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ICT and Girls: The Need for a Large Scale Intervention Programme

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Abstract

In recent years there have been fewer students enrolling into ICT courses and subsequently there has been a significant decline in ICT graduates. The decline in participation by females has been even greater than for males resulting in a further widening of the gender imbalance in this discipline. Much of the research indicates that it is the early years that influence children's decisions regarding career choice. For many girls, although they are initially interested and engaged with IT in their early years of schooling, this fades as they reach middle and senior secondary school. Reasons for this decline in interest include the perceptions that, among other things, IT is 'geeky', male dominated and generally not a people focused career. There have been many initiatives to try and redress the problem however most are localised, poorly funded and depend very much on one key individual usually in schools. This paper briefly describes the outcomes of the Young Girls ICT project designed to encourage girls to continue with computing. The paper considers what the best options might be for encouraging more girls to continue to study computing.

Keywords

Gender, information technology, computing, female, intervention programme

Introduction

The Australian ICT industry employs fewer women than men; a situation well described in the literature (see amongst others Maslog-Levis 2005; Poole 2005; Craig 2005; Byrne and Staehr 2005; von Hellens and Neilson 2001). Currently only 15 percent of the 348,200 Australian ICT workers are female (ABS, 2006). In this workforce women are also less likely to hold senior management positions and are paid less than men in similar positions (Byrne and Staehr 2005). Yet female ICT workers record the highest average earnings for all female occupations (Clayton, 2005).

The outcome of the gender imbalance in the ICT workforce is not simply one of inequality of numbers. This imbalance means that the ICT industry does not have a broad range of employees with different life experiences, different skill sets and perspectives. A lack of diversity in development teams can result in products that fail to meet the needs of all, processes that are not invented as well as products which are therefore not built (Margolis and Fisher 2002).

Without more women in technology industries women voices will not be heard in how technology shapes society. Additionally, women may miss out on emerging jobs of the future, which ultimately will lessen their economic security and choices.

The Numbers

The lack of interest by girls in the computing discipline is clearly evident at senior secondary schooling level. By the time students leave the secondary education system there is a large gap between girls and boys undertaking computing subjects and those who are interested in pursuing a computing career. In 2006, in the final year of high school in Victoria for example, girls represented 29.0% of students who completed the Victorian Certificate of Education (VCE) subject *Information Processing and Management* (IP&M) and 7.7% of VCE *Information Systems* (IS) students. In actual numbers this equates to only 138 girls completing the IS course[1] and only 1460 girls completing the IP&M course[2], from the over 26,924 girls enrolled in the VCE.

Further along the pipeline, statistics from higher education show the poor uptake by female students of information technology courses nationally. Undergraduate female enrolments peaked in the early 1990s at 27.2% (Lang 2003). In 2005, female students made up just 19.7% of the commencing student body in higher education information technology courses (DEST 2006).

Many girls are interested and engaged with ICT during their early years of schooling; however this interest fades as they reach higher levels. Newmarch, Taylor-Steele and Cumpston (2000) suggest that the barriers to girls contemplating ICT careers are already set by the time girls are in late primary or lower secondary schools. Newmarch et. al. (2000) argue that *how* ICT subjects are taught in schools has a major impact on girls' attitudes towards ICT. For example, many girls considered these subjects to be 'too theoretical, rigidly structured and boring' (p. 9). Girls are more positive towards ICT when the curriculum incorporates group work or cooperative assignments rather than individual projects. On the other hand curriculum focusing on the use of software packages that girls' associate with secretarial work is a disincentive for interest in ICT subjects. Rogers and Duffied (2000) also argue that teachers and teaching have a significant impact on girls' choices.

ICT Education in Australian Schools

One place where girls can be encouraged to think and work positively with computers is at school. This can be done via appropriate curriculum and teaching practices or via specific intervention programmes. Within each State and Territory different ministers, departments, statutory authorities, and in the case of non-government schools, individual schools, have the authority to establish policies and practices for curriculum, resource allocation and utilisation, and teacher professional development[3]. Consequently the approach to curriculum varies across the different states and territories.

In Victoria for example, the *Victorian Essential Learning Standards*[4] (VELS) define what students should know and be able to do at different stages of learning from Prep to Year 10. School implementation of the VELS commenced at the beginning of 2006. Schools, however, have the flexibility to construct programmes that are appropriate to their local circumstances. The *Information and Communication Technology Standards*[5] therefore do not mandate how and where students will acquire their ICT knowledge and skills, but they do state the standards that must be demonstrated by students at progressive levels of learning. Schools are able to construct coherent programmes that enable students to acquire and apply this ICT knowledge and skills. School choices are influenced by factors such as the location and quantity of computer resources, the ICT expertise of teachers, preferred teaching methods and learning styles and the opportunities offered by timetabling arrangements. The three common learning arrangements are:

- *dedicated* ICT classes enabling students to apply their ICT knowledge and skills to all other areas of learning (common practice in secondary schools)

- a *distributed approach* where ICT is not a timetabled class, instead ICT expertise is brought into other learning environments (a common practice in many primary schools) and

- *combined* where some ICT teaching is delivered through dedicated offerings and the remainder becomes the responsibility of other classroom teachers.

Teaching and curriculum are not the only factors discouraging girls from ICT. However an important component of the solution is that appropriate strategies are put into place in schools to address these issues.

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[1] http://www.vcaa.vic.edu.au/vce/statistics/2006/statssect2.html#H2N40033C

[2] http://www.vcaa.vic.edu.au/vce/statistics/2006/statssect2.html#H2N40033C

[3] http://cms.curriculum.edu.au/anr2004/ch2_responsibilities.htm

[4] http://vels.vcaa.vic.edu.au/index.html

[5] http://vels.vcaa.vic.edu.au/essential/interdisciplinary/ict/index.html

In Victoria a new curriculum for VCE was implemented in 2007. Girls' attitudes to ICT have been taken into consideration in the redesign of this curriculum with the inclusion of collaborative problem-solving tasks and an approach which encourages students to 'visualise their thinking' (Mitchell, 2006). It may be a number of years before it is possible to evaluate the success of this approach.

Over the last two decades specific intervention programmes have also been implemented to attempt to redress the imbalance. These programmes include activities such as the creation of videos, 'girls in computing' days, camps, showcases, and computer clubs for girls (Craig, Scollary and Fisher, 2003). Historically intervention programmes have been focused at the upper secondary, or early tertiary, levels of education. After a comprehensive investigation into such intervention programmes, Teague (1999, p.63) advises that most of these interventions are 'restricted to very small populations and/or are not very successful'. Rogers (2002, p.3) however warns that 'If tiny, uncoordinated projects are implemented and evaluated without reference to the need to make the larger service system work better, there is a risk of concluding that "nothing works" – because we have evidence that, by themselves, each piece of the jigsaw is ineffective'. Teague (1999) suggests that what is needed is an intervention programme that is a much larger initiative, directed at a large population.

A recent Australian study to identify the factors that influence girls in their decisions regarding computing and future careers suggests that intervention programmes do have a positive effect. Preliminary findings indicate that girls who participated in intervention programmes were more positive about careers in computing, whether they undertook higher level ICT subjects or not, and were more likely to consider enrolling in university computer science courses (Anderson, Lankshear, Courtney and Timms, 2006).

Research Approach

The *Young Girls ICT – Into Computing Too* (YGICT) was recently completed. The project involved an in-depth exploration of intervention programmes operating for girls and ICTs within Australian schools. The purpose of the research was to better understand what was happening at the school level. This paper describes the research undertaken and the outcomes.

The first stage of the research involved an extensive review of the literature. Figure 1 describes the key causes and effects that are identified in the literature, which contribute to the lack of girls choosing to undertake further study and then a career in ICT, and is the starting point for this research. The factors can be loosely grouped into three categories: those relating to the *computing discipline and the profession* (including public image, an alienating culture and constant change); those relating to *educational institutions* (including the unconscious promotion of gender stereotypes, a perception of computing as a male domain and how computing subjects are taught); and factors relating to the *individual* (including family background, lack of role models and a lack of knowledge about computing careers).

The research explored the different intervention programmes whether small scale, such as involving a single teacher and their class, or on a large scale involving a whole school approach implemented across Australia. Programmes operating from outside the educational sector but aimed at young girls were also included as part of the investigation. Funding for the *Young Girls ICT* project was provided by the Department of Family and Community Services, Office for Women and the project was overseen by AWISE, the Australian Women in Science and Information Technology Entity.

The project began with short telephone interviews with a staff member from each of 280 government primary schools. The schools were chosen at random from state government web sites with 40 schools selected from each state and 20 from each territory. Furthermore information was sought from educators about intervention programmes, via requests in appropriate publications and through state computer teacher associations.

The project also involved an extensive search of Australian educational and government web sites. Part of this included looking for information on the approaches taken by the different State and Territory Departments of Education. The purpose of this was to establish the extent to which Governments are aware of the issue of the declining number of girls studying ICT and what policies they had in place to address this issue.

Finally a full-day workshop was held with 14 educators who operate intervention programmes. The purpose of this was to further explore how their projects were conducted and evaluated.
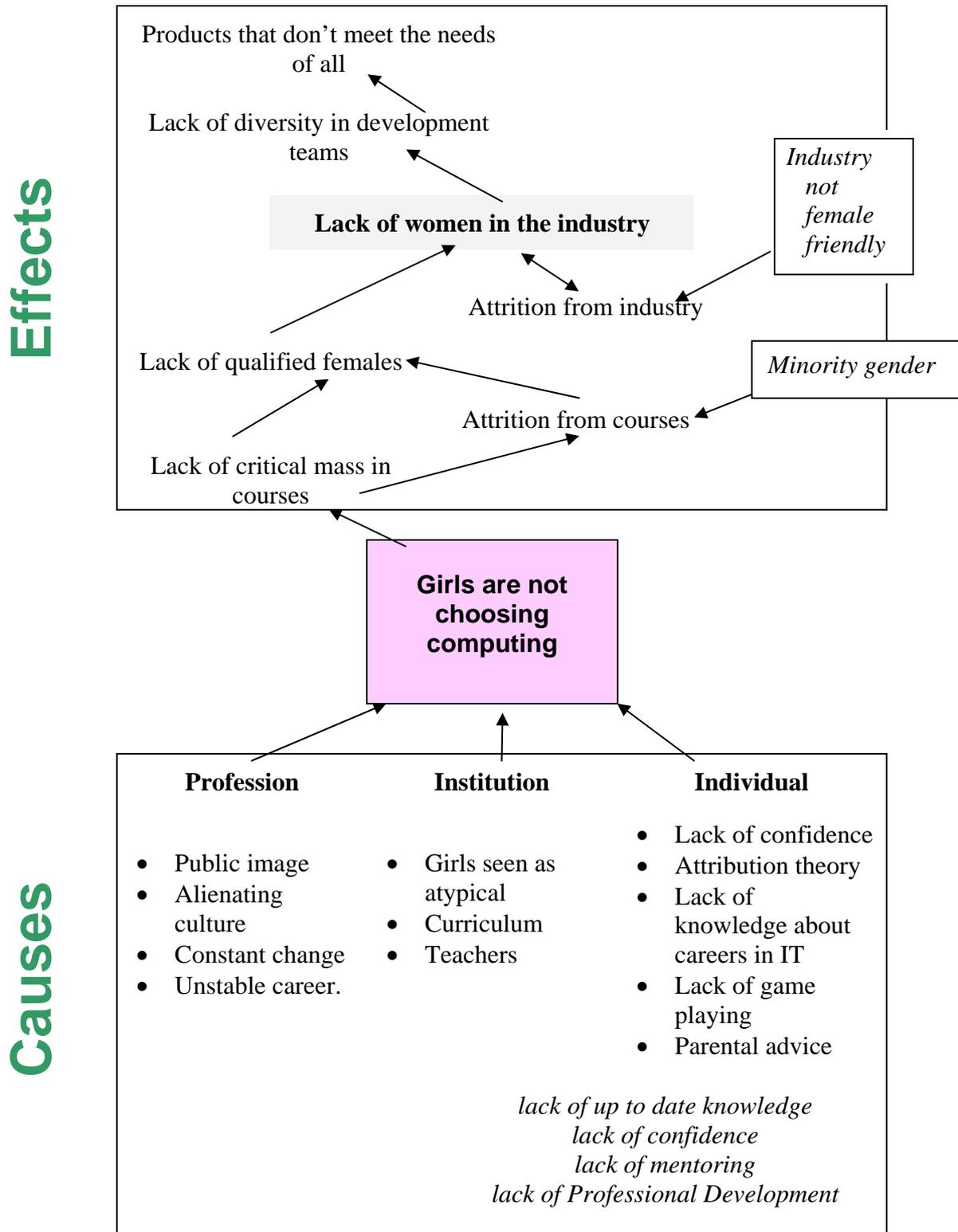
Products that don't meet the needs of all

Lack of diversity in development teams

Lack of women in the industry

Industry not female friendly

Attrition from industry

Lack of qualified females

Minority gender

Attrition from courses

Lack of critical mass in courses

Girls are not choosing computing

Profession

- Public image
- Alienating culture
- Constant change
- Unstable career.

Institution

- Girls seen as atypical
- Curriculum
- Teachers

Individual

- Lack of confidence
- Attribution theory
- Lack of knowledge about careers in IT
- Lack of game playing
- Parental advice

*lack of up to date knowledge
lack of confidence
lack of mentoring
lack of Professional Development*

Effects

Causes

Figure 1: The causes and effects of the lack of girls choosing computing

Results

The results of each of the different stages of the research are discussed next.

Telephone Interviews

The results on a state by state basis of the telephone interviews are described in Table 3.

Table 3: School contacted

State	Number contacted	Number of programmes	Type of programme
ACT	20	1	Have software that interest girls – they can use during their spare time
New South Wales	40	2	Girl related software available
Northern Territory	20	1	Girl related software they can use before school.
Queensland	40	3	Girls only lunchtime access to computers twice a week Software specifically for girls available
South Australian	40	1	Software specifically for girls available
Tasmania	40	1	Girls only lunchtime access to computers once a week
Victoria	40	2	Allowed to use computers during spare time. Have software programmes that are directed at girls, but no specific times they can use these by themselves.
Western Australia	40	1	Girls only lunchtime access to computers once a week

The results indicate that only twelve of the schools (4.3%) consciously provided resources or intervention programmes for their female students: Ten schools did this by choosing appropriate software for girls to interact with; and two schools provided 'girls only' access to their computer facilities at least one lunch time per week. Generally the intervention activity relied on the passion and enthusiasm of an individual teacher. Two schools indicated that in the past there had been a computer club/group for girls within their school but when the teacher who was organising it had left, the club had discontinued.

Issues which emerged from the interviews included a lack of understanding, as well as problems with a very crowded curriculum;

- [There is no need for interventions as]… *students are allowed to use computers during their spare time.*

- *When creating units of work I am conscious of the girls and that they are less likely to participate if we are not careful, but I just can't do separate things for the girls.*

- *I have two computers in my classroom. I am pretty good with them but there is not much time to teach individual children on the PCs when you have 25 students.*

- *Yes girls need to be engaged and encouraged to participate. However boys also need engagement or else there are behaviour issues. It's hard to do everything.*

Review of Websites

The States and Territories have different approaches to addressing the issue of ICT and girls. The strategies included:

- providing guidelines on how teachers can better engage girls with computing;

- providing access to information and research on the area;

- providing professional development activities including curriculum that has a specific focus on engaging girls in ICT;

- providing resources specifically for intervention programmes; and

- developing frameworks for action.

The review of Education and Government websites found information regarding numerous programmes in individual schools. Typically these programmes were small, usually involving a single teacher and their class, and usually relied on one enthusiastic individual. There were few programmes involving a whole school approach. The state with the highest amount of activity was Queensland with significantly more public information available regarding programmes in that state.

One-day Workshop

From the information gathered during the telephone interviews and extensive website search, key educators who were involved in intervention programmes were identified. Fourteen of these educators, representing primary secondary and tertiary institutions, were brought together for a one-day workshop, with the majority coming from Queensland. These educators were enthusiastic women (and one man) who had seen a need to encourage the use of, and interest in, computers by girls. The most common activity they were involved with was running a computer club for girls. Although, typically the schools were supportive of the work of the individual it was evident that in most cases if that individual left the school then the programme would cease to exist. Each of the computer clubs established were run during lunchtime or after school, and the facilities the staff had were limited to what the school was generally able to supply for the teaching programmes. The programmes were mostly designed by the individuals and focused on activities they believed were of interest to the girls. All of the educators believed that their programmes were popular with the girls however few had made any attempts at evaluating or disseminating their success.

Overall the results from this research indicate that:

- Some programmes exist which specifically attempt to engage young girls in thinking and working positively with computers.

- Many of these programmes are conducted at primary schools and often rely heavily on one individual teacher within the school. We can assume that if that person leaves the programme will cease to exist.

- Most of the programmes are not part of an overall co-ordinated approach but run at an individual level (that is one school does not necessarily know or share resources with another school).

- Facilities and funding for programmes must come out of general school budgets and it can be assumed that programmes are therefore restricted in what they can do or offer.

- Programmes aimed at secondary girls are more likely to be organised by external bodies, such as Women are I.T. (WIT) and the Victorian ICT Network for Women, than from within the school.

- Where there has been a state based initiative, such as in Queensland, this has resulted in significantly more programmes in operation and more awareness of the issues amongst teachers.

- Few of the programmes have been evaluated so it is difficult to assess their success.

Moving Forward - Recommendations

A number of reasons exist for the lack of programmes within schools. The rapidly changing nature of computing makes it difficult for any school to focus on all areas. Being proactive in the area of girls and ICTs, is just one of many issues that schools are attempting to address. Consequently it is frequently left up to individual teachers. Anecdotal evidence would suggest that in most schools there is little understanding of the seriousness of the flow-on effect if girls fail to develop an interest and enthusiasm for ICT. In many instances teachers are doing their best just to overcome their own lack of confidence in their use of technology and in keeping abreast with the rapidly changing technology itself. There are many competing demands for teacher attention within schools as well as a lack of resources. Intervention programmes such as computer clubs, that do operate are generally through the interest of one key individual or a small group of teachers and are often extra-curricula. Most of these initiatives are localised, are poorly funded and resourced, and generally rely on the goodwill of a few people.

To further demonstrate the competing demands surrounding technology and schools the Australian School Innovation in Science, Technology and Mathematics (ASISTM) project was examined. The Australian Federal Government has provided funding for specific projects which will improve science, mathematics and/or technology education in schools. A total of $33.7 million is being made available for ASISTM projects. Some 116 projects have been funded since July 2005 only two (1.7%) had a gender and ICT focus. The situation is no different at the state level: Since 2003 the Technology School of the Future, South Australia has awarded 70

research grants to enhance and enrich learning and/or teaching via ICTs. None of these projects have specifically had a focus on girls and ICTs (see Craig 2006, Appendix 3).

Given the variety of approaches taken to improving the number of girls wanting to study ICT and the general lack of success of these programmes, as indicated by the decreasing numbers, the question then is what can be done? The outcome of this research project suggests that good programmes need to become embedded into the school curriculum rather than being dependent upon one key individual's enthusiasm. Additionally a lasting and strategic cultural change is more likely if initiatives are targeted early in the pipeline – such as at the upper primary school and lower secondary levels.

Our research highlights the need for a larger scale government initiated intervention programmes. For example there was a higher proliferation of programmes in Queensland, which specifically targeted young girls and their interaction with, or attitudes to ICT. The approach adopted in Queensland through the *Girls and ICTs Framework for Action 2003–2004* and *Girls and ICT Strategy 2005–2008*, has demonstrable benefits with much greater awareness and activity in primary schools in that state (Craig 2006).

Computer Clubs for Girls (CC4G) which was created by e-skills UK, the not-for-profit Sector Skills Council for IT and Telecoms is an example of a very successful approach. CC4G was developed for girls aged 10-14 years old in response to a gender imbalance within the UK IT industry, which is similar to the previously discussed Australian ICT workforce imbalance. CC4G was designed to provide an opportunity for girls to experience and use IT in a different way. The materials aim to rekindle girl's interests in IT. All state schools in England are currently able to use CC4G at no cost, owing to funding from the Department of Education and Skills. This has been a significant investment with the total cost running into the millions of pounds. Computer Clubs for Girls is currently delivered to 2,000 schools and more than 62,000 girls.

Feedback from CC4G indicates that this type of club is highly beneficial both to students and schools. e-Skills UK report that since 2002, when their pilot programme was launched, there has been a reduction in the gender gap between boys and girls studying the General Certificate of Secondary Education ICT courses from 18% to 11% in 2006 (e-Skills 2006). Feedback from club facilitators in the programme also indicates an increased confidence in participating students, improvement in key skills such as communication and teamwork and the added advantage of disengaged students re-gaining enthusiasm for learning. "Teachers have found it a useful vehicle to re-engage girls who are underachieving in school" (e-Skills 2006). Further, the UK model is linked to the UK standardised curriculum objectives.

The outcome of the research we are reporting in this paper, has been the implementation of a pilot programme for girls in a Victorian government school based on the CC4G model. The project will run for approximately 12 months and has the support of the Education Department and a local ISP. A major issue that we have already encountered in establishing the pilot programme has been that schools in Victoria have to pay for their own download costs. Finding a partner to support this has been important. Additionally it is becoming obvious that the model can not be successfully implemented into Australian schools without major adaptation.

Conclusion

The issue of the lack of girls considering a career in computing is not new nor does it appear to be diminishing.

The Young Girls ICT report identified significant difficulties and issues. Interventions have historically been focused at upper secondary school and tertiary levels but have been fragmented because they have been undertaken by autonomous groups or individuals. Specific mention of gender equity, as a focus, is made in many official curricula documents. However the continuing decline in the number of young women who are prepared to consider computing for their career would indicate that the current method of relying on individual teachers and inclusive teaching practices is not sufficient. Rather than localised ad-hoc programmes, a coordinated large-scale intervention programme needs to be developed. For example, in the United Kingdom, CC4G is currently delivered to more than 62,000 girls. It is showing a positive impact on the attainment of 10–14 year old girls in ICT.

Models such as CC4G (e-Skills 2006), the Carnegie Mellon University Women@scs Outreach Programme (Blum and Frieze 2003), the Girl Scouts programme developed by the Girl Scout Research Institute in the USA all need to be explored to see whether they would be of benefit, and are adaptable to, Australian schools. Further research is required to look at these, and other successful models, to develop a model that will work in the Australian education environment.

Our current project is significant in the Australian context because it will develop a programme for girls, on a large-scale, providing extension and support activities for curriculum based learning. The programme aims will actively work to address the lack of diversity in the ICT industry. Through this programme it is anticipated that

young girls' attitudes to ICT courses and careers will be significantly changed early in their secondary education and carry through to an increased involvement in ICT in later stages of education and industry. It will change the view that ICT is boring and only for the boys to something that is fun and exciting for girls, just as much as boys.

The lack of women in the ICT industry is a complex issue that will not be easily solved. Our project will help to engage girls to think and work positively with computers thereby making a significant contribution to addressing the issues faced by young girls early in the ICT pipeline.

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