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“What’s Your Problem?”
ANT reflections on a research project studying
Girls enrolment in Information Technology
subjects in postcompulsory education

ABSTRACT

Despite more than 30 years of gender reform in schools, the percentages of girls enrolled in information technology subjects in the post-compulsory years of education has remained persistently low: often under 25%. This article investigates data collected during an Australian Research Council Linkage Grant project (2005-2007) focused on identifying the reasons for this under-representation, and ways in which the situation could be changed. The paper looks beyond the official recommendations of the project to explore how the research experience and the data combine to raise important questions about the limits of research in this area. We discuss the difference between the researchers’ perception of the problem under consideration, and the participants’ perception of the same issue. We use the resources of actor network to highlight the gaps, tensions and contradictions within the data and to ask key questions about the extent to which the enrolment of girls in IT is indeed ‘a problem’.

Keywords: actor-network theory; gender issues; information technology; post-compulsory education

INTRODUCTION

The percentages of girls in Australian schools who elect to enrol in post compulsory information communication and computing technologies units has barely changed over the past twenty years hovering consistently around (and often below) 25% (James, et al., 2004). Analysis of this statistic (and its persistence) has often focused on such factors as the impact this under representation has upon the total numbers of students studying information technology or related courses at university (hereafter referred to as IT); the looming personnel shortages in information technology professions (Wentling & Thomas, 2004); the impact that opting out of IT as an area of study has on girls’ future career paths, including the potential to reduce their chances of employment within lucrative and “in demand” industries, and, indeed, curtailing their ability to contribute to the construction of the kinds of technologically mediated futures that impact upon their lives into the short and long term future (Wajcman, 1991).

Despite the fact that these various versions of ‘a problem with girls and IT’ have received a reasonable amount of attention from researchers and industry professionals over the past twenty years, during this time there has been little impact upon the numbers of girls following the pathway to tertiary study of information technology. Indeed, the numbers
of girls studying IT in schools are actually trending down. (AAUW, 2000; James et al., 2004)

In response to this scenario—and in recognition of an increasing anxiety within the IT industry about the difficulties of recruiting appropriately qualified staff into the field—a range of researchers¹ and industry partners from NSW, South Australia and Victoria designed a multi-method, multi-stage project intended to identify the processes that lead to this gender gap and possible ways in which the situation could be challenged. The project was titled: From High School to Higher Education: Gendered pathways in information communication and computer technology education and ultimately received funding through the Australian Research Council (ARC) Linkage Project scheme. The project, referred to by the research team as the Girls and Information Technology Project or GAIT, had the following objectives:

- identify the educational pathways and career outcomes for males and females in IT fields;
- ascertain why the proportion of girls who enter education pathways leading to IT careers is so small;
- identify strategies that might lead increased numbers of girls to qualify for, choose, and enter IT courses at the higher education level.

It worked to achieve these objectives through consideration of the following questions:

1. How do girls and boys decide what to study at years 11 and 12?
2. What are girls’ and boys’ understandings and opinions of senior secondary school IT subjects, IT career-related courses and IT-based careers, and what informs these understandings?
3. Why do girls and boys choose or reject post-compulsory IT educational pathways, including senior secondary IT subjects?
4. How do year 11 and 12 curriculum structures, school contexts and pedagogical practices affect boys’ and girls’ interests in pursuing studies in IT-related areas?
5. What changes need to be made at the school level to better and more accurately promote IT industries, and the educational pathways that lead to them, to girls and boys?

Over the three year period, the research team collected data from across 28 schools and more than 1400 students. As a result of the themes found within questionnaires, focus groups and interviews, the research team identified a range of factors that influenced

¹ Industry partners: New South Wales Department of Education and Training; Australian National Schools Network; South Australian Department of Education and Children’s Services; Office for Women, NSW Premier’s Department. Academic partners: Deakin University (Catherine Harris, Julianne Lynch, Leonie Rowan); University of Western Sydney (Margaret Vickers, Toni Downes – now CSU, Susanne Gannon, Carol Reid, Kerry Robinson). Research Assistants: Cristyn Davies (UWS), My Trinh Ha (UWS), Clare Sidoti (UWS), Karen Tregenza (Deakin), Vianne Tourle (CSU), and Josina van den Akker (UWS); Consultant: Fred Kleydish
girls’ and boys’ subject selections, and the reasons why they would choose or reject post-compulsory IT pathways. In response to this data the team put forward a number of recommendations in response to the original challenge: how to improve participation rates of girls in post compulsory information technology studies. The formal findings are reported and discussed in detail elsewhere (see Lynch, 2007) but summarised briefly here:

- provide more accurate and timely career advice and subject information, to counter common misconceptions. This includes differentiating between the different kinds of IT career pathways
- Emphasise the relevance of senior IT subjects to university studies in software engineering and information technology.
- Use learning activities that align with work practices in IT industries and that make links with the local community. Make particular use of group based learning, project learning, and ‘real world’ tasks.
- Make use of new leisure and lifestyle technologies to help break down the divide between everyday technologies and IT studies.
- Recognise that many students will achieve high levels of computer literacy at home and will need a more challenging IT program if their interest in the IT field is to be sustained.
- Affirm girl’s interest and competence in difficult technical tasks; affirm boys’ interest and competence in communication and design activities; and, affirm the behaviours and attitudes of girls who express an interest in computing technology.
- Provide opportunities for commonly held notions about gender and IT to be aired, debated and challenged.

This list of recommendations—like many formal documents—points to some of the key issues to emerge from the project but also partially obscures several important points. Most specifically, the tidy list does not in anyway communicate just how difficult the GAIT project was to actually conduct, nor the significance of this difficulty for the process of responding to the recommendations themselves. Despite the fact that the researchers, the industry partners and the funding body saw the low enrolment of girls in IT units as a problem, schools, for the most part, did not. The original GAIT project evolved significantly over its three year period in response to a disinterested and unmotivated ‘target audience’. In this context the researchers needed to consistently re-invent the design, methods and even the intended outcomes from the project in order to recruit schools, teachers and students into the project.

At the end of the project’s life cycle, it is tempting to gloss over these difficulties and to rejoice in a project that was completed on time, and within budget, despite some extraordinary obstacles. This paper, however, seeks to position the difficult context, not as the background to a paper, but rather as the explicit focus of the paper.

More specifically, in this article we are interested in identifying how the experiences of one branch of the research team in this project can be used to reflect upon the process of
the research, and the formal recommendations of the research. Our interest throughout is in developing a more robust, detailed and rich understanding of both ‘the problem’ and ‘the solutions’ as they are defined in multiple contexts and by multiple participants.

The paper has three sections.

In the first we look specifically at the moves and countermoves the researchers undertook to recruit and maintain participants into the project.

In the second we look at some of the data that emerged from the study, with particular attention to the ways in which this data helps make sense of the recruitment difficulties outlined in the previous section. We discuss the difference between the researchers’ perception of the problem under consideration, and the participants’ perception of the same issue.

In the third we use the resources of actor network theory to re-visit the official recommendations and to highlight what an innovative approach to the Girls and IT “problem” might actually look like.

Throughout the paper we will focus primarily on data collected by members of the Victorian research team.²

PART ONE: GETTING STARTED: THE GAP BETWEEN THE PLAN AND THE PERFORMANCE

The project was originally conceptualized as a mixed method investigation that would involve principals, teachers and students from schools across three Australian states: New South Wales, South Australia and Victoria. Our aim was to have schools that were located in rural, regional and metropolitan contexts in each of these areas, as well as schools from different socio-economic backgrounds. In addition to this, we were looking for schools that were either above or below the national average regarding percentages of girls undertaking IT in the final two years of schooling.

The project design suggested that we would recruit schools through a series of written invitations to schools. We would select schools from data provided by various government agencies, which indicated percentages of girls enrolled in IT, units, and other factors such as the school’s location, and its socio-economic environment. When they responded to our invitation principals from the participating schools would be asked to nominate 2 members of the teaching staff who may be willing to share their insights and valuable local knowledge about the study of IT at the school. These nominees would be invited to participate in a 20 to 40 minute telephone, or in some cases face-to-face, interview. The interview would take the form of a semi-structured conversation

² The views expressed in this paper are the views of the authors, and not necessarily the views of the project team.
consisting mainly of open-ended questions. Topics relating to the characteristics of the schools - such as population and location details – would be discussed, along with participation and performance levels of male and female students in the areas of IT. Teachers were to be asked for their opinions and beliefs about probable factors that might be influencing current student participation and performance rates in IT at their school.

The next phase of the research would see year ten students at each of the participating schools asked to complete a survey focusing on their computer usage at home and at school, their ideas for subject choices in Year 11 and 12 (the post-compulsory years), their opinions of Year eight, nine and ten computer subjects, and their beliefs about how effectively boys and girls work with computer technology studies. Students would also be asked if they were willing to be contacted again with regard to participating later in a 40-minute follow-up discussion session.

In the final data collection phase focus groups would be held with groups of six to eight including boys and girls who have a high or low interest in IT. The Focus Groups would explore issues around students’ constructions of IT education and careers, their attitudes towards computer technology and uses at home and at school, and their plans and aspirations in terms of post-compulsory subject selection.

In reality, the Victorian arm of the project struggled to find schools willing to participate right from the beginning. Letters sent to schools went unanswered. Phone calls were unreturned. Emails disappeared without a trace. We modified the ‘pure’ stratified random selection approach whereby we were selecting schools solely on the basis of data available regarding their location and female enrolment rates and began to draw on different kinds of networks. We approached education department employees for recommendations about interesting schools so that we were able to ‘name drop’ when phoning schools (“your school has been recommended to us by person x in the department of y”). We drew upon schools that we had worked with for other projects, hopeful that our existing contacts could recruit their IT department into the project. And we drew upon personal friendships with teachers in schools to see if this would possibly get us access.

Amongst the members of the Victorian research team, the focus almost shifted away from finding schools that met our original grid (rural high SES; rural Low SES + high and low percentages of girls; regional High SES+ Regional Low SES + high and low percentages of girls; metropolitan high SES + metropolitan Low SES + high and low percentages of girls) towards finding schools in the different locations with a mix of participation rates; towards just finding schools in the different locations towards just finding any school at all.

The researchers were able to resist the urge to take any school they could find, and managed to recruit 8 schools that were consistent with the original criteria. The recruitment process took more than 16 months and involved approaches to more than 30 schools, teacher and principals.
The schools (represented here by their pseudonyms) had the following characteristics:

Crocodile: Rural, low SES, low diversity, mid female participation
Otter (H): Rural, low SES, low diversity, mid female participation
Bandicoot: Regional, high SES, low diversity, low female participation
Dragon: Metro, low SES, high diversity, mid female participation
Angelfish: Metro, low SES, high diversity, low female participation
Black Mare: Regional, mid SES, low diversity, low female participation
Sheepdog: Rural, low SES, low diversity, low female participation

Once we were in schools, there were yet further hurdles to climb. Ethical clearance procedures required us to receive signed parental consent forms for all students who were asked to participate in surveys and focus groups. We initially sent letters home, via the teachers, along with small postcards outlining our interests and asking students to participate. Session after session was postponed and rescheduled when our coordinating teachers/contacts advised that only a few students had returned the surveys. Regular phone calls and emails to teachers to check on the progress of the consent form resulted in requests for more copies of the form or, better still, for a form (to cover both the surveys and the focus groups) and for more time.

The original plan had been to survey students, and then select some from the survey group to interview. As the months went on it became apparent that getting access to the students for one session was going to be hard enough, let alone trying to get them back twice. In addition to this, two separate sessions had twice the impact upon school timetables, and at the time of the research, many schools were implementing major reforms and had little ‘free time’. The times that we were offered were generally at the end of terms and usually fairly short: somewhere between 40 and 60 minutes on average. We agreed to ‘fast track’ the data collection and to follow the surveys with brief focus group discussions.

Eventually we adopted a different recruitment strategy whereby we offered a free lunch to students willing to participate. This lunch was ordered by the students and most commonly involved pizza and chocolates. Before and during the lunches we grouped students and conducted focus groups. Many of the discussions ended up happening over lunch with significant impact upon the quality of audio recordings that resulted. We also commonly had two researchers interviewing groups at the same time in the same location in a desperate move to get the most out of limited time we had. The provision of the food impacted noticeably on the attitudes of teaching staff, and we took care to ensure that all teachers also had access to the lunches (as well as to morning teas which we provided any
time we called into the schools.)

At the end of a two year period we had collected almost exactly the data we had aimed for. The huge amount of negotiation involved in this process, however, was far more than anticipated.

The moves and countermoves outlined here provide much more than background to the project. Rather, the need for this ongoing re-invention of project design provided us with the first key finding from the project: for most teachers and students in the schools approached, there WAS no problem regarding the participation of girls in IT. Where the researchers saw ‘problem’ students and teachers just saw ‘life’. As the project progressed it became clear that for the majority of the participants there was no problem concerning the enrolment of any students, boys or girls, in IT. Rather, the low numbers were seen as logical, natural and easily explained by a range of commonly cited factors. We’ll turn to an exploration of these factors in the second section.

PART TWO: WHAT’S THE PROBLEM ANYWAY?

As outlined in the introduction, in this section we discuss the difference between the researchers’ perception of the problem under consideration, and the participants’ perception of the same issue.

The first indication that the researchers and the participants saw something quite different when looking at the enrolment patterns in IT classes came from the difficulties we had recruiting schools. Further indications came from the data we collected. As we will outline below, teachers, students and (by proxy, their parents) looked at the IT enrolment patterns and saw, not a narrowing of employment pathways, or missed professional opportunities, or limited financial futures, or a perpetuation of limited and limiting gender norms.

Rather, the majority of the participants saw patterns that could be explained by several ‘logical’ and ‘obvious’ factors.

First: it was widely acknowledged that students’ previous experiences with ‘computers’ (both in dedicated IT subjects and as part of their cross-curricular learning) up to and including year 10 often lead to particular beliefs about the likely focus of year 11 and 12 IT subjects. Students and teachers agreed that many kids came to secondary school thinking that they knew all that they needed to know about IT and made the point that they didn’t want to waste any more time. The notable exception to this were some of the (few) students who did study IT because they thought it was “easy” and a “bludge”.

From this point of view, the problem was that students have already done enough IT in the compulsory years of schooling, and could see no compelling reason to change this.

Second, IT was routinely described as boring and too theoretical.
Q: So in those first years, 7 to 9, when you did it, did you enjoy IT at all?

All: No.

Girl 1: I don’t think I did, I can’t remember.

Q: Any particular things, why you say you didn’t like it?

Girl 2: It’s pretty boring. (Bandicoot Focus Group)

A group of boys enrolled in year 11 IT units indicated that the girls’ words might indeed be accurate:

Boy 2: ...[all we do is read stuff]...and answering questions.

Boy 3: That’s the only thing we do.

Boy 2: It’s true, answering questions all the time.

Boy 3: Just one semester, just answering questions. That’s it. Not opening the computer. Do nothing. Just answering. (Dragon Focus Group)

The problem in this context is the content and pedagogy in IT classes. Why would anyone choose to study such boring material?

Third, many students commented on the fact that their early schooling plus their own home activities had provided them with what they saw as enough of an IT skill base and that the way IT was taught did little to change the perception that there was scope for personal engagement in the IT curriculum.

Girl J: I don’t think people are studying IT because I think that in your younger years because you’re brought up around computers and technology they automatically think you have a good grasp of knowledge of how to do basic tasks and in year 7 and 8 you might have a few lessons on them but they never go in depth into like coding and stuff like that and being able to do your own things so kids don’t really get interested in it. And then they’re sort of pushed towards other paths and stuff. (Angelfish focus Group)

A fourth (but—in the eyes of students and teachers considerably less compelling) reason put forward to account for the low enrolment was the competition between subjects to recruit students. This was commented on repeatedly by students and teachers:

Girl J: ...see I don’t think IT for our unit was every really put out there as a subject where...media career prospects, this is what you could get out of it blah, blah, blah. I think our school is more orientated on trades and more science subjects I think. Like with physics, chemistry, biology, they’ve very sort of [sold] that... (Angelfish Focus Group)
Teacher: I’d certainly say [we are] under selling it … and a lot of other faculties I think [also] find it easier to either express or to demonstrate to students the sorts of things they’ll be doing when they get to year 11 and 12. I’ve found that very difficult and I just give them a rundown of the difference between the two [available subjects]. (Bowerbird HS, NSW)

From this perspective, the problem could be that, as a subject area that bids for a share of post-compulsory student enrolment, IT does not appear to have a unified group of teachers, at the school or state levels, who might promote the interests of the discipline. Indeed, at each school within the project “IT Teacher” meant something quite different: some were working solely in IT subjects; most were working in a combination of IT and maths; and others were working in IT and commerce, or English or another discipline area altogether.

A fourth reason put forward by participants to account for the low enrolments in IT units was the belief that IT was not a seen as strategic subject choice, particularly for those students aiming for university. Rather, IT was seen as a subject field that was too easy, and which would add little to their tertiary entrance score.

Girl 2: I think that people choose the subject that they do because of the pressure put on them by teachers and mixed teachers and parents as well but from like year 10 you’re pressured into choosing subjects that will get you into a uni course you want to do and from year 10 you have to choose what you uni course you want to do and they’re always going on about pre-req’s and what you need so you don’t really have the chance to sort of explore other subjects. Its sort of if you want to do that then you have to do these subjects and then that’s it. (Bandicoot Focus Group)

The problem in this scenario rests with the ways in which various subjects and areas are ranked against each other and, in the students’ words, either scaled up or down as a result of their relative difficulty during the process of calculating a tertiary entrance score.

Similarly, students wanting to enter the workforce did not see IT as an area of high employment. Whilst the industry partners and the research team was convinced that IT was an area of considerable employment growth and a field characterized by diverse career options. For teachers and students (and indeed their parents) IT was seen as a field that had few employment opportunities.

Boy 3: .... There [are] ways to influence more people to get on computers but there’s ... no point cause there’s already a lot of people on computers. (Bandicoot Focus Group)

Boy 4: In year 10 I did like certificate 2 and I was going to continue on with IT but then a lot of people are saying that there would be actually a shortage of positions in IT because its so popular so then I just had a different career change and I just decided to do something else (Angelfish Focus Group)

Girl 2: years ago my mum said ‘there’s no jobs in IT do other stuff’. So I do other stuff now. (Crocodile Focus Group)
Teacher M: There is no jobs anymore. All the jobs, they are overseas. Or overseas people come here. The industry is dead. Why work in it. (Male Teacher, Dragon, Interview)

Interestingly, some of this data was collected in a dedicated IT teaching space which had approximately 20 computers arranged around the edges of the walls communicating very little in the way of collaborative activity and two posters on the wall illustrating the different professionals or pathways associated with the it. This same poster was found in a number of other interview sites but was never referred to or acknowledged by any of the teachers or students when we were discussing the broad challenge of promoting IT pathways.

It is also worth nothing that there was common slippage in teachers’ comments between IT professions, and professions where people use IT:

Q: …a lot of people don’t register how diverse the whole industry is and then…

Male Teacher P: …or that’s involved in most jobs and most jobs you do spend a long time in front of the computer.

Q: Yeah. I spend half my day in front of mine.

Male Teacher P: So you think you’re in a job…but there are still jobs that don’t do that much at all. I mean if it’s a personal relations type job you’ve got a chance, but you don’t. But there’s more and more that do have a large portion of computer time involved. (Teacher, Interview, Sheepdog)

For the purposes of this paper, the key point is that this selection of data defines the IT problem in a number of different ways. Each version of the problem seems to lead to logical recommendations (already cited above) that might increase IT enrolments overall: these include recommendations relating to improving pedagogy, raising the profile of the area and improving publicity and promotion materials; ensuring greater articulation between early and later IT units; and so on.

However, all of these practical recommendations become much more complicated when considered alongside two other strands of the data.

Firstly, students initially insisted that there was no lingering image problem for IT, attributing any problems particular students’ had to personality rather than the IT factor:

Q: What about the whole computer nerd thing? Do you think that still exists anymore?

Boy J: You get that off TV shows and that but no not really.

Girl C: Depends on the way people have been brought up or their personalities.
Boy B: ...you can have someone if they…as a nerd, and they like computers but then you can also have someone that you know is out there and likes hanging around with friends and stuff, and also has an interest in computers as well so I don’t think its…you know what kind people that do it.

Girl C: I don’t think that’s anything to do with an image of being a nerd because there’s people who are very popular people who are into computers and stuff like that. I think its how people present themselves to their peers. Like it wouldn’t be oh because you like computers, you’re a nerd. It would be like “oh cause you dress like that, you’re a nerd”. (Angelfish Focus Group)
Girl C: And their intellectual abilities. (Angelfish Focus Group)

A similar sentiment is expressed by a teacher at Fairy Wren who argues that:

Male Teacher I guess it probably or maybe gets down to interests. Like we try to encourage the kids to take the courses that they’re interested in. I guess, I don’t know, it probably comes down to the girls probably aren’t interested in it, I guess, the programming as well as computing. (Teacher, Fairy Wren, Interview)

Students in the majority of the schools also made the claim that no one cared any more about what subjects students’ chose, and that there was no reason why anyone would hassle or view negatively a girl who undertook the study of IT.

These denials of the impact of gender, however, were frequently accompanied by entirely unselfconscious depictions of boys and girls as naturally different.

Girl 1: I think guys … it’s probably the way guys’ brains work more than anything. Cause you know how they do physics well a larger portion, maybe that’s how they … [think] … (Otter Focus Group)

Girl 2: I reckon girls are more into fashion and social wise than boys. Like into computer games and … (Bandicoot Focus Group)

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Boy 1: They’re more interested in fashion and stuff.

Boy 2: Don’t want to break their nails.

Boy 1: Like they just think fashion and stuff.

Girl: I just think boys tend to play the games and things on the computer. Do you know what I mean? Kind of like a PlayStation, they'll go on and play the games together. Like PlayStation stuff aren’t really ... its kind of like you’ve got girl and boy things. (Bandicoot Focus Group)

Complementary sentiments were expressed by several teachers. For example:

Male Teacher: ... I found most of the girls have problems in logic, in mathematics, they just can’t understand the procedure. They cannot ... I don’t know why. (Dragon, Interview)

Male Teacher G: Probably one of the difficult areas I have, certainly even in 12, is that the boys tend to look at the hardware and revolved around you know what sort of CPU have you got in the machine. Whereas the girls tend to not have that perspective. They’ve had no interest in hardware, and that’s why I really don’t want see us trying teach the systems which really revolves around the hardware. So the boys have more interest in that technical side, the girls don’t. (Male Teacher G, Sheepdog, Interview)

These views were seen as fairly typical of the female community as a whole:
In the light of this set of data, the ‘girls and IT’ problem becomes more contradictory: for the researchers this data points to the persistence of narrow, limiting, gender norms. For the students it points to little more than reality.

When this version of the problem is set alongside other versions of the problem, the task of implementing recommendations becomes vastly more complicated. Suddenly the challenge is not simply recruiting students into IT units through more sophisticated and coordinated approaches to career planning or changes to pedagogy and curriculum that might perhaps be facilitated by professional development or alternative assessment regimes. Suddenly the challenge is recruiting students who seem themselves as naturally and biologically unsuited to the area.

To make matters even more complex, each version of the problem appears to demand different kinds of responses. This poses significant challenges when, as researchers reporting on our findings, we are asked the inevitable “well what do we do now questions” (both conceptually and practically) to engage with these understandings of the “girls and IT problem in schools”. It is this ‘what happens next’ question which informs the final section of the chapter.

PART 3: REFLECTIONS ON RECOMMENDATIONS

With the production of formal recommendations, the official responsibilities of the project team were at an end. Three questions, however, appeared to demand attention from the research team.

The first question concerns the status of the various explanations and recommendations. If we choose to act, how do we choose which of the competing explanations to believe? Do we accept all of them, and develop responses to all? Do we pick one above the others and focus efforts on that one?

A second question concerned how to get the people who would presumably need to be involved in any intervention to care about the problem anyway?

The third question was perhaps the most challenging: is there any point in trying?

It was an attempt to respond to these questions that initially led us to turn to the resources offered by Actor-Network Theory (ANT) to discuss some of the issues that need to be reconsidered if an intervention is to be realistically considered or, indeed, considered as realistic. In this concluding section we seek, not so much to provide a definitive set of answers to these questions, but rather to explore the different kinds of recommendations that might emerge by bringing the ANT resources to bear on the ‘problem’ of girls under enrolment in IT units.
ANT has grown from a modest set of interests largely concerned with social studies of science and technology, something of an *enfant terrible* in social theory, to a point where interest in it now spans a broad range of disciplines. ANT-informed studies tend to ask anthropological questions, such as: “what is going on here?” What distinguishes ANT-informed studies from anthropology and related social sciences is that they do away with the differences between people and things in order to “…find a way of talking about the social-and-the-technical all in one breath” (Law, 1991, 8).

Early ANT literature was characterised by studies that traced the relational shifts associated with projects, things in the making. A key consideration was the principle of generalised symmetry (Callon, 1986), in which all projects, regardless of their outcomes, were examined the same way. More specifically, in following the actors engaged in the formation of a particular socio-technical assemblage that the same status and hence mode of interrogation is afforded each actor, human or non-human.

We are also conscious of a commitment in all ANT-informed work to be holistic in approaching any complexity, and to avoid essentialist simplifications. So this broad sketching of ANT acknowledges the multiple enactments (Mol, 2001) of ANT and signals our intent to trace the study reported here in a similar manner. In other words, we draw on recent work loosely called “the performative turn” in science and technology studies. This turn or move is ontological. It shifts from the view that objects are single entities with particular essential attributes to one in which an object is a texture or pattern of partially co-ordinated, partly coherent performances. Just as most sociologies accept the human as decentred and the product of multiple subjectivities, so too in this stance, are objects. That is, an object does not exist in and of itself as some kind of stand alone entity but is performed through multiple practices.

In a now famous study, Annemarie Mol (2001) reports an ethnography of a common disease, atherosclerosis. She argues, employing a performative approach, that the disease is multiple: more than one due to the multiple performances of the disease but less than many due to the interconnectedness of the enactments. Further, there is no single thing or cause at the base of these performances. The disease is the various performances.

How does this help us make sense of the Girls and IT Data?

Firstly, the resonances between Mol’s study and the Girls and IT data outlined above are strong. Clearly there is no one, single, coherent performance of either “IT in schools” or “Girls and IT in schools”. Rather both these phenomenon have multiple enactments that partially overlap, contradict and cohere. From teachers, and students we have heard variously that IT is too easy. IT is too hard. IT is too boring. IT is too theoretical. It is too familiarly practical. IT has no particular image. IT has a negative image. Enrolment is influenced by ‘interests’. Enrolment is influenced by biology.

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3 Here the work of John Law, Annemarie Mol, Donna Haraway, Marilyn Strathern, Bruno Latour, Michel Callon, Vicky Singleton, Anni Dugdale, Ingunn Moser is useful.
Teachers are committed to the IT programs. Teachers are consumed by other factors. There are lots of jobs. There are no jobs. It is a crisis. It is not a crisis. It just is what it is.

Whilst the design, conduct and analysis of the study generally continued to pursue the starting premise that the low numbers of girls enrolled in IT *was* a problem, taking the ANT dictum to ‘follow the actors’ and to accord the same status to each actor must inevitably challenge the ‘the researchers know best’ stance which underpins this study and much of social science research. Every move the researchers made in the project was designed to convince students, teachers, principals and parents that opting out of IT at high school and in university was a bad thing for students generally and girls even more specifically. From this premise action seems immediately called for.

An ANT perspective on the data challenges us to pursue a different pathway. There are three points to be made about this.

First, as the ANT-informed approach suggests, girls participation in IT can be seen as an intricately inter-related set of enactments that overlap with a broad set of “realities” in schools to do with IT generally and gender-based thinking and related practices. The approach we have taken here is to resist the urge to blame, name or simplify. Tinkering or focussing on one or a few won’t solve the problem. When the enactments of the set of inter-related “realities” are taken together, it is clear that broad brush sets of recommendations, no matter how comprehensive they may appear on paper are likely to have the same limited impact of all previous reforms, and to persist, if at all, only so long as there are external resources to keep them in place locally.

Second, in order to move on from the patterns identified in this research, we need to acknowledge not just the current patterning of relationships but the previous layers of patterning that have been laid down over many years, what John Law (2004, p. 27 & ff.) calls the hinterland. He draws upon and extends the work of Latour and Woolgar in their account of science to develop this concept, describing it as (Law, 2004):

>A bundle of indefinitely extending and more or less routinised and costly literary and material relations that include statements about reality and the realities themselves; a hinterland includes inscription devices and enacts a topography of reality possibilities, impossibilities, and probabilities. A concrete metaphor for absence and presence. (p. 160)

Or, perhaps, more succinctly, “if a statement is to last it needs to draw on—and perhaps contribute to—an appropriate hinterland” (Law, 2004, p. 28).

In the beginning of this project, the research enacts the participation by girls in IT in school as a serious problem, one of significance and importance to a range of stake holder groups external to schools. What became equally apparent was that locally, in the schools in which we worked, participation by girls in IT was not enacted, in the main, as a problem by the principals, teachers, students or parents. At the school level it is enacted as a more or less natural consequence of a variety of practices and competing enactments of IT. The difficulty of interesting schools in the research, and of collecting
data underlines the misalignment that bedevilled the research from the beginning.
Borrowing from Law (2004, p. 29), it is the character of this hinterland and its practices
which determines what girls and IT *is* in schools.

Open endings, as Mol (2001, p. 184) suggests, does not imply immobilization. What
this ANT-informed analysis does say is, yes, it, the low participation by girls in IT is
hard, is difficult and complex, something the many previous studies about this
phenomenon would confirm and which are underlined by the many recommendations of
this study. Further, it is also clear that the problem of interest in this research, generated
from rationalising systems of aggregated statistics has a lot of work to do in order to
engage the realities of contemporary schooling for some young women.

And this is the third and final point we make and which we draw on the work of Latour
(2004) to develop. The matter of fact at the core of the research reported here is the
<25% of girls who elect to enrol in post compulsory IT units. In the logic of this
research project, this fact, assembled at a point of calculation remote from all the sites
from which data was gathered, is the framing rationale for what was proposed. In many
ways, this type of research is typical of research that identifies a pattern, more often
than not via statistical techniques, and then seeks an explanation as to why the pattern is
not as might or should be. Latour (2003) argues that this style of research epitomizes the
laboratory age of the 20th century in which there was a sharp distinction between
expert, scientific analysis that took place in research centres of various kinds and the
outside where “began the realm of mere experience - not experiment.” But, as he goes
on to argue (Latour, 2003), this separation is rapidly fading,

The sharp divide between a scientific inside, where experts are formulating theories, and
a political outside, where nonexperts are getting by with human values, is evaporating.
And the more it does, the more the fate of humans is linked to that of things, the more a
scientific statement (“The Earth is warming”) resembles a political one (“The Earth is
warming!”). The matters of fact of science become matters of concern of politics (np)

These changing circumstances are those in which this study took place. Latour’s work
points a way forward in terms of what he calls hybrid forums, in the case of this
research we suggest a greater participation of the local sites in exploring the patterns of
subject enrolments in the post-compulsory years and that, symmetrically, questions can
be asked of not only the pattern but also the pattern makers, of their logics, concerns and
practices.

This is unchartered territory. We are not harking back to forms of participatory research
which, despite their good intentions, largely maintained the asymmetry of the researcher
and the researched, the humans and the non-humans, the centre of calculation and the
sources of data. Some of the current scientifically driven debates about things like
global warming or genetic engineering point towards what we have in mind.

Thus, this paper is not about closing off debate about girls and IT in school but of
broadening the debate. Presenting the multiple enactments of girls in IT at school as the
reality that is found in schools is not a solution to the problem but a way of challenging
and perhaps shifting the intellectual patterns that have thus far characterised research in this field. If we accept the ontological argument that the enrolment of girls in IT is seen as a set of overlapping, contradicting and partially cohering enactments then any reforms based upon simplification cannot succeed. Further, the simplifying move that, on average, girls ought to participate more in IT denies the nuanced and indeed, in many instances, sensitive approaches to the IT needs and interests of young women locally that is identified in this research.

Finally, this paper has brought to mind, what Bruno (Latour, 2005, 2008) has been saying about the separation of matters of fact and matters of concern in recent publications (Latour, 2004):

We explain the objects we don't approve of by treating them as fetishes; we account for behaviors we don't like by discipline whose makeup we don't examine; and we concentrate our passionate interest on only those things that are for us worthwhile matters of concern. (np)

This, indeed, may well sum up much of the experiences of this project. We started with the assumption that a certain percentage of girls in IT was a problem. All the data we collected ‘explained’ why this problem arose. But this same data could just as easily be read as evidence that boys AND girls were actually making extremely sensible and intelligent decisions about not studying IT for entirely ‘valid’ reasons. And there are as likely many other logics at play that we did not draw from our data. The key point is that despite three years that constitute—in an academic world—a project completed, we still do not fully understand the hinterland of girls in IT OR ways to challenge it or, indeed what, precisely, is most worth challenging nor what, in fact, actually can be challenged. And whilst this whole project was premised upon the need to mount a challenge to the percentages of girls in IT, it may well be that the project asks us to return to a related but distinct concern: the ways in which schooling systems participate in the construction, circulation and naturalization of historically marginalizing gender norms. In this way, the recommendations of this project can never be read outside of recommendations for us to follow these actors to a space that is no longer deemed worthy of much discussion or time or space in school, university or teacher education curriculum: the issue of gender.

REFERENCES


