

Gender identity and meaning making in specialist IT classes

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Abstract: An exploration of how year 12 students in a New Zealand high school make meaning of their experiences of different specialist IT (information technology) courses shows that gender identity is a potent factor in their experiences. At a personal level, individual students, males and females, construe their experiences of CPS (computer studies) and TIM (text and information management) courses differently. However, students tend to think of different computer activities as masculine and feminine practices. They imbue courses with masculine and feminine identities, depending on the type of computer applications, knowledge and skills that are emphasised in the courses. These are socially defined notions of computing activity as gendered practice. Also, students' experiences are tied up with ideas about what sort of computer practices are consistent with their developing and personal identities as male and female students of IT and computer users. This has implications and raises questions for those who are concerned with a perceived 'problem' in the under representation of females in computer science and related courses. It suggests that the 'problem' is more complex than it may initially appear.

Introduction

This paper explores how students in specialist IT (information technology) classes make meaning of their experiences of IT courses. In specialist IT classes, computers comprise both the subject and the mode of study. The terms "IT" and "computing" are used here in their broad sense to encompass a range of computer-related practices. A basic precept of the discussion is the idea that students are central players in the education process. They are active and purposeful agents in their own learning experiences, not passive recipients. This is not to lose sight of the social constructions and institutional arrangements within which individuals operate. In particular, the intention is to shine light on how gender, the social construction of sex, is a factor in students' experiences of specialist IT courses.

Student agency, identity and experience

Student agency is commonly thought of as the capacity of individual students to influence and control their own lives and experiences, including learning. This is manifest in a range of actions – choices made, advocacy and support, resistance and challenge. However, individuals do not exist and act in cultural, historical and institutional isolation. A socio-cultural view of agency has it that the choices and actions of individuals are socially mediated (Wertsch, Tulviste, & Hagstrom, 1993). Student agency, then, is integrally linked to social group membership and identity.

One way of conceptualising identity is that of possible selves. Possible selves describe peoples' ideas about who they are and what they might become (Markus & Nurius, 1986). These possibilities are socially constructed and negotiated in different life domains, such as home, work and school. Possible selves are gendered selves.

...when adolescents are considering their future selves, girls and boys have different cognitions about most probable and most promising selves which may affect their future career aspirations. (Curry, Trew, Turner, & Hunter, 1994, p.136).

The concept of possible selves implies multiple masculinities and femininities, that is, a range of roles or identities that can be adopted by males and females in different social *milieu* or contexts. Students negotiate their concepts of self in the context of their families and peer groups, in home, school and other social settings. These negotiations are reflected in their actions and behaviour.

...ultimately my students are in charge of how they spend their time, how they wish to be seen, who they wish to be. They are active agents, critical decision makers. When it comes to visible effort in public – in front of peers and rivals for peer-group status – student decision making becomes a high-stakes matter of self-definition in which academic behaviors may directly conflict with social identity needs. (Jackson, 2003, ¶5)

Students' concepts of possible selves, then, are influences in their schooling experiences. Thinking in terms of IT education, individual boys and girls might hold different concepts of possible IT selves in relation to their life and career aspirations, that require different computer skills and knowledge. Consequently it could be anticipated that they would be likely to favour the computer practices and courses that they think would best prepare them for their anticipated roles in society and to respond differently to the curriculum that is presented to them in different classes. These notions of self, as IT users and learners, might conform or offer resistance to gender stereotypes pertaining to IT use and roles. The notion of possible selves and student agency as a nexus between the psychological and the socio-cultural, or between the personal and the social, helps to make sense of the ways that students give meaning to their experiences.

Experience is a nebulous concept. It is a word often used in educational research literature, but rarely defined. Yet it is a concept central to social science research, which is concerned with humans and their relations with themselves and their environments (Clandinin & Connelly, 1998). To experience something, such as an IT course, is to go through some sort of process, to undergo some sort of transformation. To be experienced is to know or understand something, to make meaning of what one does and observes. That knowledge may be shared by others or be uniquely personal. One person's experience of an IT course may be quite different to another's. However, although experience is a personal condition, defined by the knower, it is not a private condition. It is not acquired in a social vacuum (Serpell, 1993). Experience, then, is unique, but it is also socially constructed. Experience derives from the personal and social agency of people, as individuals and as members of social groups.

Describing students' experiences of specialist IT classes is problematic. Experience is intensely personal and only fully knowable to the person having the experience. However, one can look for clues about students' experiences in their language and behaviour. Although individual males' and females' experiences are by definition unique, it may be possible to discern common factors or influences in those experiences.

Research context

The data for this paper comes from qualitative, case study research relating to two year 12 case study classes, 12CPS (computer studies) and 12TIM (text and information management), in a New Zealand High School, KHS (Kahikatea High School). The data was collected in 2001, as part of a broader study involving three case study classes at years 9

and 12. Selected students were the focus of classroom observations at different times in the year. These students comprise what Yin (1994) would call embedded cases. The data takes the form of *in situ* observation records and semi-structured student interviews, which were conducted with small groups (pairs) of students. In the interviews students explained and accounted for their experiences of different IT courses. These interviews are the primary information source for this paper.

Kahikatea High School is an ordinary, mid-decile¹, urban, co-educational high school. The school has not been subject to extraordinary financial support for IT developments. In year 12 at KHS, students have a choice of two specialist IT courses in their subject options. These courses derive from different IT traditions and curriculum domains and they are administered in different departments – CPS in the computer studies department, and TIM in the business studies department. However, both are essentially introductory computing courses and are based on utilitarian, user-oriented, applications-based, technocratic “how to” constructions of computing. They are located in what Moursund (1997) calls the computer-as-tool paradigm. They introduce students to a range of common applications, including word processing, databases and spreadsheets. Points of distinction derive from the inclusion of different applications and emphasis on different skills. For instance, programming is part of the CPS course, but not TIM, and in TIM greater emphasis is given to keyboarding skills and text production.

The 12CPS class is a mixed-gender group, although males outnumber females. In contrast, the 12TIM class is an all-female class. Students, then, have exercised their choices in a way that has created differently gendered participation patterns in the 12CPS and 12TIM classes. The school has facilitated these choices and patterns in the way that the curriculum is organised, that is, in the provision of multiple subject offerings from different IT traditions. This provides a context of gender contrast within which to investigate the meaning students make of their experiences in specialist IT classes.

Personal experiences of IT courses

Individual students in the 12CPS and 12TIM classes construe their experiences differently. Most of the students in these classes describe their experiences of the specialist IT courses in which they are engaged in positive terms, but some are more ambivalent or negative in their constructions. A range of factors plays a part in how individuals understand their experiences and their attitudes towards the courses. These factors include expectations and aspirations, prior experience with computers, the pedagogy of the classroom, classroom relationships and achievement or performance. These factors are linked, but any one factor may be of greater and lesser significance to an individual. The differences in students’ experiences highlight the personal and social agency of students as they give meaning to their experiences. Ben, Lisa and Mason in 12CPS and Angela in 12TIM provide examples of students who construe their experiences of specialist IT courses differently.

¹ Decile ratings are based on the socio-economic characteristics of school communities. A decile 10 school has a high socio-economic rating and a decile 1 school a low rating.

Ben

Ben is interested in computers and has a passion for computer games. He identifies as a game-playing boy and is keen on violent, role play/adventure computer games.

Bn (Ben): Um, it [playing computer games] just, it helps us relax, helps us crash. It, you know, it brings out the guys instinct just to crush, kill and destroy. So, you know coz if you look at most of the good games it's got blood, its got explosions, its got people dying, its got, yeah.

He aspires to know more about how computers work and to join the ranks of the students (males) he considers to be computer experts. These are the students who are seen by their peers to have superior technical knowledge of computer hardware, software and systems. Computers tend to comprise a hobby or sport for the computer experts. They engage in computer gaming and are recognised as people who like to tinker with the technology. They are computer controllers and players. Ben's gaming interests give him partial membership of this group, but he would like to have more extensive knowledge of the type that is possessed by those that he holds to be experts. There is a sense that he feels somewhat inadequate in not having this type and level of knowledge.

Ben is disgruntled and disappointed that the 12CPS course isn't what he expected.

Bn: Computer studies, sort of, sounded a lot more like you would learn more about the computers and putting them together, which I was *wrong*_ I, I thought because_ you know I thought it would teach me about the_ the components and chucking them together and shit like, stuff like that... Yeah, that that's what I wanted but I didn't get that_ Oh well.

Ben's images of what CPS should be is of technical and computer science constructions of computing, rather than the applications-based construction of his experience. His ideal of what learning in 12CPS should entail and his expectation of the course are in conflict with the reality of his experience. This is the basis of his disappointment and attendant ambivalence about the 12CPS course at KHS.

Lisa

Lisa also expected something different of 12CPS, but her expectation is different to Ben's.

L (Lisa): Well I thought, you know how you get the big menus when you, I thought you would probably just go through and learn what like all of them were. Just like we could go into Word, go into Works, just learn the basic stuff_ And then you'd, he'd show us a different program and say this is the basic stuff in here, maybe give us a few exercises and then he'd choose basic stuff on something else and then we'd get to learn to use the Internet correctly, maybe, and_ just basically learning more about the actual computer, not about making a computer program or_

What Lisa means when she says that she expected to learn "more about the actual computer" in 12CPS is that she anticipated learning how to use a range of generic and everyday applications, to become familiar with the various software application's menus and to develop skills related to document production and communication functions. These include keyboarding/typing, the production of pictures and graphics and the use of the Internet. It doesn't

mean learning about the hardware and operating systems. Her image of what CPS should be is aligned with information management and office practice models of computing. She values the aspects of the course that involve learning about word processing and database applications, but she dislikes components of the course she associates with mathematics, particularly programming. As far as she is concerned, programming is difficult, boring and of no interest or use to her. She makes a negative comparison between CPS and what she thinks happens in TIM, which she thinks involves doing “cool” formatting, drawing activities and fun projects.

At a personal level, Lisa is negotiating a personal identity as a computer user, some one who has skills and knowledge to use a range of common applications. She wants to pursue a career in broadcast journalism. Lisa sees herself as a non-mathematical, arty person and student. Based on previous school experience she has learned that she is not good at mathematics and is disposed to dislike anything that she associates with mathematics. She rejects the possibility that she could or should pursue mathematical computer learning, even though she is doing relatively well in assessments related to a range of applications in 12CPS. Thus there is a disjunction between Lisa’s expectations and her experience of 12CPS. Her concepts of self, which define and preclude particular futures, are at odds with the 12CPS course and its perceived emphasis on programming and mathematically oriented computing practices.

Socially, Lisa appears to get on well with her peers in 12CPS. She and her immediate neighbours consult and assist each other with computing tasks. However, there is a sense that she feels like an outsider in the 12CPS class. Lisa doesn’t really identify as a CPS girl. Her interests seem to be more closely aligned with those of the TIM girls. She signals that she thinks, in hindsight, that TIM would have been a better subject option for her.

Mason

In contrast, Mason identifies very strongly as a CPS boy. He is a computer enthusiast for whom computers are his hobby and likely future employment. He wants to be a programmer and plans to go to polytechnic next year to pursue computing studies. Mason indicates that he regularly engages with computers out of school, playing around with and building computers in his spare time.

M (Mason): Well, my Dad_ we have had quite a few computers and upgraded them as we go and I’ve got all the old parts sitting in the shed outside. And whenever I get something new I switch it round and try to make it better.

His voluntary leisure involvement with computers attests to a fascination with the technology, with the workings of computers. Mason conveys confidence to tinker with the hardware and software, to experiment and manipulate the technology and to try to understand how it works. He looks on computers as a challenge – something to be manipulated, played with and ultimately mastered. He fits the stereotypical notion of a male techno computer geek. Within the 12CPS class, Mason tends to work alone or with a small group of boys with similar computer interests. They share hobby interests in building computers and computer games and are similarly interested in the programming component of 12CPS. Mason is drawn to and identifies with a small group of like-minded boys.

Unlike Ben, Mason construes his experience in 12CPS in very positive terms. This is despite the fact that the course doesn't extend to some of the computer practices in which he is interested. He takes an altruistic view, accepting that the course might not do all he wants it to but that it is valuable and necessary for all students to have the sort of knowledge presented in 12CPS in order to function effectively in daily life. If it doesn't address some practices to which he is attracted, so be it. For Mason, CPS provides an opportunity for him to indulge his interest in computers and provides a valued introduction to programming and thus to his envisioned future work. As far as he is concerned, any learning about computers is valuable learning and an opportunity to indulge his hobby and use computers at school is welcome. Participating in the utilitarian, applications-based course is an early step in a longer personal computing journey. He sees no reason to question the content or nature of the 12CPS course and is an advocate for CPS.

Angela

Angela identifies as an academic student. She is university bound and wants to be a journalist. She also identifies as a TIM girl. Angela does not think CPS would meet her needs even though, like TIM, CPS is a general-purpose course that introduces students to a range of commonly used software. She is convinced that TIM is more appropriate for her requirements and more closely aligned with her career aspirations. Angela's prior experience pre-disposes her to favour TIM. She is familiar with TIM and has been part of the TIM scene at KHS for several years, having taken the subject since year 9, whereas she doesn't have previous experience of CPS. These factors dissuade her from considering CPS as a viable subject for her.

Angela views herself as a TIM girl, despite and because of its typing antecedence. The association of TIM with typing is seen by some year 12 students as a negative factor, something that positions it in their minds as a non-academic subject and inferior to CPS. It might be expected, then, that Angela's university aspirations would act against her participation in TIM. Contrary to this, Angela sees pragmatic advantage in the type of learning that is acquired in TIM. She thinks that as a result of taking TIM she has "got the layout skills and_ things to do on the computer that I (want to)." Angela values the emphasis on keyboarding and document production in TIM, because of the perceived preparation for her future as a journalist and its utility in the present. She thinks that the knowledge and skills she is acquiring assist her with her schoolwork in a range of subjects and with her after school job in a real estate office. Angela identifies as a student who is interested in the humanities. For her there is no inconsistency between her participation in TIM and her current and potential selves as an academic student and aspiring professional.

The cases showcased here, and others in the classes who were the focus of observation, provide a picture of variation in the meaning students construct of their experiences of specialist IT courses. At a personal level, as individuals negotiate their possible selves and their identities as IT students and as prospective participants in the world of work, they make pragmatic decisions about the efficacy of different computer practices. They make judgements about the value of particular units of work and of a course in general. They are agents of their own experiences. Individual

boys and girls may construe their experiences quite differently. However, the fact that the 12CPS class at KHS is a mixed-gender group and that the 12TIM is an all-girls class suggests that gender is a mediating factor in students' IT subject choices and in their experiences of specialist IT courses.

Gender, identity and experience

Gender is a fundamental aspect of social relations and personal identity. It defines and is defined in daily social interactions, in the roles and responsibilities adopted by males and females and in relations of power and authority, work and production (Biklen & Pollard, 1993; Fenstermaker & West, 2002; Knuttila, 1996). Gender relations and identities are not, however, fixed and immutable, but negotiated and developed in context and over time. Kimmel (2000) and other social constructionist thinkers (Connell, 2002; Mac an Ghail & Haywood, 1998) argue that gender is plural, relational and situational. There are multiple and varied masculinities and femininities adopted by individuals in different social contexts. It is also contended that gender is the property of institutions as well as individuals, that "not only do gendered individuals negotiate their identities within gendered institutions, but also those institutions produce the very differences we assume are the properties of individuals" (Kimmel, 2000, p.96). Students who are participating in specialist IT courses at KHS imbue these courses with gender identities and negotiate their personal gender identities in the context of IT classes that represent gendered IT traditions. These notions of identity derive from students' experiences with computers in different social contexts. Ideas about what constitute masculine and feminine computer practices help to define students' experiences of specialist IT courses.

Students at KHS associate different subjects with male and female computer practices, thereby imbuing them with masculine and feminine subject identities. In this they subscribe to broad and socially constructed notions that males and females favour different computer applications and practices, that particular computer practices are masculine and feminine domains and that computer expertise is associated with masculine technological interests. This finding echoes the seminal critical literature pertaining to gender and technology, which presents a social constructionist view of computers and computing as cultural products that are historically constituted by certain types of knowledge and social practices (Cockburn & Ormrod, 1993; Turkle, 1984; Wajcman, 1991, 1994). It also supports the international literature that reports persistent gender patterns in students' preferences for different types of computer practices, albeit evolving and changing patterns (Association of University Women Educational Foundation Commission on Technology, Gender, and Teacher Education, 2000; Colley & Comber, 2003; Durdell, Glissov, & Siann, 1995; McKinnon & Nolan, 1990; Schumacher & Morahan-Martin, 2001). At KHS, the notion that different types of computer practices comprise gender domains persists in the minds of students, despite the similarities between the courses, the ubiquity of computers and the reported widespread use of computers at home and school by males and females. Students view CPS as the subject that is more suited to the needs and interests of males, and TIM as a subject that serves the interests of females.

Students associate CPS with computer science and engineering models of computer practice. A repeated theme in their descriptions of the 12 CPS course is an association between CPS the subject and learning about computers *per se*. They think CPS is about learning how computers work, even though individuals may be unclear what they mean

by this or have difficulty articulating their thoughts. Learning how computers work means different things to different students and includes acquiring knowledge about hardware, skill at building computers, and the ability to manage software and to program the machine. Historically, these are computer practices that have been dominated by males in the IT industry, a situation that is highlighted in academic literature (Alton-Lee & Praat, 2000; Ryba & Selby, 1995; Selby, 1995) and populist articles (Martin, 2003; Smith, 2001; Wells, 1998) that raise concerns about a lack of females in 'hard' computing fields of work and the under representation of females in tertiary computer science courses in New Zealand. Students see an interest in the workings of computers as a peculiarly masculine trait. For example:

A (Angela): I think its sort of_ boys and computers and sort of like boys and cars. I think it is just their toys. I think they_ don't really care what they are downloading as long as they are storing *something* [chuckles]. They don't really care what it is. And I don't think they grow out of it either.

By associating CPS with masculine activity, students imbue the subject with a gender identity. The association of CPS with learning about technical matters persists in the minds of students, even though it could be argued that the utilitarian, applications focus of 12CPS at KHS has more in common with other courses in the computer-as-tool paradigm than with computer science or engineering. The inclusion of a programming unit in the teaching scheme ensures the connection between 12CPS and nominally masculine practices and interests in the minds of students. Year 12 CPS is thus imbued with a masculine subjectivity.

In contrast, students view TIM as a feminine subject. They associate TIM with supposed female interests and work involving computers. In particular, TIM is identified with keyboarding/typing and the aesthetic aspects of document production. Students make a strong association between TIM and its typing antecedence, based on their experiences of typing and TIM courses over the years and what they have heard about the subject. A number of students in the case study classes refer to TIM as "typing", without prompting to use this label. For some, the association of TIM with keyboarding is a negative factor and they speak of TIM in pejorative terms as "just typing". This is despite developments pertaining to the TIM curriculum, both at the national level and in practice at KHS, that have seen the inclusion of a range of computer applications and the adoption of information literacy and design and problem solving models and strategies in the formal curriculum and curriculum in practice. There is a strong sense that students think of practices relating to keyboarding/typing and document production as something that girls do, and boys don't, as observed by Beth and Winifred.

B (Beth): I hate to say it, but typing [is something girls prefer]. Because in our [TIM] class there were no boys. Last year there was two but no_ four! But by the end of the year there was only one left so_ ...

W (Winifred): They think it's a girlie thing, eh? Think typing is just for girls, I think.

The emphasis on keyboarding/typing in TIM, which is a unique and distinguishing feature of TIM compared with CPS, is a key factor in the creation of a gendered (female) subject identity.

At a personal level, students negotiate their gender identities as computer users in the context of specialist IT courses and classes. The interplay between computer activity, identity and symbols of masculinity and femininity is particularly obvious in the case of Scott. He is a non-academic student who has a passion for computers, particularly gaming and programming activities, and a self-reported history of computer hacking. Scott talks of a game he has created in 12CPS, which is based on Russian roulette, as a “boy” game. He justifies the virtual violence and raw language in his creation as in keeping with the masculine character of the game. By implication, “girl” games would be different and have a gentler character. In creating violent games he is proving his masculinity, which for him is defined by aggressive behaviour. For Mason, an interest in mathematical computing is a masculine trait, and his personal interest in computer programming is something that he thinks derives from being brought up as a boy. He displays his masculinity through his computer interests and participation in CPS. The boys in 12CPS exhibit a common interest in the control aspects of computing. As far as they are concerned, this is part of being male. They think that females have different computer interests and practices, which relate to the aesthetics and routines of document production and to communication functions. This notion of gender-defined difference is epitomised in the following observation by Ben.

Bn: Um_ oh [boys are] interested in, um, quality games or interested in_ um, copying the games or_ doing web pages, stuff like that... [Girls] Just use it for communication wise on the Internet, and that's about it. You won't find many girls that are interested in strategy games or stuff like that. They just, they go on the Internet to talk to people and chat and stuff like that.

The identification of particular types of computing practice as masculine activity, and of masculinity with particular computing practices, leads males in year 12 to reject TIM as a viable subject. They identify this as a girls' subject and consequently reject it as an option for them. It is inconsistent with their masculine identities and concepts of self as computer users and students of IT. It is also the basis of judgements about the worth of different units in the 12CPS course. The boys favour the applications they associate with masculine activities, notably the programming component of 12CPS.

The girls in CPS and TIM classes are similarly negotiating their gendered identities through their computer practices and engagement in specialist IT courses. They, too, identify different practices with male and female interests. For example, when talking about people they have known who are good with computers, both male and female students cite male examples. With one rare exception, females do not feature in the list of those cited as computer experts. Those who are deemed to be good with computers or to be computer experts have acquired this status through their observed interests in control aspects of computing – programming, software engineering, systems management, building computers. There is considerable variation, though, in the computer interests displayed by individual girls. Angela in 12TIM is focused on developing knowledge and skills pertaining to document production and identifies as a TIM girl. In contrast, Joanna and Xiao-hong in 12CPS are particularly interested in programming. Thus, some girls aspire to acquire some forms of nominal male computer knowledge. Having an interest in computer programming is not counter to their concepts of gendered self. Rather, they have developed gender identities that cast themselves as CPS girls. For some girls, this may be an act of feminist resistance. For example, Joanna's espoused desire to learn to program could be seen as a political statement. She resists the subject that she thinks is defined by traditional female

activities and thereby circumscribes girls within traditional roles. She actively challenges gender boundaries. However, girls tend to view males' perceived passion and fascination for computer technology *per se*, which is manifest in a need for males to play with machines and to take things apart, as peculiar and alien. This male trait is a source of amusement for some girls. It does not mean, however, that girls do not themselves exhibit passion for computer technology. For example, Joanna says she "loves" her computer and that she uses it "too much, mainly for word processing, accessing the Internet and using e-mail. Gini, a girl in 12TIM, says she "loves" the Internet and that e-mail is the "bestest [sic] thing ever", and signals that she spends a lot of time on her computer for communication purposes. It is the passion of the (male) technician and engineer that the girls think females lack and which they personally resist. Girls just aren't interested in these aspects of computing.

In the context of the computer-as-tool paradigm that operates at KHS, males appear to be more circumscribed in their subject choices than are girls. As gendered beings and agents they disallow possibilities of self that are associated with traditional female computer practices. Consequently they avoid 12TIM, which is the course that they identify with these practices. Also, they tend to be less enthusiastic about the aspects of the 12CPS course that they associate with female computer interests and practices, notably word processing. This is not to say that any individual male's concept of self is necessarily incompatible with what is seen as traditional female computer work, but none of the embedded cases display such interest. Nor does it mean that males do not value general skills and knowledge of common applications, such as word processing, for their relevance in a range of disciplines or fields of work. Rather, males value other skills and practices more – web page design, programming, adventure gaming, building computers – in the creation of their unique and personal masculine identities as computer users and IT students.

As a group, the girls in the 12CPS and 12TIM classes seem to be interested in a broader range of computer practices, spanning a continuum from traditional female keyboarding/typing practice to programming. However, these girls show little or no interest in some computer practices that boys say they pursue outside the classroom, such as building computers and role playing strategy games, although several girls indicate that they regularly play other types of computer games for entertainment. It could be that females' gender identities as computer users are no less restricted than those of males, but in a different form, and that this is not revealed in the context of the specialist IT courses and classes at KHS. It needs to be remembered that the construction of the specialist IT curriculum at KHS, comprising CPS and TIM subjects, embodies a computer-as-tool model of computing. There are aspects of computing practice, such as electronics and computer engineering, that are not part of the IT curriculum at KHS. Nevertheless, in the context of the specialist IT curriculum at KHS, males seem to adopt more restricted notions of what it means to be an IT student and computer user and to conform more closely to gender stereotype. Females present a broader range of femininities associated with a wider variety of computer practices.

Conclusion and implications

Gender identity, then, is a fundamental factor in year 12 students' experiences of specialist IT courses at KHS. Gender and gender relations are socially constructed and establish different computer practices as more or less acceptable to males and females. This does not mean, however, that all girls and all boys construe their experiences

the same way. The expression of gender identities is individually differentiated. In the negotiation of their gender identities and ideas of possible selves, students give different and personal meanings to their experiences in specialist IT courses, which are influenced by a range of factors that impact on their notions of who they are as IT students and prospective participants in the world of work. This is evinced by similarities and contradictions in interests and aspirations within and between groups of boys and girls in different specialist IT classes, 12CPS and 12TIM, and in the attendant constructions they place on their experiences of these courses.

This social constructionist view of gender and experience, and the idea that these phenomena are defined in the nexus of the personal and the social, has implications regarding the debate about students' participation in different IT fields. To view the different experiences of males and females as purely matters of individuals' likes and dislikes, interests and preferences, ignores the social context and runs the risk of being overly simplistic. Similarly, a perspective that focuses solely on broad, social construction of gender and ignores the personal and individual agency of students potentially oversimplifies the situation. But what might this mean for those who are concerned with the 'gender problem' of different participation patterns and, more particularly, with a lack of females in 'hard' computing?

At one level, it may be thought that changing attitudes towards different IT applications and effecting change in patterns of student participation in different IT fields – programming, software and hardware engineering, systems management – is simply a matter of exposing individual girls or boys to greater information about IT fields and careers. For example, that telling students that they could and should consider different IT subjects and occupations through career counseling and other promotional mechanisms will change attitudes and perceptions. This may well be effective for some students. However, an appreciation of the social construction of gender and the potency of gender constructions in the field of IT means that this may not be as straightforward as it seems. In asking girls or boys to engage in different computer fields, for example, advocating for girls to get involved in 'hard' computer science and engineering, one is asking students to alter and adopt different gender identities and to act counter to the models of gender roles and computer interests that they see every day.

The boys and girls at KHS show that they have firm ideas about what constitutes male and female computer practices. There is a continuum of computer practices, ranging from technical and control activities associated with electronics, computer engineering and computer science at one end, and the user activities associated with clerical and office practices, including keyboarding, at the other end. The middle ground comprises a range of computer applications and activities associated with document production and information processing and communications functions. This middle ground is the domain of males and females. The boys and girls at KHS express interest in applications relating to the Internet and the processing and presentation of information. However, the extremes of the continuum are possessed by different genders, with males showing a preference for control practices and females for keyboarding and text production activities. It isn't that students think males or females are incapable of participating in nominally feminine or masculine computer practices. They just don't want to. It is anathema to their ideas about what boys and girls do. Perhaps, then, some more fundamental questions need to be asked about the way that the

curriculum is organized at national and school levels, about the types of opportunities that are provided for students to participate in and experiences different computer applications. Also, about the role models to which students are exposed in their daily lives, both inside and outside of school environments. Rather than just focusing the 'problem' on students and their attitudes, consideration also needs to be given to broader social constructions of gender identities and how these come to be associated with particular computer practices. Perhaps the IT industry also needs to look at itself and the role it plays in the social construction of gender identities and images of computing. As an aside, it is interesting that there is no public concern at a lack of male students in fields that tend to be favoured by females that is commensurate with the perceived 'problem' of girls and IT. This in itself reveals a socially constructed notion of what counts as 'real' or valuable computer knowledge and skill.

None of this is to say that change cannot happen or to imply that isolated interventions will have no effect on the attitudes and aspirations of individual students or on groups of students. It could be argued that the breakdown of some gender boundaries is to some extent inevitable as the technology itself changes and as students, males and females, appropriate technology for their own needs. For example, international research shows that the ubiquity of computers and the Internet has seen an increase in male and female students' interest and engagement with computers for information and communication purposes (Colley & Comber, 2003; Durndell et al., 1995; Schumacher & Morahan-Martin, 2001). However, given the potency of the social construction of gender and the clear association of masculinity and femininity with different computer activities evinced by year 12 students in specialist IT classes at KHS, effecting change would seem to necessitate more than telling individuals that they should expand their horizons and become different people. Social and institutional arrangements also have to be addressed so that what students hear, see and do in a range of social contexts challenges gender stereotypes. These include, but are not confined to, school structures and curriculum arrangements relating to specialist IT courses.

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