

Female Engineering Students' Perceptions of Recruitment Motivation and Career Development: A Preliminary Study

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Structured Abstract

BACKGROUND

Engineering diversity is an emerging research theme in engineering education. The gender issue, focusing on women in engineering, is one of the most discussed topics among a variety of important issues in engineering diversity.

PURPOSE

In order to add knowledge base about women in engineering to existing literature, this study aimed to analyze female engineering college students' perceptions of recruitment motivation and career development.

DESIGN/METHOD

A qualitative-based interview method was adopted in the study. A purposeful sampling was used to interview female engineering college students from a research-based university in Taiwan.

RESULTS

A four-stage qualitative analysis strategy was used to analyze transcripts, which in turn yielded 7 research themes, including 4 themes in recruitment motivation and 3 themes in career development.

CONCLUSIONS

The findings in the study identified some specific patterns about recruitment motivation for Taiwanese' female engineering students. The research themes in career development were similar to the results reported in previous research.

KEYWORDS

Women in Engineering, Recruitment Motivation, Career Development

Introduction

Background Information

Recently, Chou (2013) analyzed three engineering education journal articles from 2000 to 2009 and reported that existing literature lacked Asia-based research regarding women in engineering. Chou further contended that female engineering students' learning experiences in the Asia-Pacific region remained unknown and thus a need to fill such literature gap was necessary.

In engineering colleges, students' recruitment (input) and career development (output) are two major topics for engineering educators (Sulaiman & AlMuftah, 2010). The former focuses on how to attract students into engineering students and why students choose engineering as a major; the latter deals with students' career planning before graduation and the issue regarding connection between engineering major and job hunting in workplaces.

Based on above background information, to add knowledge base about women in engineering to existing literature, this short paper reported our findings regarding female engineering students' recruitment motivation and career development. The target school is one public research-based university in the southern Taiwan.

Future Plan

Due to the nature of qualitative-based approach, this study only recruited 15 female engineering students from different engineering departments. From a quantitative research perspective, the sample size cannot represent the population of female engineering students in engineering college. However, the qualitative themes yielded in the study can serves as a preliminary guideline for future quantitative and qualitative research. Table 1 lists our future plan:

Table 1 Future Plan

Number	Goal
1	Themes identified in recruitment motivation and career development serve as question item in the future quantitative-based survey research.
2	We will recruit female engineering students in teaching-based universities. Comparison between teaching-based and research-based schools will be conducted.
3	We will interview more participants from each engineering departments to enrich qualitative findings.

Literature Review

This secon reports the results in the previous research regarding factos identified in recruitment motivation and career development.

Factors in Recruitment Motivation

Jawitz, Case, and Tshabalala (2000) explored the process of career choice by interviewing South African female students' motivators to engineering majors. The findings showed that role of parents and schoolteachers and science experiences at schools were two main factors influencing female students' attitudes of choosing engineering as majors. Basically, parents and schoolteachers' perceptions of academic disciplines may push female students

in one specific career. Moreover, female students' enjoyment of science learning would affect their career decision.

Gill, Sharp, Mills, and Franzway (2008) interviewed 41 Australian female engineers about school experiences and identified three factors influencing their enrolment in engineering departments: capability in math and science, family connection, and encouragement from teachers. Engineering women considered achievements in math and science strengthened their attitudes toward engineering. If family members sustained good images of engineers, there was a potential motivation choosing engineering as majors. Teachers in high schools played a role of cheerleader to inspire engineering women to take up engineering.

Bucak and Kadirgan (2011) surveyed 1163 male and female high school students' career choices and reported that career services and family members were two major factors influencing students' career decisions. Career counsellors' influential power of decision-making for students are greater than family members'.

Factors in Career Development

Amelink and Creamer (2011) employed a mixed research method to explore engineering students' learning satisfaction and engineering career and identified a gender difference in career development. Female students expressed their intention to obtain engineering degrees. However, once graduating from colleges, engineering women may not pursue a career in engineering due to cultural norms in engineering learning environments. Learning support and satisfactions directly influence female students' interests in engineering as a career.

Varma and Hahn (2007) surveyed 150 college students majoring in computer science and engineering about early career aspirations and future career plans and found that a significant difference in future career plans existed for male and female students. Most of male engineering college students (90%) expected to enter in the workplaces after undergraduate degree. As for engineering women, however, some (12%) expressed their uncertainty in the future.

Trenor, Yu, Waight, Zerda, and Sha (2008) used a mixed research method to examine different ethnic women's educational experiences and career plans in colleges. The quantitative findings revealed that there was no significant difference in five constructs: social supports, barriers, sense of belonging and experiences, impressions of engineering, and persistence goals. The qualitative results reported that most of engineering women desired to obtain engineering-related jobs after graduation. Few female students planned to apply for graduate schools.

Research Method

Research Design

In the current research, a qualitative-based interview method was employed to obtain female engineering students' lived learning experiences. Overall, two open-ended questions were used to facilitate the interview process:

1. What motivates you to choose engineering as majors (recruitment motivation)?
2. After graduation, what is your career plan (career development)?

Reserach Participant

The study selected one public research-based university in the southern Taiwan as a target group by adopting a convenience sampling principle. The rationale of choosing this university has the largest engineering college (more than ten engineering departments) in Taiwan. 15

engineering women were recruited for voluntarily participating in the research. All participants who engaged in a one-hour interview process were senior college students.

Data Analysis

Moustakas's (1997) four-stage phenomenological analysis was employed to analyse all transcripts: (a) preliminary grouping, (b) clustering of invariant meaning units, (c) searching for themes, and (d) composite textural-structural descriptions. During data analysis, qualitative analysis software called Nvivo was used to compare and sort the collected data.

Research Result & Discussion

Qualitative data analysis identified several themes at three pipeline-process stages. Simple quotations were inserted in each theme to strengthen text description.

Factors in Recruitment Motivation

Theme 1: Self-Ability in Math and Science

Most engineering women perceived that self-ability in math and science was a major factor that drives them to choose engineering as majors. Female students' math scores were higher than an average level in the college entry exam. For example, Student 2 stated, "Compared to other subjects, I did very well in math and science subjects at the senior high school." Student 4 said, "My intuition is that engineering is a math-related discipline. I am good at this. That is why I choose it."

Theme 2: Family Members' Experiences

Several female students attributed major choosing to their experiences in family-related businesses or family members' careers. Early exposure in engineering activities pushes them toward engineering majors. For instance, Student 1 stated, "My family owns an electrical material company. I grow up in electrical stuff. I even play with semiconductors. I am familiar with engineering." Student 9 said, "My two big brothers major in computer engineering. They always show some interesting coding assignments to me. They also give me some advises about survival in this field."

Theme 3: Engineering as Applied Science

Some female students considered that engineering is applied science that allows them to apply academic theories into practice, especially product design and development. In their minds, engineering relates to daily technology use. For example, Student 8 stated, "For me, department of chemistry is a theory-based major. All I want is to make something by applying theories. So I choose chemical engineering." Student 7 said, "Majoring in physics is too boring to me. I do not want to be a science doing experiments in a lab. I want to be a tech-savvy guy who can develop something interesting."

Theme 4: Higher Salary

Few female participants created a relationship between engineering majors and earning money. In Taiwan's society, engineers, such as electrical engineers, works at science parks (similar to Silicon Valley in the United States) can obtain well-paid salary. Those students considered that the title "engineer" might allow them to receive more payment or job opportunities. For example, Student 3 stated, "Compared to other fields, being an engineer is a much more stable job. Higher salary and higher warfare." Student 10 said, "Tech-related job can make more money. I think the engineer is a lucrative job."

Factors in Career Development

Theme 1: Getting a Master's Degree

Like other Asia countries, Taiwan society emphasizes credential-based culture. People with advanced degrees may receive more job opportunities and higher salaries. In the cutting-edge technology markets, obtaining a master's degree allows female students to position in an advantageous point. For example, Student 15 stated, " It is a peer pressure. Everybody did it. If you do not follow this trend, you may not be competitive in job markets. " Student 10 said, "Going directly to workplace after graduation is not a smart decision because employers want to hire someone with advanced degrees."

Theme 2: Job Hunting

Some female students were intended to seek a job after graduation. In their minds, workplace experiences can enhance their professional engineering skills rather than practicing academic theories or conducting lab experiments at schools. For instance, Student 5 stated, "Workplace is a real world. Schools fill with academic activities. Earning practical experiences is much more important to me." Of those who desired to work, a couple of students prepared national engineering exams in order to find a job in the government. For example, Student 10 stated, " I want to be a civil servant with engineering professionals. Working in the government is much more stable than ever changing technology companies. "

Theme 3: No More Engineering

Few female students tended to abandon their engineering professionals since they experienced several learning difficulties during four-year school training. These engineering women attempted to make use of learning resources to improve their engineering learning but did not receive better outcomes. For instance, Student 14 stated, "I am interested in engineering. But it is very difficult to learn. Maybe I will not touch engineering anymore after graduation." Student 4 said, "No engineering DNA in my body. I really want to give up!" When asked about expectations before and after entering into engineering schools, those female students considered a huge gap existed even though they excelled at math. For example, Student 13 said, "Coding is fun. But developing computer programs by yourself is another thing. It is a tough task."

Table 2 summarizes the findings of the study. Overall, seven themes (four in recruitment motivation and three in career development) were identified. Most factors yielded in the study could support the results reported in the past related studies.

Table 2 Summary of Findings of the Study

Recruitment Motivation	Career Development
1. Self-Ability in Math and Science	1. Getting a Master's Degree
2. Family Members' Experiences	2. Job Hunting
3. Engineering as Applied Science	3. No More Engineering
4. Higher Salary	

Conclusion

This study aimed to analyze female engineering college students' perceptions of recruitment motivation and career development. The qualitative analysis yielded 7 research themes, including 4 themes in recruitment motivation and 3 themes in career development. Overall, the findings identified some specific patterns about recruitment motivation for Taiwanese' female engineering students. The research themes in career development were similar to the results reported in previous research.

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