in nontraditional academic fields are positively correlated with parental education and occupation level, was not tenable in this study. In other words, my findings are contradicting to that of previous studies claiming that higher parental education level was associated with student's choice in nontraditional fields to their gender group. For instance, in the case of the humanities and social science field, the level of parental education was positively associated with the probability of females bookmarking majors in the fields but not with that of males. The results also suggested an opposing effect of parent's educational and occupational level for the two gender groups regarding the preference for natural science, engineering and technology majors. Males were more likely to bookmark natural science, engineering and technology related majors as parent education and career level increased, while females became less likely to do so, holding other variables constant. One possible explanation could be the discrepancy of task values between gender groups. In other words, when being financially well off, males tend to embark on a path toward a lucrative career while females show more inclination to pursue a career that enables them to achieve communal endorsement goals. Besides, the effect of the mother's occupation level was greater than the father's occupation level in some academic fields. Specifically, the

change of mother's occupation level was associated with a greater gender difference in preference for most academic fields, including humanities and social science and natural science. In other academic fields, the changes of parental occupation level exerted a relatively equal role in academic preference.

Hypothesis 2, as the parental engagement in educational planning increases, student's preference in particular academic field increase accordingly, did somewhat hold for this study. However, in most of the academic fields, the effects of parental engagement were significantly associated with the preference of males in the field rather than that of females. Specifically, parental engagement significantly predicted male students' preference in humanities and social science, business and management, and medicine and healthcare. The parental engagement was significantly negatively associated with females' preference in the engineering and technology field. A possible explanation can be that the family environment did not provide enough psychological or behavior support to their female children to develop self-efficacy and interest in this field. The effect of parental engagement was significant for both females and males when showing a preference for majoring in the medicine and healthcare field. As parental engagement increased, both males and females were more likely to major in this field. As Dietrich and Kracke (2009) claimed, supportive and affectionate parents created a family climate that favored the socialization process. Children who grew up in a warm and mutually supportive relationship tended to develop a higher degree of emotional stability, sociability, and empathy that conform with the requirements in this field.

As hypothesized, in most investigated academic fields, the parental expectation in a particular academic field strongly predicted the chance of their offspring bookmarking a major in these fields. Results of the present study shown a significantly positive relationship between

parental expectation and the probability of students showing preference in the same field. Even though the effect of parental expectation was not statistically significantly associated with students' preferences in natural science, we can conclude a strong effect existed due to the large value of the estimated parameter.

Aligning with hypothesis 4, results demonstrated that a stratification of academic field preference between gender groups still existed. Specifically, females shown less preference in the natural science and engineering and technology fields and males in the humanities and social science field. However, hypothesis 5 might not be tenable as my results. I only found a significant interaction effect between gender and mother's occupational level for natural science field.

Findings regarding the effects of parental characteristics and gender on academic field preference may carry implications for school counselors, teachers, and parents with respect to their involvement in educational planning for high school students. Specifically, as parental engagement has been found positively associated with student's academic preference, extra help should be given to parents enable them to create cognitively stimulating and emotionally supportive family environment. This is important when we want to encourage more female students to engage in STEM fields. As the results of the engineering and technology field model, the probability of females bookmarking majors in this field decreased as parental engagement increased, indicating that the family climate did not serve to help female students' development of self-efficacy and interest in this field. Correll (2001) argued that females were less likely to keep a high self-concept of their math ability than males. Thus, extra encouragement and support should be given to females. Moreover, public policymakers can refer to this study when it comes to resource allocation in assisting educational planning in the secondary school system. As the

results of this study, parents played a critical role in assisting student's academic field choice. More resources should be distributed to train parents in terms of establishing the mutually supportive parent-child relationship, exposing students to more academic and career options, and grasping the trend evolvement in academic fields and industries.

There are some limitations to this study. First, as most of the participants were from three schools, the results may not be generalized to other schools that are essentially different from the sampled schools. Also, these schools located in regions that were well-known by their prosperities of industry, agricultural and international trade. In this sense, we can not generalize our finding to schools in other regions with a different economic structure. Third, the results of this study are not generalizable to Western social contexts because all participants were from China due to the difference of sociocultural values and family relationship ethics. Fourth, the results should be interpreted with cautions as I used preference in the academic field as my outcome variable rather than major choice in other studies because of the following reasons. First, since the respondents were 10th graders, they only bookmarked their potential majors on the online educational program instead of actually choosing a college major. Second, most of them bookmarked majors in more than one academic fields. So, it is unclear whether the results were different if combined categories were predicted. Third, since actual major choice can be shaped by multiple external factors, such as performance in NCEE, tuition, college program characteristics. Thus, showing preference in a particular field did not indicate they only prefer majors in this field or would finally choose a major in this field.

Further research can include more family-related variables, such as family income and family structure, to increase the predictability of a student's academic field preference. Household income directly determines the financial capital and resources that enable the student

to pursue their interests and academic preparation activities. Previous research has also found the family structure to be related to field choice. For example, the number of children and whether the household is a single-parent or step-parent household has been shown to be negatively associated with STEM field choice (Leppel, Williams & Waldauer 2001; Pearson & Dellmann-Jenkins, 1997; Wang & Degol, 2013). Nevertheless, the present study contributes to our growing knowledge about parent characteristics' role in college field choice.

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Appendix A

Table A1

Zero-Order Correlations among Predictors for model 1

Measure	1.	2.	3.	4.	5.	6.	7.
<i>Predictors</i>							
1. Parental Education Level	--						
2. Father's Occupation Level	0.29**	--					
3. Mother's Occupation Level	0.15**	0.29**	--				
4. Parental Engagement	0.16**	0.11**	0.06	--			
5. Parental Expectation for HUM	-0.001	0.02	0.004	0.08	--		
6. Female	-0.09*	-0.11**	-0.08	0.03	0.15**	--	
7. Shanxi	0.26**	0.08*	0.06	-0.15**	-0.07	-0.03	--

Note. $N = 642$ students. Pearson's r reported; * $p < 0.05$; ** $p < 0.01$

Table A2

Zero-Order Correlations among Predictors for model 2

Measure	1.	2.	3.	4.	5.	6.	7.
<i>Predictors</i>							
1. Parental Education Level	--						
2. Father's Occupation Level	0.29**	--					
3. Mother's Occupation Level	0.15**	0.29**	--				
4. Parental Engagement	0.16**	0.11**	0.06	--			
5. Parental Expectation for SCI	0.15**	0.06	0.03	0.01	--		
6. Female	-0.09*	-0.11**	-0.08	0.03	0.01	--	
7. Shanxi	0.26**	0.08*	0.06	-0.15**	0.12**	-0.03	--

Note. $N = 642$ students. Pearson's r reported; * $p < 0.05$; ** $p < 0.01$

Table A3

Zero-Order Correlations among Predictors for model 3

Measure	1.	2.	3.	4.	5.	6.	7.
<i>Predictors</i>							
1. Parental Education Level	--						
2. Father's Occupation Level	0.29**	--					
3. Mother's Occupation Level	0.15**	0.29**	--				
4. Parental Engagement	0.16**	0.11**	0.06	--			

5. Parental Expectation for ENG	0.07	0.03	0.05	-0.01	--		
6. Female	-0.09*	-0.11**	-0.08	0.03	-0.31**	--	
7. Shanxi	0.26**	0.08*	0.06	-0.15**	0.03	-0.03	--

Note. $N = 642$ students. Pearson's r reported; * $p < 0.05$; ** $p < 0.01$

Table A4

Zero-Order Correlations among Predictors for model 4

Measure	1.	2.	3.	4.	5.	6.	7.
<i>Predictors</i>							
1. Parental Education Level	--						
2. Father's Occupation Level	0.29**	--					
3. Mother's Occupation Level	0.15**	0.29**	--				
4. Parental Engagement	0.16**	0.11**	0.06	--			
5. Parental Expectation for BUS	0.02	0.04	-0.002	0.01	--		
6. Female	-0.09*	-0.11**	-0.08	0.03	0.09*	--	
7. Shanxi	0.26**	0.08*	0.06	-0.15**	0.07	-0.03	--

Note. $N = 642$ students. Pearson's r reported; * $p < 0.05$; ** $p < 0.01$

Table A5

Zero-Order Correlations among Predictors for model 5

Measure	1.	2.	3.	4.	5.	6.	7.
<i>Predictors</i>							
1. Parental Education Level	--						
2. Father's Occupation Level	0.29**	--					
3. Mother's Occupation Level	0.15**	0.29**	--				
4. Parental Engagement	0.16**	0.11**	0.06	--			
5. Parental Expectation for MED	0.16**	-0.12*	-0.07	-0.07	--		
6. Female	-0.09*	-0.11**	-0.08	0.03	0.07	--	
7. Shanxi	0.26**	0.08*	0.06	-0.15**	0.10**	-0.03	--

Note. $N = 642$ students. Pearson's r reported; * $p < 0.05$; ** $p < 0.01$

Appendix B

Questionnaire

Parental Educational Level

1. Father's highest level of education :
 - Less than high school
 - High school diploma or equivalent
 - Bachelor's degree
 - Master's degree or above
 - I Don't know

2. Mother's highest level of education:
 - Less than high school
 - High school diploma or equivalent
 - Bachelor's degree
 - Master's degree or above
 - I Don't know

Parental Occupation Level (drag down menu)

3. Father's current occupation :

4. Mother's current occupation :

Parental Engagement in Educational planning

5. How often did your parents share their study experience with you?
 - Never
 - Rare
 - Sometimes
 - Always

6. How often did your parents discuss college program and major with you?
 - Never
 - Rare
 - Sometimes
 - Always

7. How often did your parents share their work experience, responsibilities, or feelings with you?
 - Never
 - Rare
 - Sometimes
 - Always

8. How did your parents help you learn the major that you're interested in? (multiple responses)
 - Collect and provide major related information, such as academic field, fundamental courses, career path
 - Fund you to attend tutoring or club related to the major or its fundamental courses
 - Give advice on applying major related intern or volunteer position
 - Help to get a position for a major related intern or volunteer by using their social resources
 - other

9. What is your family decision mode regarding academic planning?
 - Parents dominant without considering your opinion
 - Parents dominant and considering your opinion
 - Child dominant without considering your opinion
 - Child dominant and considering your opinion
 - Other

10. Parents' expectation in academic field:
 - Humanities and social science
 - Natural sciences
 - Engineering and technology
 - Business and management
 - Medicine and healthcare science
 - Other

Influential factors on major choice

11. What are the most important factors to you when you're choosing a major? (you can choose up to 3)
 - Employment opportunity
 - Industry average salary
 - Exploit advantages in particular discipline
 - The difficulty of graduation and study-related pressure
 - Social impact
 - Personal interest
 - Personal goal
 - Parental expectation
 - other