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Informatics education: trends, problems and the future

Focus group
Joe Turner (USA; chair), John Hughes (AUS; rapporteur),
Adrie Beulens (NL), Betsy van Dijk (NL), Sally Fincher (GB),
Tsurayuki Kado (J), Ken Robinson (AUS), Ad Sanders (NL),
Deny Smeets (NL), Erkki Sutinen (FIN), David White (NZ) and
Hanno Wupper (NL)

Abstract

In the late 1980s there was a widespread belief in the informatics education community that informatics curricula were maturing and that the rate of change would slow down. However, the rate of change in informatics programs is as rapid as ever. In this focus group paper we examine the current state of informatics education and identify some of the stimuli for change and hindrances to change as well as future trends within and impacting informatics education.

1   CURRENT STATE OF INFORMATICS EDUCATION

The environment in which informatics education finds itself today can be characterized as follows.

An ongoing identity crisis for informatics
There is considerable variance in what is perceived to be the discipline of informatics. This results in a lack of professional identity: the public does not really know what informatics is about and the business community frequently does not

recognize informatics as a discipline in its own right. Unlike disciplines such as medicine and law, it is not possible to state a simple mission for informatics in terms of its role in society.

At the heart of this problem is the rapid expansion of the field, the lack of agreement on what constitutes the core of the discipline and the need to produce a coherent integrated body of knowledge and skills concerned with systems design and implementation.

Rapid changes that have made computing accessible to noninformatics professionals have raised questions about what the discipline of informatics is and will the discipline continue to exist.

A danger of isolation
There is a perception that informatics wants ownership of everything to do with 'computers' and 'information', that it is internally focused and is not interested in applying its knowledge and skills.

Changing roles for informatics graduates
As users have become more empowered by access to powerful software tools, applications-generation software and subject-oriented software, the need for informatics graduates as intermediaries in developing many computer systems has diminished and their role has changed. Nonetheless, demand for informatics graduates remains high.

Changing learning environments
There is a change away from traditional modes of teaching towards more flexible student-centred approaches to learning. Students want access to learning modes which allow them to learn with fewer time and space constraints, and to build their own curriculum with access to many sources of education material.

Learning is seen as an ongoing process, life-long learning is the expectation of every professional.

Informatics education is notoriously slow at adopting information technology to support teaching and learning. Other disciplines are much more adventurous in using computers in teaching.

An increasing widespread global information infrastructure
Students increasingly have access to a global information infrastructure through the world wide web and Internet. This not only provides students with access to large amounts of information (including educational material, courseware etc.) but also with a powerful means of communicating with their teachers, their peers and with others.

2   MOVING INFORMATICS EDUCATION FORWARD

Successes of informatics education
Informatics education has been by-and-large successful in meeting its responsibilities to industry. Principal among these successes are:
- production of competent technical practitioners for society;
- introduction of professional issues into the curriculum;
- responding to the needs of industry and collaborating with industry.

The discipline has been doing a fairly good job of teaching micro-concepts, perhaps not as good a job at macro-concepts, and the field is progressing more quickly in macro-concepts.

Stimuli and obstacles
There are numerous forces acting on informatics education, many are stimuli for change (both from within the discipline and from within society and the profession), others are obstacles which hinder progress. The ultimate direction informatics education takes will depend on the resolution of the forces emanating from stimuli and obstacles.

Stimuli for change include:
- changing technology in hardware, information services and information infrastructure;
- changing learning receptivity of students;
- changing expectations and attitudes of students;
- increased expectations of and dependence on informatics by society;
- changing needs and expectations of business, industry, employers;
- globalization.

Obstacles against change include:
- fear of the consequences of change by students, faculty, administrators;
- resource availability to support change implementation;
- established procedures and structures inhibiting development;
- availability of qualified faculty;
- overloaded faculty;
- inadequate reward structure for faculty;
- lack of recognition of problems by faculty;
- lack of common terminology.

3   CHALLENGES

Arising from changes to the societal, professional and educational environment and from an examination of the stimuli for and obstacles to change, are a number of

challenges for informatics education. The ability of informatics education to successfully address these challenges will largely determine the future health of the discipline.

The challenges are:

- to clarify the identity of the informatics discipline on its own, with respect to other disciplines and with respect to public perception;
- to find the correct balance between teaching theory and principles (the foundations needed for long term use to enable graduates to apply knowledge in new situations) and skills (to make students immediately useful on graduation);
- to achieve adequate and appropriate rewards for teaching faculty in informatics, recognizing that faculty in informatics education particularly have to cope with the rate of change of the discipline and expansion of subject matter of informatics (with a consequent impact on the curriculum), in addition to changes in educational practice;
- to overcome conservatism with respect to the development of learning; particularly by seeking out ways of using information technology to support the teaching of informatics;
- to understand and clarify employers' expectations of graduates and ensure that there is a realistic match between expectations of graduates and employers;
- to meet industry demands for an increase in the quality of software systems by instilling professional responsibility and accountability in graduates;
- to maintain adequate levels of IT infrastructure, particularly in terms of global information infrastructure;
- to recognize the growing impact of globalization in business and the role to produce graduates with an awareness of globalization and the informatics skills necessary to achieve these business objectives;
- to collaborate and communicate with other disciplines and domains.

4   TRENDS

Four areas have been identified in which trends in informatics education are perceived:

- forms of teaching;
- changes in the profession;
- impact on the curriculum through changes in technology;
- changes in the context of the educational experience.

Forms of teaching
There are two aspects to this trend:

- the form of teaching;
- reflection on the role of the teacher.

It is a positive sign that informatics educators are increasingly reflecting on their own professional practice, on how they teach.

Among the trends in forms of teaching are:
- project orientation;
- problem based learning;
- flexible learning;
- project work with external problems.

Trends which impact on the role of the teacher include those intended to:
- help the students analytically and critically evaluate information provided (for example, from the world wide web);
- find out the personal talents of the student and help the student in planning their personal curriculum;
- rethink the process of assessment from traditional grading to profile and portfolio-based criteria.

Response to changing needs of employers and the profession

With the external societal forces there is no longer a single job market. Computer scientists and information specialists will have so many different kinds of tasks and working areas that it will become inevitable to educate students for several different kinds of professions (as in the medical world, which has specialists, general practitioners, nurses, physiotherapists, etc.). This is exemplified by:
- the growth in use of engineering paradigms in informatics;
- a process and systems orientation in building software;
- the importance of information modelling and a re-orientation towards information as the central concept;
- the different range of skills needed in practitioners working as consultants.

Impact on the curriculum through changes in technology

Programming will be emphasized less, component-based systems will be emphasized more. There will be an increased emphasis on information modelling. With the changes in hardware there will be a re-evaluation of the importance of continuous mathematics. The external global information infrastructure will continue to raise the importance of information networks.

Changes in the context of the educational experience

There is a trend in teaching (reflecting the profession's expectations of graduates) towards focusing on the different needs of each student and towards an increased emphasis on professional preparation and life-long learning. Projects will be so large that teamwork is inevitable. Teachers have responded by including experiences such as teamwork, case-based, problem-based and project-based learning. This trend must be tempered by the necessity to balance (and assess) team and individual working.

The identification and specification of problems requires ability to communicate with clients from outside the profession. Besides technological knowledge and skills, interpersonal skills will therefore become more important. Technology and society will keep changing and developing which necessitates life-long learning.

5   THE FUTURE

Changes to the environment of both informatics and education have raised many challenges which must be addressed by those involved in informatics education. Is informatics education a discipline in crisis? If the discipline does not respond in an appropriate manner to the rapidly changing environment this may well be the case.