International Journal of Research Studies in Computing
2012 October, Volume 1 Number 2, 3-12

Including the digital divas: Female representation in ICT programs at the University of Cape Coast

Ayebi-Arthur, Kofi
University of Cape Coast, Ghana (kofiayebi@ucc.edu.gh)
Dora, Baaba Aidoo
University of Cape Coast, Ghana (daidoo@ucc.edu.gh)
Aheto, Simon-Peter Kafui
University of Cape Coast, Ghana (kafuiaheto@yahoo.com)

ISSN: 2243-772X
Online ISSN: 2243-7797

OPEN ACCESS

Received: 8 February 2012 **Revised**: 1 March 2012 **Accepted**: 7 May 2012
Available Online: 15 June 2012 **DOI:** 10.5861/ijrsc.2012.79

Abstract

Throughout the world, there are problems in attracting young women to science and technology studies. The problem is worse in Africa than in any other region. Female enrolment figures in the sciences reveal a low trend of female participation in computer science/ICT. Hence, there is the need to investigate the trends in female representation in ICT programs and its implications for admission processes as well as barriers that could possibly account for the low females' participation in computer science/ICT at University of Cape Coast to help the nation attain equity. Two hypotheses and one research question were used to direct the study. The Evans model was used to explain Barriers to participation and Eccles et al. model was used for explaining the disparity in gender representation in Science, Technology and Mathematics. A descriptive comparative study design was used for the study. Data was extracted from the congregation list of the 2003/2004 academic year to 2009/2010 academic year. The results indicate that there was statistical difference in the number of male and female students graduating in the various programs offered in the university and that there was statistical difference in the number of male and female students graduating in computer science/ICT programs. We recommend that the Ghana Education Service must improve on the mentoring programs for basic school female pupils and within the university, management can brainstorm with students some innovative strategies that could be harnessed to help eradicate gender stereotyping as a means of improving on numbers of females who participate in ICT programs.

Keywords: women; ICT; gender discrimination; role models; technology

Including the digital divas: Female representation in ICT programs at the University of Cape Coast

1. Introduction

Ghana as a member of the comity of nations is enjoined to fulfill the Millennium Development Goals by 2015. The Education Strategic Plan (ESP 2003-2015), developed in 2003, guides education sector development. The ESP serves as the framework by which Ghana meets its commitment to achieve the Millennium Development Goals – namely Gender Parity in primary schooling by 2005 and Universal Primary Completion by 2015 - and other international development goals on education (Ministry of Education, Science and Sports, 2006). The education-related indicators consist of the ratio of girls to boys in primary, secondary, and tertiary education; and the ratio of literate females to males between 15 and 24 years of age. Various efforts made by the government through the promotion of Girl-child education and Science, Engineering, Technology, and Mathematics (STEM) clinics to promote mathematics and science education have not yielded the desired results.

Even though history does not show it, women played an important role in the early days of computing. In fact, many of the initial programmers were women: the world's first conceptual programmer was Ada Lovelace; the first programmers of the world's first electronic computer, the ENIAC, were six women (Kay Mauchley, Antonelli, Jean Jennings Bartik, Betty Snyder Holberton, Marlyn Wescoff, Meltzer, Frances Bilas Spence, and Ruth Lichterman TeiteIbaum); one of the first programmers of Harvard's Mark I was Grace Hopper; the first programmer of the National Bureau of Standards SEAC machine was Ethel Marden, and so on (Gurer, 1995; Gurer, 1996). Girls and boys start off equal in mathematics and science performance and interest in school. They appear to do equally well in both subjects in elementary school. Once courses become optional in secondary school, the downhill spiral in enrolment of female students in mathematics and physical science begins, accompanied by decreases in achievement and interest (Blosser, 1990). This means that women are inadequately prepared for most tertiary majors as well as those in technical fields. For males, parental expectations for scientific and technical careers for their sons are the motivating forces while, for females, their own education aspirations provided the drive to enroll. So, women have to be more self-motivated to choose these courses (Tsuji, Gerry, & Ziegler, 1990).

All over the world, women opt to enroll in arts, human studies and social sciences in greater proportions than they do in mathematics, science and technology (Evans, 1995). The origin of this under representation of women has been attributed to structural factors, created in and through the social structures of institutions and the segmentation of the labor market, and further entrenched in values and beliefs about acceptable roles and expectations. These factors emerge in varied general and specific roles assigned to the technological domain barriers to women's participation. Persistent gender differences in the choice of college majors in technical fields account for a substantial share of the gender wage gap among college graduates (Brown & Corcoran, 1997). Conditions that prevent girls and women from accessing educational opportunities include illiteracy, poverty, time famine, socio-cultural factors, mobility and relevancy. ICTs have the potential to ease or remove some of these barriers, but they may also create additional barriers including restricted access to the technology, and factors inhibiting usage such as high costs and lack of skills and information (Green & Trevor-Deutsch, 2002).

Research has shown that cultural stereotypes (e.g., men excel in mathematics and science) influence parental perceptions of their children's capabilities and consequently lead parents to structure different perceptions of their sons' and daughters' academic abilities. If male students make choices in courses due to parental pressure, they would have still made the "right" choices. Female students on the other hand, who need intrinsic reasons, would be less likely to have adequate information to guide their selection of courses. To promote high schools choices for science based courses necessary for careers in science and engineering, educators must emphasize the relevance of mathematics to students' career goals (Tsuji & Ziegler, 1990). Another cultural aspect of gender

and ICTs is gender bias in attitudes towards women studying or using information technology. Throughout the world, there are problems in attracting young women to science and technology studies (WAfCM, 2002). Reflecting this trend, females continue to be under-represented in some fields of study, such as engineering, computer and information science, physical science, and chemistry, and women earn less than half of the professional degrees in business, law, dentistry, and medicine (NCES, 2004).

The current global significance assigned to increasing the participation of women in technology and technological education reflects two world-wide trends. First, is reflected in the pervasive utilization of technology in all domains of everyday activity in the world, with extensive implications for national economic development. On a daily basis, men and women are increasingly engaging with the processes, products and effects of technology including occupations involving technology. The second is the recognition of the need for action by the international community in securing the advancement of women and the elimination of gender-based discrimination, particularly in the fields of education and employment.

Evans (1995) present these various kinds of barriers as a series of disjunctions, all applying generally to women's participation, but applying particularly in the case of technological education. The disjunctions are between: maintenance of formal entry requirements and overall level of educational attainments among women; domestication of women's labor and educational/career aspirations, charging of fees and financial dependency/poverty; traditional curricula and experiential knowledge of women, instrumental pedagogies and women's preferred learning modes.

No one can deny the progress that has been made in the numbers of African children receiving formal education, accompanied by comparable increases in provision for teacher education during the last few decades. However, all available indicators point to severe and persistent crises in the education sector of most African countries and despite all efforts directed towards improvement of education in Africa, gross enrolment ratios are consistently on the decline and manpower development targets are not being met, particularly in the scientific and technological sector.

Girls and women experience serious disadvantages in access to education in most developing countries. In some regions, gaps between the enrolments of girls and boys have narrowed for example in East Asia and there should be parity between them by 2005. North Africa and South Asia have also made some progress; but with the exception of a few countries, in the developing world, girls and women have less access to education at all levels and lower levels of literacy. A research conducted by Asian Pacific Women's Information Network Center (APWINC) found gender differences in enrolment in ICT in universities and colleges in the Pacific region, (Kim, Wansundera, & Kim, 2003). The closest to parity in enrolment was found in the Philippines, whereas there was a marked gender difference in enrolment in the other five countries (ranging from 20 per cent female enrolment in Korea to 33 per cent in Sri Lanka). The role of women as role models is extremely important in improving the quality of the educational experience for girls and women.

Although many African countries have achieved parity in the enrolment of girls and boys in the first grade of primary school, the drop-out rate of girls is still higher than that of boys and many of those who drop out do so before acquiring functional literacy and numeracy. Girls' access to education is concentrated at the lowest level: approximately 23 per cent of primary school graduates enter secondary institutions while less than three per cent of those who leave secondary school continue to tertiary levels of education, increasing the gender discrepancies from the lower to the upper levels and perpetuating a lack of role models for those girls who might otherwise choose to follow a scientific or technical career. Another survey conducted by Schumacher and Morahan Martin (2001) argued that females are less experienced with ICT's and are more likely than males to have negative attitudes towards computers. As Evans (1995) have stated, the barriers to women's education in developing countries are well known. What is significant is the relative strengths of the barriers in different regional contexts; "The challenge is to identify which barriers are the prime ones in specific settings or sub populations and which policy measures are appropriate and affordable" (p.2).

Although a number of innovative actions are underway to remedy this situation such as national policies, compulsory science and technology education, positive discrimination for girls, changes in curriculum and textbooks as well as awareness-raising actions, it is evident that there is need for change so as to cater equally for boys and girls. Since science and technology are domains historically ascribed to males, women and girls tend to find technology intimidating and alienating. We tend to see the ICT sector as a realm of society that is unfriendly and dominated by men. We associate technology with men and assume that its production, application and maintenance are areas that fall more easily into the male domain. In these ways we ourselves sometimes play an unconscious role in reproducing the gendered nature of our society and the ICT sector at large. These internal barriers to participating in the ICT sector must also be overcome (AIS-GWG, 1999).

1.1 Statement of the problem

Throughout the world, there are problems in attracting young women to science and technology studies. The problem is worse in Africa than in any other region. Many (predominantly male) math and science teachers in Africa hold outmoded views that girls cannot think or work scientifically and that science is too mechanical and technical for girls, thus discouraging female students. As Huyer (2003) reported, girls who do enroll in schools participate less in science and technology education and professions. For example, even in countries like Brazil, where over half the students at the tertiary level are female, girls form only 34 percent of the students who join the natural science courses that include math, engineering, and computer sciences (p. 101).

In the Ghanaian education sector, females are under-represented in such fields as mathematics, engineering and computer sciences, hence, the observed shortfall of female mathematics and ICT teachers in Ghanaian Senior High Schools. Reflecting the trends in the country, only few females choose to study computer science/ICT at the University of Cape Coast compared to other programs in the sciences. The first set of students graduating in computer science/ICT programs was in the 37th congregation.

1.2 Objectives

- To identify trends in the graduation of male and female graduates at the first degree level for the period 2003-2010.
- To find out if there a significant difference between the male and female graduates in ICT programs.
- To explore related literature to locate factors that account for the low representation of females in computer science/ICT.

1.3 Hypotheses

- There is no significant difference between the number of male and female graduates for the 2003-2010 academic years.
- There is no significant difference between the number male and female graduates in ICT programs for the 2003-2010 academic years.

1.4 Research question

- What factors account for the low female participation in computer science/ICT programs at the University of Cape Coast?

1.5 Analytical framework

Barriers to participation are found to be of several kinds and explained with varied models (Evans, 1995). The Evans model is discussed in the following section.

A. Cultural: common patterns in role and status of women emerge across countries, despite widely different circumstances. They reflect the cultural and cross cultural social norms and traditions by which the subservient status of women is maintained. In some societies these create "almost insuperable obstacles to women's participation in education" (Evans, 1995). Analyses of participation rates in different social and cultural contexts show that they reflect closely the relative status of women and the power of tradition.

B. Attitudinal: perceived differences in male and female roles and capabilities, inculcated through socialization in the home and family, reinforced through schooling, through vocational/career guidance services, through experiences in the workplace, peer pressure and through absence of female role models. Enormous motivation and self-confidence is needed to break through these barriers. Lack of confidence and self esteem is itself a major barrier, and one which every successful initiative in this field has found it essential to address directly and specifically;

C. Qualificatory: lack of Mathematics/Science pre-requisites for entry to programs is often perceived as a barrier, particularly by those involved in admissions to programs (although evidence suggests that this is also perceived rather than real in some cases, Ellis (1990), for example, shows that women in the Caribbean attain higher levels of literacy and numeracy that males, and that in the CXC Secondary Schools Examinations at General Proficiency level, a larger proportion of females were entering for chemistry and mathematics than males, and equal proportions for Physics. Despite this “the belief continues to persist that females are by nature technologically ignorant and unable to absorb scientific and technological information or to acquire technical skills”); in many countries as many women as men achieve general proficiency in Mathematics and Science, but remain grossly underrepresented in Science and Technology subjects at higher levels, once "choices" are made. Many women with university entrance qualifications in these subjects opt for human and social science courses at University level.

   In other countries, social cultural and economic conditions conspire to encourage early termination of the education of girls. Low levels of general education are major barriers, which have to be tackled before the specifics of science/technology participation can be addressed. In the Middle East and North Africa, by contrast, higher proportions of women are found in science and engineering courses at University level than in many western countries. El-Sanabary (1993) attributes this to the good access to mathematics and science courses at secondary level;

D. Situational: the barriers faced generally by women in attending courses apply; family commitments, lack of partner support, financial, living in rural/isolated areas. Fees requirements are major barriers where women do not have independent control of resources, where they are dependent on male partners who are unsupportive. Male partners are more likely to be unsupportive of entry to non-traditional, male oriented spheres. (Ellis cites examples of suspicion/jealousy of male partners as well as ridicule). Women who do have their own source of income are also, on average, lower paid than their male counterparts.

   Poverty is a major situational factor in many regions. Trivedi (1989), states that the combined effects of poverty and social/cultural sanctions create almost insuperable barriers in parts of South Asia. Social class factors also interact with gender in significant ways. High social class status of some women may remove some of these barriers; King and Hill (1991) point to the phenomenon of upper class women who buy in low paid domestic labor of other women in order to pursue their educational/career aspirations. This phenomenon can be found in many developed and developing countries. Situational and cultural factors intersect in the barrier of significant distances to travel to schools and other educational centers; this is a major barrier for girls and women in, for example, India and Pakistan, as Caldwell, Caldwell and Reddy (1985) and Shah (1986) report, respectively.

Another model for explaining the disparity in gender representation in STEM is that developed by Eccles et al. (1983) as cited by Evans (1995). According to the model, both parents and teachers contribute to gender differences in motivation by (i) modeling sex-typed behavior, (ii) communicating different expectations and goals for boys and girls, and (iii) encouraging different activities and skills.

E. Institutional barriers: these are barriers which arise because of the ways in which institutions make their programs available. Significant general barriers which apply to women are well documented. These include: fixed hours; substantial attendance requirement; lockstep approach to curriculum; makes missed sessions hard to catch up on; lack of child care facilities; off putting, "unfriendly" course information. These are exacerbated in the case of entry to technical and technological studies by: lack of female teachers/assumptions and attitudes of male teachers; male orientation in courses publicity/male "image"; inflexible selection and entry requirements; often has large attendance requirement for practical skills/laboratory based work; male oriented language and male images in teaching materials; instrumental pedagogies and curriculum content which ignores the social context of technology.

2. Methodology

2.1 Research Design

A descriptive comparative study design was used for the study. Data was extracted from the congregation list of the 2003/2004 academic year to 2009/2010 academic year.

2.2 Data collection Procedure

The number of graduating students was obtained from the 34th, 35th, 36th, 37th, 38th, 39th, 40th and 41st Congregation Lists of graduate booklets of the University of Cape Coast. The various degree programs were listed and the number of students graduating was written down. This was further divided into male and female students. Percentages analysis was used to find out the number of students graduating in the various programs offered in the university. The ratio of male to female graduates and the ratio of male to female graduates in computer science/ICT programs were also determined. Independent sample t- test was used to determine if the differences in the ratio of male to female graduates and the ratio of male to female graduates in computer science/ICT programs were significant. SPSS version 13 was used to analyze the data.

3. Results

Table 1

Distribution of students graduating in various programs offered at the University of Cape Coast

Congregation	Year	Male	%	Female	%	Total
34th	2003	1333	75.2	439	24.8	1772
35th	2004	869	62.1	530	37.9	1399
36th	2005	1310	67.4	633	32.6	1943
37th	2006	2107	66.8	1045	33.2	3152
38th	2007	2270	67.6	1090	34.4	3360
39th	2008	2140	65.3	1138	34.7	3278
40th	2009	2766	67.7	1318	32.3	4084
41st	2010	2232	63.9	1259	36.1	3491

Table 2

Results of independent samples t-test of male and female students graduating in various programs offered at the University of Cape Coast

Variable	Group	Mean	Standard deviation	*t*	p-value
students	Male	1878.38	635.42	3.7	0.002
	Female	931.50	344.37		

An independent samples t-test was conducted to compare the numbers of male and female students graduating in various programs. The results indicate that there was statistical difference in the number of male (M = 1878.38, SD = 635.42) and female (M = 931.50, SD = 344.37) students graduating in the various programs offered in the university.

Table 3

Distribution of students graduating in computer science/ICT programs between 2006 and 2010

Congregation	Year	Male	%	Female	%	Total
37th	2006	9	81.8	2	18.2	11
38th	2007	61	83.6	12	16.4	73
39th	2008	59	85.5	10	14.5	69
40th	2009	65	89.0	8	11.0	73
41st	2010	51	83.6	10	16.4	61

Table 4

Results of independent samples t-test of male and female students in computer science/ICT programs

Group	Mean	Standard deviation	*t.*	*p*-value
male	49	22.93	3.9	0.005
female	8.4	3.84		

An independent samples t-test was conducted to compare the numbers of male and female students graduating in computer science/ICT programs. The results indicate that there was statistical difference in the number of male (M = 49, SD = 20.52) and female (M = 8.4, SD = 3.44) students graduating in computer science/ICT programs. The magnitude of the difference in the means was large (eta squared = 0.66).

4. Discussion

4.1 Hypothesis 1

There is no significant difference between the number of male and female graduates for the 2003-2010 academic years.

The finding from the data shows an intriguing trend for female representation in the programs offered at the university. The data shows an overall increase in enrolment numbers of females in programs. This increase possibly reflects the need to promote female education in fulfilment of the national mandates in the Education Strategic Plan in the eradication of poverty and accelerated national development. Even while the total enrolment went up from 24.8% to 37.9% in the 35th congregation, the proportion of females to males who graduated from the various programs offered in the university has consistently failed to attain a 40 percent mark. This trend

confirms the literature on the persistently low levels of female representation in university programs across the developing world (NCES, 2004).

4.2 Hypothesis 2

There is no significant difference between the number male and female graduates in ICT programs for the 2003-2010 academic years.

The findings indicate there a very significant difference (eta squared = 0.66) in the means obtained for males and female representation in ICT programs at the university. This confirms Ayalon (2003) that female students major in mathematics, technology, and sciences less often than male students, and they tend to concentrate in humanities and social sciences, two fields of study that do not attract many men (p.277). This trend calls for some affirmative action strategies during admissions to help improve on the numbers of females in ICT programs. In pursuant of this ideal, the university could reach out to administrators of senior high schools to formulate innovative strategies that could be harnessed for girls to whip up more interest in ICT subjects to stream them towards ICT programs at the tertiary education level.

4.3 Research Question 3

What factors account for the low female participation in computer science/ICT programs at the University of Cape Coast?

Relating the observed enrolment trend to the literature (Ayebi-Arthur, 2011), the enrolment trend suggests a link between the choice of subjects for students at the Senior High Schools and the representation of females in ICT programs. The literature, (Ottevanger, van den Akker, & de Feiter, 2007) reiterates the trend for high female representation in the Arts in contrast to Science related subjects. When these girls gain admission to tertiary institutions, the programs of choice tends to lean largely towards the Arts. Again, the literature (Weinberger, 2004) concludes that females were not pursuing programs in the field of computer science in adequate numbers, and when they did enter the profession they were more likely to be employed in word processing and data entry positions, rather than in programming and decision-making.

5. Conclusion

The University of Cape Coast is an institution that offers training for the youth notably teachers for the second level of education and top and middle level human resource for the manufacturing and agricultural industries in the country. The products of the institution occupy very prominent decision making positions the country. If the current trend in female representation is anything to go by, the contribution of this university towards the provision of equitable education for the future employment of the youth in the country is yet to hit the mark of national and international mandates. This conclusion has implications for admissions to ICT programs.

There is the concern that if women were not active participants in the field of ICT, they will not be in a position to ensure gender-sensitive design and implementation. Additionally, the potential for establishing women as role models for younger females is lost. Considering the fact that women predominate in numbers and form the bulk of the human resource in the primary industries sector of the economy, women's technical education and their participation in science and technology related professions are critical if Ghana is to achieve the mandates of the Millenniums Development Goals (MDGs) and the Ghana Poverty Reduction Strategies (GPRS) 1& 2. Increasing the pool of human resources in the area of technology will contribute to increased creativity, expertise, and competitiveness in the technology sector. Accentuating this argument the Gender Working Group of the United Nations Commission on Science and Technology argues that it is important for all nations to move toward gender equality in science and technology, so as to accelerate the pace of national progress and achieve sustainable development (Gender Advisory Board, 2001; Oldham, 1995) as quoted by

Huyer (2003).

5.1 Recommendations for practice

In order to improve on female representation in ICT subjects at the senior secondary school and tertiary levels, all stakeholders including such females themselves, should be made more visible in the society to serve as role models for the youth. The stereotyping that occurs in society and the school should be eradicated with special educational campaigns from agencies like the National Civic Education and the Ghana Education Service (GES) as well as civil society groups like the Ghana National Campaign on Education. The GES must improve on the mentoring programs for basic school female pupils being undertaken by Circuit Supervisors to expose the youth to the benefits of a high involvement of females in ICT programs. Where exceptional females are identified in schools, they should be celebrated to inspire others. Within the university, management can brainstorm with students some innovative strategies that could be harnessed to help eradicate gender stereotyping as a means of improving on numbers of females who participate in ICT programs.

5.2 Recommendations for research

Factors influencing female students' interest in computer science/ICT as a subject of study and a career should be investigated.

6. References:

Ayalon, H. (2003) Women and men go to university: Mathematical background and gender differences in choice of field in higher education. *Sex Roles*, 48(5/6), 277-290. <http://dx.doi.org/10.1023/A:1022829522556>

Ayebi-Arthur, K. (2011). Interest in ICT studies and careers: Perspectives of senior high school female science students in three districts in the central region of Ghana. *Ghana Journal of Education and Teaching, 12*, 39.

Blosser, P. E. (1990). Procedures to increase the entry of women in science-related careers. *ERIC Digest* [Online]. Retrieved from http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED321977

Brown. C., & Corcoran, M. (1997). Sex-based differences in school content and the male female wage gap. *Journal of Labour Economics, 15*, 431-465. <http://dx.doi.org/10.1086/209867>

Caldwell, J. C., Caldwell, P., &. Reddy, P. H. (1985). Educational transition in rural. *Population and Development Review II*, 29-51. <http://dx.doi.org/10.2307/1973377>

Ellis, P. (1990). Measures increasing the participation of girls and women in technical and vocational education and training: A Caribbean study. Commonwealth Secretariat, London.

El-Sanabary, N. (1993). Middle East and North Africa. In E. M. King & M. A. Hill (Eds.), *Women's education in developing countries: Barriers, benefits and policies.* World Bank, Washington, D.C.

Evans, K. (1995) Barriers to participation of women in technological education and the role of distance education. *COMLEARN, 6*(2). Retrieved from http://www.col.org/PublicationDocuments/pub_Barriers_Participation_Women_Technological.pdf accessed on 27-04-2011

Gurer, D. (1995). Pioneering women in computer science. *Communications of the ACM, 38*(1), 45-54. <http://dx.doi.org/10.1145/204865.204875>

Gurer, D. (1996). Women's contributions to early computing at the National Bureau of Standards. *ZEEE Annals of the History of Computing, 18*(3), 29-35. <http://dx.doi.org/10.1109/85.511941>

Huyer, S. (2003). *Gender, ICT and education*. Unpublished document. Retrieved on August 1, 2009 from http://archive.wigsat.org/engenderedICT.pdf

Kim, K. C., Wansundera, L., & Kim, Y. (2003). ICT related human capital and women's informatization of Asian countries: China, India, Indonesia, Korea, Philippines, Sri Lanka, presentation at the Forum on

ICTs & Gender: Optimizing Opportunities, Kuala Lumpur.

King, E. M., & Hill, M. A. (1993). *Women's education in developing countries: Barriers, benefits and policies.* John Hopkins University Press, Baltimore and London.

Ministry of Education, Science and Sports. (2006). *10 year work plan for education in Ghana*. MOE.

National Center for Education Statistics. (2004). *NAEP 1999. Trends in academic progress*. Washington, DC7 U.S. Department of Education.

Ottevanger, W., van den Akker, J., & de Feiter, L. (2007). World Bank working Paper No. 101. Africa Human Development Series Developing: Washington, D.C.

Shah, N. B. (1986). *Pakistan women: A socioeconomic and demographic profile*. E-W Population Institute, Honolulu.

Trivedi, J. H. (1989). Women's development through distance education. *ICDE Bulletin, 21*, 17-22.

Tsuji, G., & Ziegler, S. (1990). What research says about increasing the numbers of female students taking math and science in secondary school. *SCOPE, 4*(4), 1-4.

Weinberger, C. J. (2004). Just ask! Why surveyed women did not pursue IT courses or careers. *IEEE Technology and Society Magazine,* (Spring).

World Association for Christian Communication (WAfCM). (2002). Forum: Gender and the digital divide. Retrieved from http://www.wacc.org.uk/publications/mgm/11/digitaldivide.html