GENDER AND TECHNOLOGY EDUCATION – theory and background.

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Abstract

This paper explores issues of gender as they relate to Technology Education in recent decades. It examines issues that have shaped gender participation and engagement in this area of learning.

Since the 70's there have been efforts to address the stereotyping of areas of learning according to gender, with technology being a prime example of an area that had been regarded as a males-mainly activity. Forty years on female students are still engaging in school studies that were traditionally regarded as gender appropriate, as are boys.

The examination is concerned with students in secondary education from the point of view of the orientations of biological, socialisation and cognitive approaches. That is, how do students learn and function within Technology education and how do these factors feature in students' decisions about technology education?

Introduction

This paper explores issues of gender related to technology education and discusses theoretical issues that shape gender participation and engagement in the secondary years of schooling.

The issue is explored in terms of three factors which shape how girls learn and function in technology education. The first is the biological factor. The second factor explored is socialisation and the third are the cognitive approaches that are specific for girls.

One hope was that the digital age would help to create equality in terms of access to and involvement with, technology. The United Nations have programs which aim to reduce inequalities in the technology field. The paper concludes with some recommendations for gender responsive programs which promote the sustainability of girls in technology education classrooms.

In examining the theoretical issues that have shaped gender participation and engagement in technology education, this paper adopts the definition adopted by the Australian national curriculum writers; that Technology education encompasses the practical and creative technologies including information and communications technologies (Australian Curriculum Assessment and Reporting Authority, 2012).

A social constructionist stance says that we acquire knowledge via the environment and that gender relations are socially constructed. It is then argued that, by changing the social and environmental factors from ones that reinforce stereotypical behaviours to ones which better suit girls, their interactions, engagement and learning will substantially improve in technology education classrooms. By making the environment more female friendly we improve the social and cognitive ability of female's learning. These actions it is argued will improve retention and participation rates of female students. In the longer term this may influence the uptake (the flow on) into tertiary courses in fields such as engineering at universities - the STEM subjects.

Gender equality is one of the six goals of the global *Education for All* campaign launched by UNESCO in 2000 under an agreement to *eliminate gender disparities in primary and secondary education by 2005. The aim was to achieve gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality* (UNESCO, 2012b).

The UNESCO Gender Equality Action Plan (GEAP) promotes three main outcomes at the organizational level. Firstly an increase in the number and quality of gender-responsive and gender transformative programmes. Secondly to empower women in Member States through policy dialogue and thirdly through a commitment to gender equality institutionalized in UNESCO programming.

The most recent gender mapping by UNESCO in 2012 shows that while gender ratios are increasing in secondary education across the globe more than four out of every ten countries have gross enrolment ratios (GER) of less that 80 % of the total school population. In 1970 and 2009 the global average GER for males rose from 48 to 69 %, while females increased from 39 to 67 %. The vocational nature of secondary education in some countries is recognised as a reason for why girls do not participate (UNESCO, 2012a).

Theoretical Issues

In examining the theoretical issues that have shaped gender participation and engagement in technology education the biological, social and cognitive domains need to be examined.

The Biological

Sex is a descriptive category used to designate female and male. Gender is a social category (Rothschild, 1988). Petrina discusses the fact that differences are not determined by biological sex (Petrina, 2007). There are many examples of high achieving female's world-wide.

Ehrhart and Sandler in 1987 noted that upbringing and socialisation play powerful roles in forming a child's abilities and confidences: reinforced not only by parents and teachers, but also by the media- teaches children roles, attitudes and behaviours thought to be 'appropriate' for each sex. In general boys are encouraged to be active and independent, to explore and to learn how things work. Girls are 'taught' to be passive, verbally oriented, and dependent. Boys receive chemistry sets, building toys, trucks and sports equipment; girls receive dolls, kitchen equipment, and sewing and embroidery kits. Parents' expectations that their children's interests and achievements will follow traditional sex roles will steer girls away from certain curriculum areas; in contrast, encouragement from parents for boys to succeed in math, science, and technology is crucial in student's decision to take or not take these courses in high school (Petrina, 2007; Fleer & B. Jane, 1999; Fleer & B. Jane, 2004).

Psychologists tell us that differences in socialisation are manifested in neurological and physiological differences between the sexes. Fuller suggests that the differences become hard wired over time and hence are not easily overcome (Fuller, 2011). Stereotypes, as such derive from gender norms and sex roles not from gender itself.

Social domains and feminist critique

Feminist critiques emerged in the late 1960's in response to the growing social critique of the directions of science and technology and originating on university campuses with interdisciplinary courses with social content (Rothschild, 1988). Feminist scholarship aimed to develop a body of work about women's lives and their contribution to society and secondly, to develop a distinct feminist theory and approach to knowledge. The 1970's saw the development of this research linking with the curriculum. There was a slower emergence of feminist research and teaching in science and technology fields, STS (Science, Technology and Society) programs. Two reasons may explain this. Firstly there were fewer women in these fields and secondly not only the culture but the subject matter in these areas had masculine associations. Technology fared better than the scientific fields. Works highlighting feminist issues were published in the early 1980's and brought feminist perspectives to technology in three ways. Firstly through the history of technology, uncovering women's contributions to invention and innovation which helped redefine what was seen as significant technology. Secondly research went into the relationship of women's traditional work – as producers and reproducers – to technological development and change. Finally it explored and questioned the values and frameworks that underlie both the study and practice of technology (Zuga, 1999).

Stanley's work (Stanley, 1992, 1993, 1998) demonstrates that historically fields of endeavour that the focus from female to male activities have altered. The social structure for computing knowledge as a device was used as a relay or vehicle for power relations. Computers and digital technologies became the pedagogic device of the struggle and conflict between groups, students, parents and administrators who sort to control the production of the discourses. Bureaucratic agencies including the school support centres, software production services and school experts who would produce, transmit and acquire school computing knowledge controlled the mechanism (Singh, 1997).

Wacjman (Wajcman, 2000, 2004) writing on techno feminism argues that the concept of technology since the start of the century is based on male activities and traditions and those characterizations continue to define technology by affecting the design and development of artefacts which are tied to social networks. In Feminism Confronts Technology, (Wajcman, 1991) talks of the differential impact of technological change on women and men - focuses on examining social shaping of technology. Artefacts are shaped by gender relations and have meanings and identity. The exploration of the hierarchy of sexual difference affects the design, development, diffusion and use of technologies (Bijker, 1995). Pinch and Bijker's (1989) work saw technology as a reflection of society and therefore requiring a constructivist approach. Stanley (1998) has developed the notion of gender and functionality within technology. Spender (1980) in analysing the power and control of language as against the artefacts and function claims that it is this gendered nature of control that is shaping education now.

The five perspectives from which females perceive truth and knowledge need to be acknowledged in order for females to thrive towards self-realization. These are women's self-concepts, the power of ones' mind, knowing and reason and the institutions they function within; families and schools. The interests of females learning is not necessarily vested in

formal education but rather the inner self and the totality of living (Blenkley, Mc Vicker, Clinchy, Goldberger, & Tarule, 1986).

The question of what may be the difference in how genders learn was addressed by Jon-Chao Hong, and associates in a qualitative study which concluded that there was little difference apart from time management and a lack of knowledge base on the girl's part. (Hong, Ming-Yueh Hwang , Wong Wan-Tzu, Lin Hung-Chang, & Yau Che-Ming, 2011). Danilova and Pudlowski (2010) says that one size does not fit all when it comes to technology and engineering studies. The shrinking pipeline could be due to the use of learning styles that attract some participants and not others. In appealing to teens Persson says we need to acknowledge that issues of gender, design and culture exist and should mould what values are placed on artefacts students wish to work with and relate to (Persson, 2010).

To move forward Wajcmen says, *'We need to bridge the common polarization in social theory…..Technology must be understood as part of the social fabric that holds society together; it is never merely technical or social. Rather, technology is always socio-material product – a seemless web or network combining artefacts, people, organizations, cultural meanings and knowledge'*(Wajcman, 2004,106).

Technology and cognition

Weber and Custer in their 2005 study concluded that both genders entered Technology education courses with preconceived notions about the types of activities in which they would engage. The challenge for curriculum developers is to make connections between the skills and concepts of some under- rated subject areas and make them more appealing to one or both genders. Weber and Custer (69) called for more research to better understand the dynamics of student preferences for technology related topics, activities and pedagogical approaches.

> *"Pedagogical considerations are also critical to sound gender-balanced curriculum design. Research has found that there are instructional methods, learning styles, and interests that can be characterized as distinctively female. (Brunner C., 1997; Zuga, 1999)*

Petrina in discussing teaching methods for the Technology classroom claims that some groups may require differential treatment to have a fair chance to participate and perform. Equal outcomes may require differential treatment… we have to attend to the barriers as well as intervene in the status quo conditions to achieve equity and equality in technology studies.

Biases are hidden and subtle as well as obvious. Sex-bias or sexist curriculum materials in technology tend to give girls the message they are not important. Language that is not consciously gender- specific tends to default to the male in technology courses.

McMahon and Carol suggested in 2001 that career development programs should begin at the primary school level (McMahon M. & Carroll J., 2001). The 1950's witnessed growth which focussed on vocational aspirations of 'generic' adolescents and adults. Aspects of maturation and parental influence with a minor influence of gender and culture added to expectations of work and in turn study requirements (Ford, 2011). The prevalence of different occupational aspirations according to gender is linked to the stereotypical educational expectations from an extremely early age. Ford's study showed the gendered view of work stemming from the earliest years of education (6).

Australian government policy has looked to redress educational inequality in The Karmel Report of 1973 (Australian Govenment, 2003; Karmel, 1973). Steps toward equity have not been sustained over time.

In Conclusion

Three key factors that emerge from the research literature concerning the steps teachers can take to positively discriminate for girls in technology education classes. Initially it is the perception of the 'trades days' gone by and what parents remember of manual arts classes, cooking, sewing, Shop A and B that continue to drive subject choices and ultimately career choices for our current generation of youth. We must address the sex divide.

Secondly, modern technology education provides avenues for enhanced female learning in all these spheres and we are presently at a critical juncture when the national curriculum is being written and implemented. There is no better time to be commenting and making ones voice heard. Lerman, Mohun and Odenziel tell us we should not focus just on females but it is crucial to look at the pairing of femininity with masculinity. Femininity is not the only social boundary used to render technological activity invisible (2003). Technology as a system, has the potential for the distribution of power but it is the importance of context in understanding technology, and the importance of technology in understanding society that takes us past the 'old' boundaries that we have been burdened with in the past.

Finally an awareness of the feminist issues and values is crucial to assist educators to overcome the stereotyping that still occurs subliminally and in language discourses and enactment. One off programs to promote STEM and entry into engineering programs has not proved to be long term solutions. We as educators need to build notions of technological literacy at the earliest ages we can reach children and their families, in order to address the social perceptions that continue to haunt us.

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