GENDER AND SUBJECT CHOICE: AN EMPIRICAL STUDY ON UNDERGRADUATE STUDENTS' MAJORS IN PHNOM PENH

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ABSTRACT

*The empirical study on 610 undergraduate students between the age of 16 to 25 in Phnom Penh, Cambodia, was set to examine the relationship of gender and subject choice. The findings have revealed that women were overrepresented in non-science subjects and their gender identity has strong connection with subject choice (*** $p < .001$). The study gave an insight of how gender disparity in science due to factors such as strong gender socialization, social practice, science identity, curriculum, and challenges in science career. However, the new findings, based on regression model, rejected the economic status as a challenges to science subject selection.*

Keywords: Gender Socialization, Subject Choice, Higher Education, STEM, Career, Cambodia

INTRODUCTION

In the education landscape, subjects have been gendered and hierarchized in the development process of knowledge economy. Being hierarchized means that only top ranking subjects can bestow an individual with high returns in terms of success and career. Particularly, STEM subjects are considered having higher values contributing to economic development and growth (Roberts, 2002). These gendered and hierarchal subjects, sociologists of education argued, are the reasons behind the under-representation of women in the globalized mainstream knowledge economy, while feminists saw as one of the factors perpetuating gender inequality in education, reinforcing gender stereotypes, and reproducing patriarchal control although subject choices based on the gender identity are reducing and stereotypes are lessened in some science subjects (Devine et al., 2012). Gender disparity in science has become a hot topic for discussions among policy makers and academicians, and they agreed that women do under-represent in science.

To understand this issue, in the context of Cambodia, this empirical study is an attempt to explore how gender of individuals can influence their decisions on subject choice among 610 undergraduate students in Phnom Penh, Cambodia. This study will also examine whether the socioeconomic backgrounds of students, such as parents' occupations, parents' education level, residence of individuals, and social class could have any influence on their subject majors.

Theoretical Frameworks

Scholars expressed different arguments and utilized different theories to explain the roots of the problem, but they all agreed that the actuality of subject choices is one of the factors driving gender inequality in higher education and in the labor market. Studies so far focused on gender identity itself, society, economics, culture, religion, job market, education

institution, and even individual factor.

Mendick (2013) put forward three accounts to explain the gendered subject choices: biological account of subject choices, social psychological account, and sociological feminist account. However, there are no complete evidence supporting his arguments. For instance, on biological account, subject choices linked with biological factors of women such as health, body structure, brain, and IQ measurement, etc. Xu (2008) found that men have better scores in science tests than women do, especially on the tests of spatial ability, while other scholars presented that spatial ability can be improved if there is a proper training and less gender stereotypes (Stout et al., 2011). This argument indicates that distinction in test result is not driven by biological factors, but by how training and social factors women received upon the education process.

On the psychological account of gendered subject choice, social psychologists "seek to understand the development of individuals in interaction with society" through variables such as confidence, self-esteem, self-concept, anxiety, and risk-aversion (Mendick, 2013, p. 205). These internal factors influence the women's decision in subjects. Women have the maladaptive patterns of attribution which are unlikely to yield favorable successful discussion in science selection.

Moreover, women were oriented towards performance goals, seeking for a favorable judgment from others. In contrast, men are "oriented toward mastering something new" and going for adventure (Dweck, 1986, p. 1040). Gender socialization in the family has guided men to adaptive instrumental roles to attain the collective goal. These roles are seen as logical, assertive, rational, etc., However, women were socialized to perform integrative expressive roles – maintaining good interpersonal relationship and need to be emotional, caring, good at expressing feelings, sympathetic (Broverman et al., 1972; Parsons, 1955). Thus, subject choice is a by-product of gender socialization, passed on from older generation to the younger one.

Sex is biologically constructed, but "gender is constructed within social practices, including science and mathematics" (Mendick, 2013, p. 207). Therefore, by employing sociological approaches, feminists tried to understand what takes place outside to understand what takes place inside. Subject choices are not impelled by the internal factors, but the external factors compelling women to opt for. External factors such as patriarchal system, socialization, sex, class, and social institutions take control of women decision regarding subject choices. In this context, categorizations of subject choices between hard subjects (masculinity) and soft subjects (feminine) are part of individual identity and determine what the person will become in the future in term of a career goal based on their gender.

Through three approaches by Heather Mendick guided us with theoretical frameworks to understand gender in a relationship to subject choices, adding to traditional concepts such as class, gender, culture, ethnicity in the sociology of education. However, so far empirical studies had rejected the biological account and criticized biological account for its fancy in patriarchy. Furthermore, various studies did not find the relationship of subject choices and school achievements with biological factors, but rather created its linkage with sex-role socialization of certain individual (Klainin et al., 1989).

Outside factors influenced individuals during the decision making process has been proven in some study. for instance, a study in the UK has revealed that subject choice was influenced by intrinsic motivations, extrinsic motivations, and sex role stereotypes. The intrinsic motivations are more likely to influence both sexes to choose feminine subjects, but extrinsic motivations have a strong influence on boys to choose masculine subjects by linking subjects to future career goals, such as lucrative jobs (Whitehead, 1996). This means that the demand

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for the labor market which labor market may absorb men into the fields faster than their female counterparts, these phenomena motivated by social practices.

We are also convinced that those who have strong sex-stereotypes, would make subject choices appropriate for their gender identity. Making subject choices based on their identity shows that girls are more likely to accept the gender-stereotyped subjects, gender division of labor and to re-enforce the male dominating superiority, while boys are more likely to demonstrate their masculine power and fulfil their traditional male roles. Likewise, subject choices can be instigated by the codes of masculinity and femininity as well (Lapping, 2005). Codes of masculinity and femininity mean subject are gendered.

In addition, socioeconomic backgrounds can also influence subject choice as revealed in many studies. These studies revealed the relationship of numbers of factors such as social class, parents' occupations, parents' education level…etc which influence the individuals' subject choice (Chanana, 2007; Davies, 2008; Elsworth et al., 1999; Gautam, 2015; Sheng, 2015; Spade et al., 1997). These factors influence the subject choices of women are laying external to the science and can be gender, race, class inequalities and politics and "practice of science is a social practice" (Howes, 2002). Individual chose subject based on external influences, such as social interactions, peer pressure, and other socioeconomic and political factors. An empirical study in Australia found that higher educated parents' children tend to get enrolled in the advanced mathematics and more girls regardless of class enrolled in mathematics class in public schools (Daly & Ainley, 1999).

The theoretical frameworks stressed that gender socialization plays significant roles in determining the gender disparity in science. Furthermore, external factors such as socioeconomic backgrounds, demography of students, policy, curriculum also play their parts.

Gender in Science in Cambodian Context

In the context of gender and subject choices, various reports highlighted how science is unpopular among Cambodian women (Rann, 2013). According to the 2017 report published by the Cabinet Office of Cambodian government, there were only 25.5% of women in science, which increased from 11% in 2011 reported by UNESCO (2011). It should be highlighted that English and Accounting are the most popular majors in Cambodia, which studied by majority of Cambodian female students at tertiary education level (Chey & Hang, 2013). Thus, in a connection with the above literature, under-representation of women in STEM is the result of gender socialization, culture, religion, social system, politics, science identifications, and career aspirations, while there are also arguments blaming the biological and psychological factors perpetuating the gender inequality in science.

HYPOTHESES

Based on the above theoretical frameworks and literature, we formed following hypotheses:

H1. There are more women studying non-science subjects.

H2. Lower class students are more likely to study in non-science subjects

METHODOLOGY

Non-probability-convenience sampling was employed in this study. The survey was conducted from 22 January to 20 February, 2017. The study was conducted on 610 undergraduate students from 4 universities located in Phnom Penh, Cambodia. During a survey process, two students were asked to do the survey. Each of them received rewards for

their labor.

Data coding was done in SPSS. Simple regression analysis was performed using hierarchical models to find out the statistical significance or correlations of the independent and dependent variables *(*** $p < .001$; ** $p < .01$; * $p < .05$).*

Regression equation models are given as:

$$Yi = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_k X_{ki} + e$$

In this equation, Y represents a dependent variable and X for independent variables, β_0 for constant, which is the value of Y when X = 0. β is the slope of the line.

Faculties come under study are STEM (Science, Technology, Engineering, Mathematics), Faculty of Health Science includes students who are in the fields such as medicine, pharmacy, public health. Faculty of Humanity and Social Sciences, Faculty of Business and Finance, and other Faculties.

FINDINGS

Demographic Details

In this study, 43.8% *(N = 267)* of students are male and 56.2% *(N = 343)* are female. The students' age ranges from 16 to 25 years. 38.2% (N= 233) of students come from provinces and 61.3% (N = 374) of students come from Phnom Penh.

Table 1. Socioeconomic Backgrounds and Subject Choice

	Model 1			Model 2		
	B	**SE**	**β**	**B**	**SE**	**β**
Constant	2.21***	.38		2***		
Gender	.3***	.10	.10	.21**	.5	.08
Residence	.36*	.10	.14	.37**	.10	.14
Social class	-.00	.08	-.00	-.02	.11	-.01
Father's occupation				.09*	.04	.10
Mother's occupation				.01	.03	.01
Father's education				-.02	.06	-.03
Mother's education				.04	.06	.04
R^2		.032			,042	
F		4.951**			3.111**	
N		601			563	

*(*** $p < .001$; ** $p < .01$; * $p < .05$).*

The findings indicated that gender has strong statistical significance with subject choice *(*** $p < .001$)* in the first hierarchical model. However, the *P value* decreased in the second hierarchical model *(** $p < .05$).* This means that there are more women in non-

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science majors than men, which confirmed hypothesis 1.

Location of residence (province or Phnom Penh) has indicated its weak influence on the dependent variable in the first model *(* $p < .05$),* but medium decree of influence in the second model *(** $p < .01$).* This explains that more students in Phnom Penh are study non-science subjects.

In a social class relation, both hierarchical models did not show any relation between the independent and dependent variables, which did not confirm the second hypothesis. However, other independent variables such as father's occupation, mother's occupation, father's education level, and mother's education level, the results revealed that only father's occupation has influence on students' subject choice selection, but the influence turned out to be very weak *(* $p < .05$).*

Under this first stage of hierarchical model,

$$Yi = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_k X_{ki} + e$$

Constant = 2.215 ***, R^2=.032, ΔR^2 =.025, F= 4.951**, N= 605

Under the second stage of hierarchical model,

$$Yi = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_k X_{ki} + e$$

Constant=2.006***, R^2=.042, ΔR^2=.029, F= 3.111*

DISCUSSION AND CONCLUSIONS

The findings have indicated that gender socialization is strong in Cambodia, which can permit society, the job market, economic system, and education institution to overlook women's qualifications and potentials in the fields of STEM. Cambodia has a long history of neglecting women's education in general, not to mention the STEM subjects which scholars concerned about. As some people strongly considered STEM masculine subjects, women are reluctant to pursue and tend to distance themselves from STEM and reluctant to challenge social traditions and men's predominant positions. Those who stepped in STEM careers have overcome social and cultural factors such as gender stereotypes, patriarchal ideology, culture, and socialization. After graduation, competent women have to face the job market, which have male preferences. We think that gender disparity in science can be looked at from how feminists' arguments based on patriarchal control over women's body and decision making.

Social Practice

In this discussion of gender and subject choices, it is important to look at the details of the so-far explored factors in previous papers which concentrated on the issue. We think that in many cases, especially in a patriarchal society, selecting subjects from school to university, female children have a limited freedom of subject choice decision making. Parents or older siblings have a stronger say as they have more experience and authority. This allows a general social belief that it is an obliged duty of children and the younger ones to listen to their parents and the elder regarding education and other life matters, which many a times, the decision goes to male members in the family. Similarly, Guatam (2015) saw in his study that father tends to exercise more power in instructing and guiding daughter's subject choices. In the case that he did not decide, he instructed male elder siblings to help. Therefore, subject choice is firstly decided by family members as a part of social practice.

In the words of Howes, "practice of science is a social practice" (Howes, 2002, p.69). This argument reflected the social factors such as gender stereotypes and patriarchal system are misleading the women's perceptions in science subjects. On the other hand, it turns women away from STEM education and career (Koch & Gorges, 2016).

Science Identity and Gender

The second argument on gender inequality in science is the science subject identity itself, which perpetuates the general belief and have been differently demarcated from other non-science subjects. This means that science is a knowledge which have been treated and highly valued. Thomas (1990) debated that society and media generate three important belief factors on science. First, science is a different, outstanding, and superior subject which is not suitable for women. Second, it makes people assume that science is more difficult than other subjects. Third, people assume that science is good and has higher value and honor (Chanana, 2007). Though these claims are subjected to further debates and empirical evidence to confirm, but we think, women more or less hold back in science through its influences as they have been socialized by society to follow social norms and culture. Likewise, Dweck (1986) argued that women were trained to be caring and expressing feelings and emotions, but men were trained to initiate and invent something new, logical, and rational under the roof of culture and social norms. Therefore, early gender socialization has taught individuals how the identity of subjects are defined and how the subject is allocated within gender.

Education Institution and Curriculum

Education system and curriculum are a one set pioneer to effectively narrow down the gender disparity in science, as women can be more inspired and motivated through curriculum contents. Koch & Gorges (2016) suggested the initiation of STEM related curriculums during school years can increase women's interest in science, confidence, and participation. The measures can be started with school curriculum as previous literature indicated that curriculum plays a significant role in bringing women to STEM education and careers (Messersmith et al., 2008).

Thus, well planned curriculum can be an effective method to make female students encounter experiences in science and boost their interests in science. Experiencing STEM activities inside and outside the schools can reduce self-perceptions and science stereotypes. It is important to note that curriculum do not only motivate girl students to learn, but also to encourage educators to learn for themselves and encourage long term equal representation of gender in science.

Challenges in Science Career

It is obvious to say that gender bias in science leads to under-representation of women in science careers. On the one hand, those women who are already in the fields of science face challenges and stereotypes against their gender identity and careers. Challenges in careers mean that women have been discriminated in work place as scientists (Melguizo & Wolniak, 2012; Xu, 2015; Xu, 2016). For instance, significant differences in earning and career aspirations of women. It is also important to note that a gender earning gap exists across employment sectors.

All in all, we, in this study, neither aim at generalize the whole situation in Cambodia nor the world regarding the gender and subject choice. However, what we found in this study did indicate that socialization, science identity, science career have significant influence on subject choice in modern Cambodian education system. This would alarm scholars and policy makers about the situation, they should look for better and effective

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measures to bring more women to science education. In this context, media, education curriculum, role model, equal opportunity in science career…etc should be looked at.

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