CHAPTER 13

Women in Higher Education: A Vase-Breaking Theory by Female Technologists in Taiwan

Ya-Hsuan Wang

Introduction

Taiwan's preeminence as a kingdom of technology is reflected not only in its curriculum structure, but also in its gender allocation in terms of majoring in university subjects. By virtue of practicing *Gender Equality Education* in schools, more and more female technologists are working in universities while more and more girls are enrolling in technological subjects in universities. However, according to previous research (Wang 2010), rather than challenging gender inequality, female technologists actually reinforce patriarchal society. Taiwan has moments of gender equality—for instance, the first female, President Tsai, was elected in 2016 while transgender politician Fen Tang was recruited by the government and transgender teachers such as Janet Chen were hired in schools. However,

Y.-H. Wang (✉)
Institute of Education, National Chung Cheng University, Chia-Yi, Taiwan
e-mail: sunny.wang@ccu.edu.tw

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gender inequality is still pervasive in implicit and subtle ways due to patriarchal ideologies of gender status and stereotypes.

Responding to emerging social issues such as gender mainstreaming and gender equality in the multicultural and e-society, the *2004 Gender Equality Education Reform* that operated within Taiwan's particular sociopolitical context aligns with the revolution of gender structure in the field of technology and science. However, a recent Department of Statistics (2009) survey continues to show that the ratio of males and females in technology the university level is 78.3 to 21.7%, while that for humanities is 31.1 to 68.9%, and the social sciences 37.5 to 62.5%. Thus, it can be observed that gender disparity continues to exist in university subjects, and the gender gap in technology is still very prominent.

Technology has often been perceived in gendered terms. The normative and stereotypical notions of gender roles often stress that men are more interested in technology and science, while women are seen as voluntarily choosing to stay in nontechnology fields such as the humanities. However, these normative and traditional views of gender disregard the unequal structure in society, to which much gender differentiation owes its roots to social construction.

An empirical study by Wang (2010) shows that female technologists have successfully demonstrated both femininity and masculinity characteristics in comparison with men who are constrained by normative notions of masculinity. However, even while women have successfully entered the fields of science and technology, ostensibly breaking gender boundaries, often they are perceived in terms of "failing" to maintain their female identities in their performance of gender. Thus, it is significant to understand how women enact gender in their attempts to challenge gender boundaries and create further gender mobility.

Addressing the framework provided by the UN policy of gender mainstreaming since 1985, this chapter focuses on gender-technology relations. It challenges the normative notion of technology as a masculine culture and technology as a male institution. The chapter aims to propose a "vase-breaking theory" by integrating all multiple influences and positioning upon female technologists in terms of the domains of the personal, family, school, and society.

Literature Review

Lather (1991) defined gender regime as the power relations between men and women that determine the division of labor. Gender is one of the most salient principles of social relations; it shapes the conditions of human life including the allocation of power and privilege, and the formation of identity, consciousness, and social systems.

Brickhouse (1994) posited two ways of perceiving the equity project in science education—the deficit model and the inferiority treatment model of gendered stereotypes. The deficit model reflected the sexist tendency in gender research in the 1970s and focused on the mistaken belief that girls lack the cognitive skills to do science or perform abstract reasoning. The inferior treatment model was supported by evidence of girls with higher academic achievement, but lower involvement in technology, which focuses more on why girls "won't do" science, reflecting their low participation in the field due to gender discrimination. This research adapts the inferior treatment model.

Sexual politics in technology is a perspective that examines how gender constructs women and how elite women can break these social constructions. Connell (2006) rethinks several policies such as GIST (Girls into Science and Technology)/WISE (Women in Science and Engineering), by asking "do these policies make gender equality or gender discrimination?" If these policies asked women to surrender their femininity and reset a masculine identity, then GIST/WISE can change nothing (Wajcman 1991).

Wang (2014) analyzed four aspects of gender boundary crossings and proposed a successful discourse by women scientists and technologists. First, individual female success was based on emulation of masculinity, self-empowerment, and personal interests in multiple disciplines. Second, they received family support, as well as sufficient socioeconomic status, engaged male playmates, and operational toys in their youth. Third, schools supported them by enabling women role models in single-sex schools, and creating a talent class of math and science, alongside early streaming. Finally, social support came from a policy that stressed gender equality in technology in terms of achievement and participation.

Wang (2016) also proposed four "trap discourses"—*the discourse of anti-feminine selfhood* produced self-denial of women's rights, a self-exclusion effect of masculine women, achievement phobia, and incapacitating panic; *the discourse of shouldering women responsibilities* saw motherhood

as original sin, non-motherhood as stigma; *the discourse of de-feminization* came out of a no women-only space, sexual harassment, against femininity; and *the discourse of non-female community* reflected STEM as man's land. It corresponded to Guy's (1994) organizational architecture theory of a glass ceiling, glass walls, trap doors, and sticky floors.

Methodology and Methods

This study adapted a feminist approach to disclose the personal descriptions of female experiences in Taiwan's higher education. Individual interviews were conducted with 28 elite women, including 12 female university teachers and 16 female university students majoring in technology in six of Taiwan's top universities: *National Taiwan University*, *National Cheng Kung University*, *National Chiao Tung University*, *National Tsing Hua University*, *National Taiwan University of Science and Technology, and National Chung Cheng University*. All the interviewees were from a portion of the diverse ethnic backgrounds represented in the mainstream of Taiwan—most Fukkien Taiwanese, some Chinese, and a few Hakka Taiwanese. The details of the object of this study are seen in Table 13.1.

In this research, empirical data about gender-technology discourses were collected by individual interviews and oral historical interviews from 28 selected *elite females* (teachers and students majoring in technology in Taiwan's top universities). They were asked about their life experiences of "doing" technology, "doing" gender, and performing femininity or/and masculinity roles. Interviewing items were focused on their learning experiences in technology and its dilemmas, their motivations and the social models they followed, the successful self-understanding of elite girls in the field of technology; how they perceive their success, linking with their personal concepts of femininity or masculinity; how they have made/used/transformed/or discarded their femininity during their careers in technology; and how they interpret gender boundaries and gender mobility by mapping the gendered culture in the technology field.

Individual interviews were conducted with a brief description of the purpose of this study and the background of the researcher. This study is part of a two-year project funded by the National Science Council in Taiwan. The first year targets female technologists in universities and the second year female technology students in university. In most cases,

Table 13.1 Object of study

Age	32–57 (Older generation, university teachers)	12
	20–25 (Younger generation, research students, and undergraduates)	16
Marital status	Married, have children	7
	Married, no child	2
	Single	19
Position	Professor	6
	Associate professor	2
	Assistant professor	4
	Research student	8
	Undergraduates	8
Department	Electrical Engineering	7
	Physics	2
	Mechanical Engineering	5
	Biochemical Science and Technology	1
	Bioinformatics and Biosignal Transduction	1
	Architecture	1
	Computer Science and Information Engineering	1
	Biological Science and Technology	1
	Electronics Engineering	2
	Materials Science and Engineering	2
	Communications Engineering	2
	Aeronautics and Astronautics	2
	Medical Informatics	1
Total		28

Source Data collected by author

all the participants were willing to participate voluntarily in the project. Some participant's interviews were cut into several parts during the same day or different days due to their commitments. In total, the interview length for each participant was between 1.5 and 2.5 h. In order to double-check the quality of data, the study employed a follow-up investigation using Bem's (1974) Gender Role Scale. The scale investigates the type of gender role for the researched females—masculinity, femininity, undifferentiated, or androgynous.

Research Findings and Discussion

Based on the contextual data, this research concluded that elite girls did not grow up with specific gendered subjectivity and identity which was yet to be found in the women technologists' family, schooling, and social contexts.

Gender Discourse

Most of the girls in the study have strength in family support for technology learning. During their learning career in schools, they met some (but few) female technologists or scientists as social role models. Some of the elite girls were aware of gender inequality, which existed in their family or the wider society, yet most were not. They were not cognizant of the perception of technology as a masculine field, although the discourse of "men are good at technology" was found in their narration. The elite girls appear to be included in the field of technology, but they seemed to perform with more masculinity than femininity. The discourses of female-technologist nomination and strong-woman predication no longer appear to bother the younger generation. The boundary between masculinity and femininity for the younger generation is becoming blurred.

Individual: Masculine Women?

The above findings show that the female disadvantage in the invisible culture of gendered technology is mitigated. However, are they all masculine women? Based on Bem's scale investigation, the results are as follows.

Table 13.2 shows BEM's Gender Role Scale results by university teachers. Most are masculine women.

Table 13.2 BEM's gender role scale results by university teachers

	Masculinity	*Femininity*	*Typology*
TA	5.75	4.65	Masculine
TB	5.55	4.25	Masculine
TC	5.45	4.15	Masculine
TD	5	4.65	Masculine
TE	4.95	4.45	Masculine
TF	4.65	4.95	Feminine
TG	4.45	5.05	Feminine
TH	4.3	5.75	Feminine
TI	4.2	4.45	Undifferentiated
TJ	4.1	4.25	Undifferentiated
TK	4	4.55	Undifferentiated
Mean	**4.76**	**4.65**	M:5 F:3 U:3 A:0

Table 13.3 BEM's gender role scale results by university students

SA	5.25	3.75	Masculine
SB	5	4.1	Masculine
SC	4.75	5.4	Feminine
SD	4.7	5.05	Feminine
SE	4.65	4.9	Feminine
SF	4.45	5.3	Feminine
SG	4.25	5.35	Feminine
SH	4.8	3.9	Undifferentiated
SI	4.35	4.35	Undifferentiated
SJ	4.3	4.8	Undifferentiated
SK	4.05	3.7	Undifferentiated
SL	3.5	3.8	Undifferentiated
SM	3.4	3.6	Undifferentiated
SN	3.15	4.25	Undifferentiated
Mean	**4.33**	**4.45**	M:2 F:5 U:7 A:0

Table 13.4 BEM's gender role scale results

Gender role type	*Masculinity*	*Femininity*	*Undifferentiated*	*Androgynous*	*Sum*
Teachers	**5(46%)**	3(27%)	3(27%)	0(0%)	**11(100%)**
Students	2(14%)	5(36%)	**7(50%)**	0(0%)	**14(100%)**
Sum	**7(28%)**	**8(32%)**	**10(40%)**	**0(0%)**	**25(100%)**

Table 13.3 shows BEM's Gender Role Scale results for university students. Most are undifferentiated.

Table 13.4 indicates BEM's Gender Role Scale comprehensive results that masculine women constitute only 28% of the sample.

Although the quantitative data indicate that most of the participants are not masculine women, the interview data show that most of them consider themselves masculine. According to the qualitative data, female technologists performed masculinity more than femininity: e.g., preferring thinking and understanding to memorizing or recitation; preferring reading natural scientific mystery books to romantic fictions. The agreed beauty symbolized no professionalism. There is a dilemma that they mostly identify with male role models and adorn masculinity, but they cannot escape from the anxiety of being a "strong woman." The stigma of strong women is still in place. It corresponds to what Vaerting (1923) said of masculinity as the dominant sex.

Patriarchal Family: Not Really Bad?

Most females grew up in non-patriarchic families. They got support from their parents who provided their childhood with a good education, unisex toys, cultural capital, and high educational expectation. The most important support for the females is the family models in technology and science. Most interviewees identify with male role models in their family such as uncles or fathers working as engineers, medical doctors, or professors. Few of them identify with female role models in family, and yet they are really inspiring the interest of exploration.

However, is patriarchy really bad? Some participants grew up in a patriarchal family, but they still do well in technology fields. Although there is a popular argument that girls will benefit from a gender-free family as well as a gender equal society that is reflected in some of my participants, another argument reflects that some girls actually benefited from being in a patriarchal family, particularly from the older generation.

An older generation can take advantage of a patriarchic family structure in relating to the youngest daughter. In their own upbringing, parents had the highest expectations for boys. Elder daughters were trained to do housekeeping, yet the youngest daughter having essentially a "nobody status," was free from parental expectations which in a patriarchal society values masculinity and technology. Masculine women were welcome into STEM fields thanks to their man-like characteristics, and hence, they were enabled by patriarchal men, allowing them to survive in social structures with a strict gender boundary.

Masculine Schooling?

Schooling was perceived mostly unfriendly to girls' exploration into science and technology. Gender discrimination from the male gaze threatens girls' potentiality in technology. Female students had to spend much time crashing the "stigma of beauty," detaching the weakness-label, and moving beyond their teachers' Pygmalion effect. However, these constrains cannot by themselves dissuade girls' involvements in technology as long as they have female models and the freedom of inquiry in single-sex schools (radical feminist standpoint).

Feminist Society?

In recent years, Taiwan is gradually becoming a feminist society. Technology as a field was required to recruit more women in order to develop female technologies as well as fulfilling the demands of gender equality policies. There is a saying in Taiwan's vocational structure: Technology desires gender as well as gender equality. Therefore, within what is becoming a liberal feminism society, women university technology students perceive that the traditional gender stereotype of the "strong woman" has been transformed into gender reaffirmation. However, Taiwan is rooted nevertheless in a patriarchy society in which gender continues to have a strong direct effect on employment and family. As Yichi said, a female's achievement cannot be seen as her own success:

> Women are like working in a fishbowl. If we succeed, others criticize our success came from our beauty. If we fail, others justify female inferiority. Even in university our professors made me hate my gender. When my ability in SECT was well presented, my university teachers appreciate my effort rather than my potential. It seems to them my success is temporary because I work very hard. I was never recognized by my SECT talent. He even then said to me, "how come you beat your male classmates!" I then asked myself, shouldn't I beat men? (Yichi, 22 years old, undergraduate student, Department of Healthcare Information Management).

In society, numerous obstructions exist for female technologists: Women with a sense of alienation due to gender distances from men have less female models in SECT; women often threatened by dirty sex jokes could be disadvantaged by gender divisions of labor in SECT; women have the dilemma of choosing between a career and family. Most importantly, women themselves have the self-doubt syndrome because they don't *believe* their gender as others do.

The "older generation" encountered more obstructions than the younger generation, especially when they need networks for cooperation research. As a minority group in science, females lack societal resources and support and hence they work alone (Wu 2009). Much of the older generation had difficulty gaining access to international academic conferences and/or seeking or joining big cooperation projects, as Gueilang has said:

> Gender minority has impact on developing work groups. For example, women are disadvantaged in the social occasion. I feel uncomfortable in the international academic conference, which is full of male scholars, but I have to attend it. I have nobody to talk to during the coffee break. I was aware of being lacking of social networks. Women are too rare in the field of engineering to develop a cooperative project. We cannot be like men who are freely bud(d)y bud(d)y in the unformal situation and they easily found networks and budget for research cooperation (Gueilang, 52 years old, Professor Electrical Engineering).

However, the uprising of feminism in society encourages technology females by establishing a lot of new opportunities within which females can work. Thanks to such feminism promotion, there are increasing female associations of SECT in which females can communicate and share personal experiences as well as seek cooperative partners.

> I found the feminist society helpful. Women may encounter the similar problem while working and managing their career in the field of technology. A female association can offer great opportunities to share and to talk about it. We need the female engineer society. I believe it can keep more females in engineering. (Chenwei, 38 years old, Associate Professor, Electrical Engineering)

Above all, in contemporary society technology females are offered some societal support such as gender equality, female-relevant technology, female recruitment, and other privileges made available by gender programs. In this aspect, however, they have to overcome plenty of threats from the still dominant masculine culture, including an unfriendly workplace, shortages of female networks, and the constant dilemma of the demands between family and career.

As a whole, the advantageous forces and obstructions for women doing technology are summarized in Fig. (13.1). It is a so-called vase-breaking theory for technology females that I have constructed. It shows that the female can break the gendered technology frame by establishing the advantageous forces (inside the vase) and overcoming the disadvantageous forces (outside the vase). In this case, women can accomplish big businesses such as doing technology or doing science distinguishably. In this way, the vase woman stigma can be broken

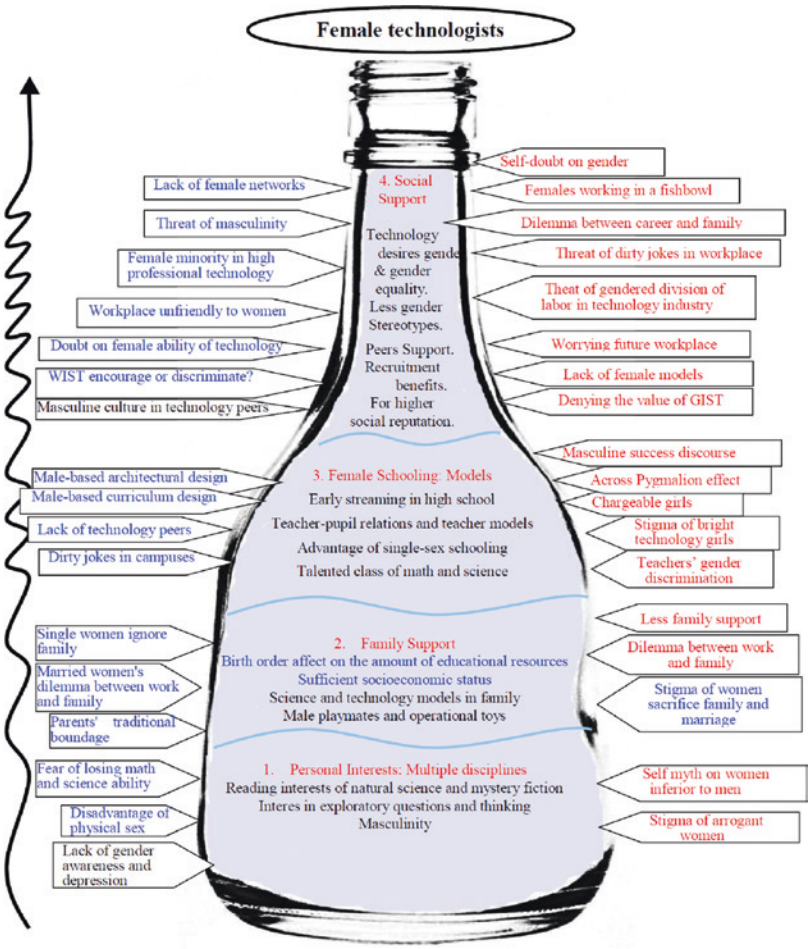

Fig. 13.1 Vase-breaking theory

and promote a move away from historical gender inequality. Also, through the vase-breaking theory, the masculine ideology need no longer dominate the technological fields through the positive gender discourses.

Conclusion

Is the technology-gender boundary still fixed or mobile and flexible? My first augmentation is that it is still in place. Female technologists across three generations still adore masculinity without involving a resistance against patriarchy. In their interviews, they were quite independent and positive about the potentials in technology in terms of their own selves, family, and school aspects, yet they became increasingly dependent and impotent in a technology social space after working in "man's land." Most female technologists developed their networks in STEM depending on their husbands, teachers, and colleagues (all of whom are males). The social capital they represent is the key to succeed in SECT that is still a male and masculine institute as Phipps (2008) has maintained.

Yet my second argument is this social space is already mobile. For the younger generation currently at university, masculinity no longer fully penetrates the technological fields through space domination and its authority structure. However, female students are still under the protection of an educational umbrella. They might not experience the social exclusion by gender in many aspects, especially in academic seminars or workforce, where males best perform their masculinity. A gender formation is being allowed to be redefined that breaks the dualism of men/women and femininity/masculinity (Berila 2011).

In conclusion, a gendered structure reproduces a gender ideology in which males are superior to women in technology fields as well as in the wider society. Gender inequality in Taiwan is still in place but has improved over the years within universities with the *Gender Equality Education Act*. Compared to the older generation, this younger generation is more fully included in technology, but they don't feel the demand of "performing masculinity" as males. In short, elite girls have broken the gender boundary in technology thanks to their personal interest, family support, and school empowerment from which they have gained power in the field of technology. Gender mobility is seen in the elite girls who have survived in the social structure of a loosened gender boundary.

Femininity is more welcome in the social world of elite girls than that of female technologists. A vase-breaking theory is based on those female technologists who can appropriate both the supporting and resisting forces from individuality, family, schooling, and society.

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