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Career Exploration Among Technical and Vocational Education Students: Insights by Gender and Location

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Abstract

Career exploration is crucial for facilitating the transition from education to employment, particularly among students in minban (private) higher technical and vocational colleges in China. This study investigates the effects of gender and location on career exploration behaviors among final-year engineering students. A total of 340 students from three minban (private) higher technical and vocational colleges in Nanjing, Jiangsu Province, were selected through cluster random sampling. Data were gathered via an online survey using the Career Exploration Scale (CES) on the WJX platform. Statistical analysis revealed that gender significantly predicted career exploration, with female students demonstrating higher engagement than their male counterparts. Conversely, location showed no significant effect, and no interaction between gender and location was found. The findings offer valuable insights for educators and policymakers in designing targeted strategies to promote career exploration and improve graduate employability in China's vocational education sector.

Keywords Career Exploration, Gender, Location, TVET Students

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1.0 Introduction

One of the most important developmental responsibilities for students in the modern educational system is to set clear plans and make proper preparations for their future careers. The vocational education system, along with the higher education system, is an important component of the modern education system. Final-year engineering students in higher vocational colleges are at a vital point in their career growth and employment transition. Career exploration, a process that enables individuals to understand themselves and the professional world, and form informed career decisions and adaptability, has a high degree of developmental significance (Stumpf et al., 1983). Career exploration, defined as the process by which individuals understand themselves and the professional world to make career decisions and adaptability, is extremely important for career development (Stumpf et al., 1983). Career exploration is crucial for vocational college students preparing to enter the workforce, as it impacts not only their employment quality but also their career adaptability and future career development path.

Although students' career development greatly benefits from career exploration, this process often comes with significant behavioral, emotional, and cognitive costs. College students struggle to engage in ongoing and in-depth career exploration activities because they need to find a balance between heavy academic burdens, internship tasks, interpersonal relationships, and life pressures. Furthermore, external environmental factors such as individual socioeconomic background, gender role cognition, and the distribution of urban and rural educational resources will all impact the breadth and depth of career exploration (Lent et al., 1994; Felsman & Blustein, 1999).

Career exploration, on the other hand, is a diverse process. Multiple socio-demographic variables influence its performance and impacts; the two most important of which are gender and location, specifically rural versus urban. As a result, in-depth investigation of the behavioral characteristics, influencing mechanisms, and differentiated performance of college students' career exploration, particularly in terms of social variables such as gender and urban-rural background, has significant theoretical value and practical significance for improving the scientific and relevance of college vocational education and promoting students' career maturity and adaptability.

1.1 Gender Bias in the Career Exploration

Gender bias in career exploration is a serious issue, shaped by a variety of societal, familial, and academic factors that influence college students' aspirations and decisions. Females frequently feel confined by traditional gender roles, particularly in STEM disciplines, where they demonstrate lower self-efficacy despite exemplary academic accomplishments, discouraging them from following these routes (Amini et al., 2023; Dernadeta et al., 2022; Lin, 2024). Even though the percentage of women in engineering has increased recently, gender biases may still limit their willingness and level of career exploration. According to Gao (2023) and Hadi & Aryani (2023), women's career decisions are made more difficult by obstacles, including the threat of stereotypes and the difficulty of striking a work-life balance. Longitudinal studies suggest that gender stereotypes might sustain disparities in career interests and aspirations throughout adolescence, influencing future educational and employment paths (Blažev et al., 2024). As a result, addressing these misconceptions and implementing interventions that promote gender parity in educational and professional settings is critical to creating a more inclusive atmosphere for career exploration.

1.2 Location Bias in the Career Exploration

In academic research, the impact of physical location, specifically rural versus urban, on career exploration remains a crucial topic of study, particularly among college seniors. In other words, urban-rural differences have an important impact on students' career exploration paths and resource acquisition. Evaluating the subtle variations between these environments offers important insights into how geographic location influences the process of career discovery. Urban students typically have access to more information sources, internships, and career counseling resources. In contrast, rural students encounter systemic limitations such as inadequate educational resources, low family social capital, and information asymmetry – all of which are especially noticeable for engineering students (Chen et al., 2021). Engineering students in rural areas may have significantly limited career cognition and exploratory behavior due to a lack of possibilities, such as industry internships and corporate practice (Hawes et al., 2021).

It has been shown that young people in rural areas tend to have different goals from those in urban areas. According to one study, for instance, urban young women who are about to make a career decision must deal with social and economic pressures that frequently result in a more standardized career path than their rural counterparts, who might foster aspirations more in line with their limited local opportunities (Nungsari et al., 2024). Urban pupils, on

the other hand, tend to have higher aspirations for careers in STEM fields. On the other hand, they may exhibit a more cautious attitude when it comes to using their education in practical situations. Rural students were more optimistic about using science and math in their future jobs than their urban counterparts, according to a Greek study (Stefanidou et al., 2024). According to Stefanidou et al. (2024), urban environments may unintentionally restrict young people's aspirations. This conservatism may be the result of increased competition and awareness of fewer local opportunities available.

1.3 Interaction Impacts of Gender and Location

It should be mentioned that gender and urban-rural traits may interact. Stated differently, career exploration is greatly influenced by the interplay between gender and location. Gender differences in career choices are reflected in several environmental and social factors, which emphasize the importance of location as a contextually significant factor (Chen & Zhang, 2024). Rural female engineering students, for instance, are "double marginalized" in their situation. They are more likely to experience problems related to poor confidence, ignorance, and unclear career exploration goals due to the combined limitations of gender and location (Wang et al., 2023). To maximize career advising tactics and advance career equity, it is crucial to conduct a thorough investigation of the career exploration behaviors of engineering graduates in vocational institutions across genders and urban-rural backgrounds.

Career interests may perpetuate gender stereotypes due to the interaction between location and gender, particularly in STEM fields. High school students' interest in STEM occupations was investigated by Wang et al., who found that gender disparities in interest can be exacerbated by the local cultural background, which affects students' perspectives and goals in these disciplines (Wang et al., 2023). Furthermore, Miller et al.'s research revealed that peers and advisers have a significant impact on students' specialty interests, which is especially important for women in traditionally male-dominated disciplines like engineering (Miller et al., 2024). These findings, when combined with social cognitive career theory, imply that resolving the obstacles women encounter in career progression can be facilitated by an awareness of contextual factors, whether they be gender or location–based (Budjanovcanin & Guest, 2023).

Although career exploration is acknowledged as crucial for students' career development, most empirical studies have focused on students attending comprehensive or research-focused universities, leaving populations at vocational colleges, especially final-year engineering students, understudied in China. Furthermore, gender and urban-rural origin are often studied as separate variables in current research, which fails to explore their potential interactions adequately. It overlooks the unique vulnerability of female students in rural areas, who may face "double marginalization" – a combination of geographical and gender-based disadvantages (Wang et al., 2023).

Given unique educational settings, resource limitations, and labor market focus in China, these disparities underscore the need to investigate how gender and location background jointly influence final-year engineering students' career exploration practices in colleges. Closing this gap will help guide the creation of equitable, context-sensitive career counseling programs.

The present study aims to fill this gap by investigating how gender (male vs. female) and location (urban vs. rural areas) influence the career exploration patterns of final-year engineering students in minban (private) higher vocational colleges in Nanjing, Jiangsu Province. Furthermore, this study examines the potential interaction between gender and location. Specific study aims are structured to examine these associations in the selection of final-year engineering students, experiences in minban (private) higher technical and vocational colleges, gender and location, and career exploration as follows.

This study aims to investigate the career exploration of final-year engineering students in minban (private) vocational colleges in Nanjing, China, with a particular focus on the impacts of gender and location. Specifically, it seeks to

1. assess the level of career exploration;
2. examine gender and location: urban vs rural differences;
3. explore the interaction effects of gender and location.
4. provide empirical insights to inform targeted career guidance strategies that promote career adaptability and equity among diverse student groups.

2.0 Methodology

This study employed a non-experimental quantitative research approach to investigate career exploration among final-year engineering students at minban (private) higher technical and vocational colleges in Nanjing City, Jiangsu province. It performed correlational research to find a relationship between variables. By distributing the online questionnaires to collect the data of final-year engineering students in terms of career exploration (Dillman et al., 2014).

The population of this study consists of around 1924 students in their final year of engineering studies from three minban (private) higher technical and vocational colleges in Nanjing, Jiangsu Province. Nanjing, Jiangsu province's capital, has the most numbers of higher technical and vocational colleges in the province, with 18. The study targeted minban (private) higher technical and vocational colleges, final-year students, and engineering majors.

In this research, the researcher chose cluster random sampling to acquire a targeted sample because of limited time and other essential resources (Krejcie & Morgan, 1970; Bryman, 2016). The sample size of the study was 320 students from the three selected minban (private) colleges in Nanjing, Jiangsu Province, China (Cohen, 1988; Neuman, 2007). The decision on the sample size was predicated upon the confidence level (95%) and error range (±5%). And for the number of samples from each college, it is better to choose by proportion. Before completing the online questionnaire, the research goal was provided to each participant in the online survey.

Finally, this study involved 340 students from the aforementioned colleges. There were 186 female (54.71%) and 154 male (45.29%) college students. There were 196 participants (57.65%) residing in urban areas, with the remaining 144 participants (42.35%) living in rural areas. Table 2.1 depicts the population and sampling of students at the selected minban (private) colleges using these criteria.

All participants provided demographic details before completing any study measures, including college, age, gender, location for urban or rural areas, parenting styles, and other relevant information.

Career exploration (Table 2.2) was measured using the Career Exploration Scale (CES) from Stumpf, Colarelli, and Hartman (1983). Adopted form with 12 items, which are formed into two dimensions to reflect self-exploration (SE, 5items) and environmental exploration (EE, 7 items). Sample items include "I have reflected on past experiences to understand what career paths fit me.", "I have spoken to career counselors to discuss my career options.", and "I have attended career fairs, job expos, or industry seminars.". Each item in the CES was scored on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Because of the participants in Nanjing, we have provided a Chinese version for translation which relevant experts verify. In my research, the composite reliability of the instrument was $\alpha = 0.909$, $\alpha = 0.889$ for self-exploration (SE), and $\alpha = 0.928$ for environmental exploration (EE).

The collected data (Table 2.3) will be cleaned and screened for missing values and outliers before analysis. Descriptive statistics (mean, standard deviation, frequencies) will summarize participants' demographic information and key study variables. To test the study's hypotheses, One-Sample t-test, One-Way ANOVA, Two-Way ANOVA, Independent Samples t-tests, and Post-hoc Tests/Simple Effects Analysis were used. IBM SPSS Statistics was used for statistical calculations, and results will be interpreted based on significance ($p < 0.05$) levels (Field, 2013).

3.0 Findings

H_1: Final-year engineering students exhibit a moderate to low level of career exploration.

A one-sample t-test was conducted to determine whether the career exploration of final-year engineering students in minban (private) higher vocational colleges in Nanjing, Jiangsu Province, significantly differed from the theoretical midpoint of 3.00 on a 5-point Likert scale, indicating a moderate level of career exploration.

The analysis (Table 3.1) revealed that the mean score of career exploration behavior was significantly higher than the theoretical midpoint ($M = 3.583$, $SD = 0.829$), $t(339) = 12.957$, $p < 0.001$. The 95% confidence interval for the mean difference ranged from 0.494 to 0.671. The effect size, as measured by Cohen's d, was 0.703, indicating a medium to large effect size (Cohen, 1988).

These results suggest that, overall, final-year engineering students in minban (private) higher vocational colleges exhibited a relatively high level of career exploration, exceeding the average expected level based on the scale's midpoint.

This finding (Table 3.1) indicates that students in this sample demonstrated a relatively high level of career exploration behavior rather than a moderate or low level as hypothesized. Therefore, Hypothesis 1 was not supported. The effect size (Cohen's d = 0.703) further suggests that this difference is of medium to large magnitude, reinforcing the conclusion that students in these vocational institutions are more actively engaged in career exploration than initially anticipated.

H_2: Career exploration significantly differs by gender.

H_3: Urban students show higher levels of career exploration than rural students.

To test H_2 and H_3, independent samples t-test were conducted to examine potential differences in career exploration based on gender and location.

The results revealed a significant gender difference in career exploration. Female students (M = 3.699, SD = 0.821) reported significantly higher levels of career exploration compared to male students (M = 3.486, SD = 0.826), t(df) = 2.374, p = 0.018, Cohen's d = 0.259. According to Cohen (1988), it represents a small to medium effect size, indicating that gender plays a modest but meaningful role in shaping career exploration activities among final-year engineering students in vocational colleges.

In contrast, the analysis showed no significant difference based on location. Students from rural areas (M = 3.628, SD = 0.834) did not differ significantly from their urban counterparts (M = 3.549, SD = 0.826), t(df) = - 0.863, p = 0.389, Cohen's d = - 0.095. This small effect size suggests that the influence of location on career exploration in this sample was negligible.

These findings (Table 3.2) provide partial support for the hypotheses. While gender differences in career exploration are evident, the expected disparity based on location was not statistically supported.

H_4: Gender and urban-rural background interact significantly to influence career exploration.

A two-way ANOVA was conducted to examine the main and interaction effects of gender and location on career exploration among final-year engineering students in minban (private) higher vocational colleges in Nanjing. The results (Table 3.3) revealed a significant main effect of gender, F (1, 336) = 6.012, p = 0.015, indicating that female students reported significantly higher levels of career exploration behavior than male students. The main effect of location was not significant, F (1, 336) = 0.877, p = 0.350, suggesting no significant difference in career exploration between urban and rural students. The interaction effect between gender and location was also not significant, F (1, 336) = 0.477, p = 0.490, indicating that the effect of gender on career exploration did not vary significantly by urban-rural background.

4.0 Discussion

The effects of gender, location (rural versus urban), and their interaction were the main topics of this study, which looked at the career exploration of final-year engineering students at minban (private) higher technical and vocational colleges in Nanjing, Jiangsu Province. Several significant conclusions were drawn from this study.

First, the one-sample t-test results indicated that these students' overall career exploration level (3.583) was considerably greater than the theoretical average (3.00). H_1, which predicted a moderate to low level of career exploration, conflicts with this. This surprising result could be attributed to recent advancements in career counseling services, the increased accessibility of career information through online resources, and students' increased awareness of career planning as a result of China's educational reforms, which place a strong emphasis on vocational colleges' readiness for the workforce.

Second, a significant gender difference was identified, with female students exhibiting higher levels of career exploration than their male counterparts. It supports H_2 and aligns with previous research suggesting that female students, particularly in male-dominated engineering fields, may engage more actively in career planning as a compensatory strategy to overcome perceived gender-based barriers. This result highlights the importance of incorporating gender-specific interventions into career education programs.

In contrast to H_3, there was no discernible difference in the way students explored employment options across urban and rural areas. The lack of significance in this study may be due to the proliferation of online resources and digital platforms, which have potentially reduced traditional information gaps, even though previous studies have highlighted differences in career opportunities and resource access between urban and rural students. Furthermore,

because of the comparatively consistent educational options in the area, the sample's geographic location – Nanjing, the capital of Jiangsu Province, a developed city – may have helped to minimize the urban-rural split.

Lastly, there was no evidence to support H_4, which examined the relationship between gender and location. The non-significant interaction effect suggests that there were no appreciable differences between urban and rural settings in the impact of gender on career exploration. The expected "double marginalization" of rural female students was not statistically supported in our sample, indicating that gender has a fairly constant impact on career exploration regardless of location. One factor could be the impact of national educational policies that aim to reduce regional disparities in career services, as well as the fact that resources for career counseling and online learning are accessible even in remote locations.

Overall, these results show how individual and contextual factors interact to shape career exploration, and they imply that, although gender is still a significant determinant, the urban-rural background may be losing momentum in the setting of contemporary Chinese vocational education.

5.0 Conclusions

This study explored how gender and urban-rural background impact career exploration among final-year engineering students in minban (private) higher technical and vocational colleges in Nanjing, China. According to the data, students typically demonstrate a high degree of career exploration, going above and above the expected norm, indicating the success of recent career education programs.

Gender emerged as a significant factor influencing career exploration, with female students engaging more actively in this process. Contrary to expectations, however, gender-location interactions and urban-rural disparities did not significantly alter career exploration, suggesting that, at least in established metropolitan areas like Nanjing, location may no longer be a determining factor.

These conclusions emphasize the importance of gender-sensitive career guidance in vocational colleges while also suggesting that efforts to equalize educational resources across urban and rural settings may yield positive outcomes. Future research should extend this inquiry to other regions and vocational disciplines to determine the generalizability of these findings.

Table 2.1 Population and Sampling of Final-Year Engineering Students from the Selected Minban (Private) Colleges in Nanjing City, Jiangsu Province, China

No.	College	Population	Estimated Sampling	Surveyed Sampling
1	Jinken College of Technology	844	140	150
2	Zhengde Polytechnic College	673	112	119
3	Zhongshan Vocational College	407	68	71
Total		1924	320	340

Table 2.2 Questionnaires of Variables

No.	Variables	Questionnaire	Source	Cronbach's Alpha	Items
1	Demographic Details		Self-Developed		13
2	Career Exploration	CES	Stumpf, et al., (1983)	0.909	12
Total					25

Notes: CES: Career Exploration Scale

Table 2.3 Data analysis related to the research

No.	Hypothesis	Analysis
H_1	Final-year engineering students exhibit a moderate to low level of career exploration.	Descriptive Statistics & One-Sample t-test

H_2	Career exploration significantly differs by gender.	Independent Samples t-test
H_3	Urban students show higher levels of career exploration than rural students.	Independent Samples t-test
H_4	Gender and urban-rural background interact significantly to influence career exploration.	Two-Way ANOVA

Table 3.1 Descriptive Statistics (N = 340) and One-Sample t-test (H_1)

Variable	M±SD	Test Value	t	df	p	Cohen's d
1. Career Exploration	3.583±0.829	3.00	12.957	339	＜ 0.001	0.703

Note. M = mean, SD = standard deviation.

Table 3.2 Independent Samples t-tests for Career Exploration by Gender and Location (H_2 & H_3)

Variables	Group	n	M±SD	t	df	p	Cohen's d
Gender	Male	154	3.699±0.821	2.374	338	0.018	0.259
	Female	186	3.486±0.826				
Location	Rural	144	3.628±0.834	-0.863	338	0.389	-0.095
	Urban	196	3.549±0.826				

Note. M = mean, SD = standard deviation; $p < 0.05$ is considered statistically significant.

Table 3.3 Two-Way ANOVA summary for career exploration by gender and location (H_4)

Source	SS	df	MS	F	p	η^2
Gender	4.086	1	4.086	6.012	0.015	0.018
Location	0.596	1	0.596	0.877	0.350	0.003
Gender * Location	.324	1	0.324	0.477	0.490	0.001
Error	228.367	336	0.680			
Total	4596.938	340				

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