University of the Witwatersrand,Johannesburg

Department of Computer Science

Retention of women in Computer Science

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Outline and introduction

- focus – Computer Science at university level
- motivation
- international trends
- South Africa and Wits
- why?
- what can be done?
- research and curriculum at Wits
- WWW resources

Motivation

- shortage of IT professionals
- lack of diversity
- importance for South Africa as a developing country
- untapped source of potential resources

International trends

- USA and Canada [Camp *et al.* , Kozen and Zweben 1998]
  - incredible shrinking pipeline – decrease from percentage at bachelors to percentage at full professor and decreasing trend over time
  - percentage of degrees awarded to women in biological sciences, engineering, and physical sciences is increasing

- two sources of data
  - US Department of Education – all US universities
  - CRA – US/Canadian PhD granting universities
- percentage of degrees awarded to women
- undergraduate – increase from mid 70's, then decrease from mid 80's, prediction of a slight increase in next few years

year	75	...	83/4	...	95/96	96/7
all US	19%		37%		28%	
PhD gr					16%	16%

- postgraduate

	year	Masters	PhD
all US	1995/6	27%	14%
PhD gr	1996/7	22%	14%

- percentage female academics in 1996/7 at PhD granting institutions

assistant professor	20%
associate professor	10%
full professor	6%

- Britain [Lovegrove and Hall 1991, UCAS]
  - undergraduate – acceptance into degrees, decrease in 80's as computers introduced into schools

year	78	79	80	81	82	83	84	85	86	87	88	89
%	24	24	23	22	22	18	15	10	11	10	11	13

year	...	96	97	98	99
%		19	19	19	20

  - postgraduate and academic – anecdotal, low percentage in mid 90's
- similar problems in Australia, New Zealand, Netherlands

South Africa

- general situation – anecdotal information from early 90's
  - undergraduate – 20% to 50%
  - differences between English-speaking and Afrikaans-speaking universities
  - differences between Computer Science and Information Systems
  - academic - only one female full professor
- some evidence of shrinking pipeline

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- ongoing monitoring of gender and race breakdown [Herbert 2000, Galpin and Sanders 1993]
  - undergraduate – 1986-1992 20-30%
    no trends, no difference in persistence
  - Honours – 1986-1992 23%
  - MSc and PhD – percentages are lower
- evidence of shrinking pipeline

Why?

- social factors, socialisation
- stereotyping
  - computers
  - science and computer science
- differences in ability?
- differences in knowledge
  - maths background
  - prior experience with computers

- differences in self-confidence
- differences in preferred learning environment
- misconceptions about computer science
  - programming
  - computing culture
  - administrative/clerical work
- lack of role models and mentors
- survey of causes [Galpin 1992, Herbert 2000]

What can be done

- understanding of causes and solutions
- understanding of local situation and causes
- social change
- schools
- university environment
  - mentors
  - role models
  - physical safety

- university teaching – various solutions have been suggested (discussed in [Galpin 1992, Herbert 2000])
  - subject matter
    - maths
    - applications
    - human-oriented
  - teaching approach
    - introductory courses
    - structured labs
  - change of perceptions
  - removal of gender bias

Research and curriculum at Wits

- ongoing monitoring of gender and race breakdown
- first year curriculum development [Mueller *et al.* 1993, Sanders and Mueller 1994, Sanders and Mueller 2000]
  - build from fundamentals
  - give overview of computer science
  - emphasis is not programming
  - does not favour those with computing experience

- research into attitudes to computer science of first year Faculty of Science students [Sanders and Galpin 1994]
  - males registered for CS I, more informal and less formal exposure, more confidence
  - females registered for CS I, more formal exposure, less confidence
  - males not registered for CS I, less exposure, more negative perceptions
  - females not registered for CS I, more female role models, more games

- research into role models
  [Herbert 2000, Herbert and Sanders 1999]
  - lack of positive role models
  - male dominated but women can learn
  - perception of good careers
  - confusion about what computer science is
- current research
  - how perceptions of computers and computer science change during the first year curriculum
- possible future research
  - national survey at university level

Conclusion

- shrinking pipeline is an issue
- need to understand causes and solutions
- Department of Computer Science at Wits
  - doing research into causes
  - developing curriculum
  - monitoring

WWW Resources

- SA WISE (South African Women in Science & Engineering) – association for strengthening the role of women in science and engineering in South Africa.
  `http://www.sawise.org.za`
- TAP (The Ada project) – information and resources relating to women in computing
  `http://www.cs.yale.edu/~tap/tap.html`
- The Grace Hopper Celebration of Women in Computing – conference held every three years focusing on technical and academic contributions from women in computing
  `http://www.sdsc.edu/Hopper/`

- ACM-W (The ACM's Committee on Women in Computing) – committee of international professional organisation
  `http://www.acm.org/women`
- IEEE Women in Engineering Committee – committee of international professional organisation
  `http://www.ieee.org/organizations/committee/women/`
- WiC (Women in Computing) – predominantly British organisation
  `http://osiris.sunderland.ac.uk/wic/`
- CPSR (Computer Professionals for Social Responsibility) – professional international organisation concerned about impact of computer technology on society, based in USA
  `http://www.cpsr.org/program/gender/index.html`

- CRA-W (The Computing Research Association's Committee on the Status of Women in Computer Science and Engineering) – committee of North American association of university departments and research laboratories
  `http://cra.org/Activities/craw/`
- SWIFT (Supporting Women in Information Technology) – research program to increase the participation of women in Information Technology
  `http://taz.cs.ubc.ca/swift/`
- IWT (The Institute for Women and Technology) – works on technology that has positive impacts on women around the world
  `http://www.iwt.org/`

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