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Gender and Technology Education: Some Theoretical Implications.

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

Since the 70's when technology started to be seen as not the exclusive preserve of males, 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-only activity. However, forty plus years on female students are still engaging in school studies that were traditionally regarded as gender appropriate, as are boys.

The examination is concerned particularly with post compulsory education students (typically years 11 and 12) 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 in recent decades and discusses theoretical issues that may shape gender participation and engagement in the post compulsory schooling years within the context of technology education.

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. As educators we may aim for gender neutral programs and teaching units. Is this what really occurs? Is it the reality in schools, in enacted programs and curriculum documents? 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, however, research has shown that the digital divide has heightened inequality. A brief overview of the United Nations Program which aims to reduce inequalities in all fields is provided. Finally some recommendations for gender responsive programs which promote the sustainability of girls in technology education classrooms are outlined.

In examining the theoretical issues that have shaped gender participation and engagement when considering technology education, this paper adopts the most inclusive definition of technology education 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)

The paper takes a social constructionist stance 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 girls learning. These actions are argued will improve retention and participation rates of female students. Ultimately it is these rates which have an influence on the uptake (the flow on) into tertiary courses in fields such as engineering at universities.

Gender equality is one of the six goals of the global *Education for All* campaign that UNESCO launched in 2000, when the countries of the world agreed 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:

- A progressive increase in the number and quality of gender-responsive and gender transformative programmes and initiatives in all sectors.
- Women's empowerment and gender equality in Member States advanced through policy dialogue and programmes promoted by UNESCO.
- Commitment to gender equality institutionalized in the Secretariat and in programming.

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) (p 45) Petrina discusses the fact that differences are not determined by biological sex. (Petrina, 2007) There are many examples of high achieving females world- wide. The issue is differences that are dependent on socio-cultural factors such as bias, overt discrimination, differential treatment, isolation, socialisation and stereotyping.

Ehrhart and Sandler (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. (Ehrhart & Sandler, 1987) 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 & Jane, 1999, 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 campuses with interdisciplinary courses with social content. (Rothschild, 1988) (p. 2). The purpose of feminist scholarship was to develop a body of work about women's lives and ideas and their contribution to society and secondly, to develop a systematic critique of existing scholarship and a distinct feminist theory and approach to knowledge. (p. 4) The 1970's saw the development of this research plus its linking with the curriculum. There was a slower emergence of feminist research and teaching in science and technology fields and with less visibility than the liberal arts fields. The STS (Science, Technology and Society) programs became known and linked to technological literacy. 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. (p. 4) Technology fared a bit 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 epistemological frameworks that underlie both the study and practice of technology. It is the transformative nature of the critique in this final area where studies of and about women in technology have emerged and made some positive changes notably through the writings of feminists such as Zuga and Wajcmen.

Spender, in her seminal work argues that men control language which in turn works in their favour. (Spender, 1980) Her thesis demonstrated that men have use and control of more positive language and thus ensured themselves the opportunities to use this from a power perspective. In her 1990 preface she speaks of the theory of good conduct broken by the suffragettes who have paved the way for some yielding of power. (xi) In examining positive and effective classrooms some analysis of gendered language and technology specific language used in the learning environment will be undertaken as part of a larger study in order to establish if the use of terminology does detract from female participation. Petrina would suggest that this is so in the United States. (Petrina, 2007)

Stanley, (1992, 1993, 1998) and her subsequent work on the history of technology cites many authors who talk of the silence of women in the technological developments throughout history. One notes over time that technical activities related to man are seen as technological and engineered whilst those related to women are craft and home making. Stanley (1992) demonstrates that historically and in fields of endeavour that the focus from female to male activities have altered. Singh refers to the discourse related to computer, the production, transmission and acquisition of school computing knowledge

based on the Bernstein model. (Singh, 1997) That the social structure for this knowledge is a device which at the time 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 and software production services as well as classified personnel and school experts who would produce, transmit and acquire school computing knowledge controlled the mechanism. (p. 3 – 4) The aim of the Federal and State Labor Governments during the 1980's in Australia was to link the language of computing to the market place but also to produce technologically literate workers for the needs of industry and this was tied to the social justice platform of gender equity. (p. 3)

Wajcman, (2000, 2004) writing on techno feminism highlighted that at the start of this century we were at an intersection of feminist studies, techno-science and Science, technology and society. The newly emerging info- age of communications then and now lends itself to a bright future for technology that should not hinder gender. Wajcman argues that the concept of technology 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) she strongly puts the case for developing feminism in social science debates in Technology. 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 had written of the gendered artefacts and the nature of sociological change from a gender perspective. (Bijker, 1995) Pinch and Bijker (1989) work saw technology as a reflection of society and therefore requiring a constructivist approach. (Pinch & Wiebe E. Bijker, 1989) Stanley (1983, 1993, 2002) has developed the notion of gender and functionality within technology. Spender (1983) in analysing the power and control of language as against the artefacts and function of Stanley's work claims that it is this gendered nature of control that is shaping education now. Blenkley, Clinchy, Goldberger and Tarule (Blenkley, Blythe Mc Vicker Clinchy, Nancy Rule Goldberger, & Jill Mattuck Tarule, 1986) in *Women's Ways of Knowing*, despite its era questions the power and authority elements of women in society but projects that only certain students will grow beyond their dependence on the existing that is articulated in a male dominated society. The five perspectives from which females perceive truth and knowledge need to be acknowledged in order for them 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. (pp. 5-6)

The Blenkley et al discussion leads to the question of what may be the difference in how genders learn. Jon-Chao Hong, and associates in a project based qualitative research study 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) This limited study did not seek the depth of feminist

critique. Danilova and Pudlowski (Danilova & Z. J. 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 Wajcman 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 seamless web or network combining artefacts, people, organizations, cultural meanings and knowledge'. (Wajcman, 2004) (p.106)

Technology and cognition

Feminist critiques have brought a broader perspective to the study of technology education. 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 (Weber & Gerard Custer, 2005) (p. 69) recommended that there needs to be 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. (p. 334) 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. In the US as early as 1972 Title IX of the Education Amendments prohibited sex discrimination in all aspects of federally funded education programs. As recently as 2007 girls in US and Canada continue to be relegated to traditionally female programs, which ultimately impacts their earning power and job prospects. The National Women's Law Centre in 2002 concluded that bias counselling, the provision of incomplete information to students, and consequences of career training choices, sexual harassment of girls who enrol in non-traditional classes and other forms of discrimination conspire today to create a system characterised by pervasive sex discrimination. (Petrina, 2007) (p. 3)

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. History of technology again portrays inventions and innovations made by men, and in most cases white men. Language that is not consciously gender-specific tends to default to the male in technology courses. (p. 335)

In reviewing gender and career aspirations McMahon and Carroll suggested that career development programs should begin at the primary school level. (McMahon & Carroll,

2001). Ford, following on from the work of McMahon and Carol notes the retreat from feminist discussion which places girls and women at the centre of theory and inquiry in the area (Ford, 2011). The 1950's witnessed an intensified 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. The prevalence of different occupational aspirations according to gender is linked to the stereotypical educational expectations from an extremely early age. Ford's research study in 2011 again showed the gendered view of work stemming from the earliest years of education.

Subsequent decades of Australian government policy has sought to redress educational inequality. This includes the Karmel Report of 1973. Policy makers then recoiled from equity for girls into programs such as the Boys Lighthouse Programs which reclaimed any perceived disadvantage that may have changed the face of education but not the underlying social intent of educational provision. (Australian Government & Department of Education Employment and Workplace Relations, 2003; Karmel, 1973)

In Conclusion

This paper argues that there are three key factors that emerge from the research literature concerning the steps teachers and program writers 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 in 2003 in summarising their edited work of gender and technology provided some seminal insights into technology and gender.(Lerman N E., Ruth Oldenziel, & A Mahun, 2003) 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. We need to heed the social ideologies and power and then address why some technologies acquire power status while others remain invisible. (p. 436 – 437) 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 critique, issues and values is crucial to assist educators to overcome the stereotyping that still occurs subliminally and in language discourses and finally in the 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. The UNESCO data of 2012 shows that gender is an important issue within Education For All - everywhere.

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