



A rationalised curriculum of computer education for university students in natural sciences in China

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Computer education to non-computer science disciplines in Chinese universities has been under the guidance of the Chinese Ministry of Education (CME) since 1997. The “1 + X” structure proposed by CME in 2007 for computer education to non-computer science disciplines in Chinese universities offers a higher flexibility for institutions to choose X courses for their non-computer science disciplines, but it does not adequately address a few important issues in providing students with equitable experience in computer foundation education and meeting the specific needs for those students who want to advance their knowledge and skills in computer/IT. Based on a comparative study with the similar curricula used in other national and international institutions, a new framework of “2 + D + X” structure of computer education to non-computer science disciplines was proposed at IMAU to address those weaknesses in the CME “1 + X” structure. Trials of this rationalised framework have shown that students in different disciplines in natural sciences at IMAU strongly supported this new curriculum.

Keywords: Computer education, non-computer science disciplines, Chinese universities.

Background

Computer education for students in non-computer science disciplines in Chinese universities is an integral part of tertiary education curriculum. Computer science schools/colleges/departments in Chinese universities take responsibilities on curriculum design and delivery for both computer science disciplines and other non-computer science disciplines. For example, at Inner Mongolia Agricultural University (IMAU), the College of Computer & Information Engineering (CCIE) is responsible for not only producing graduates majoring in IT, computer science, and information systems, but also delivering common core courses in computers to students in other natural sciences, such as plant science, animal science, food and food processing, forestry, environment engineering, biology, chemistry and so forth. The curriculum for computer science majors has a well defined guideline set by the Chinese Computer Society whereas there is no similar guideline for computer education of tertiary students in non-computer science disciplines.

However, standardisation of computer education to non-computer science disciplines in Chinese universities has been on the agenda of the Chinese Ministry of Education (CME) since 1997. In 1997, CME circulated a commentary document that proposed a three-tiered computer education structure to non-computer science

disciplines in Chinese universities (CME, 1997), including the subjects on introduction to computers, foundation of computer software, and fundamentals of computer hardware. There were no details on how these courses should be designed and implemented in this document. The Internet, multimedia, and wireless technologies have brought significant changes to almost every aspect in the world since 2000, which also added new dimensions into computer education. Three guidelines were released successively by CME (2004, 2005, 2006) to set up a framework of computer education to non-computer science disciplines in Chinese universities. This framework is summarised as “1 + X” structure, in which the 1 represents the common core course on introduction to computers and the X refers to more than 2 discipline-specific core courses in computer/IT.

Since 2007, all Chinese universities have tried to implement this “1 + X” structure into the computer education curriculum to non-computer science disciplines. A variety of schemes have been adopted in different institutions for the same discipline, or different disciplines within the same university. The “1 + X” structure offers a higher flexibility for institutions to choose X courses for their non-computer science disciplines but fails addressing: a) the common needs for all university students to gain fundamental knowledge in computer so as to understand the computing processes and their working environment involving computers, and b) the specific needs for those students who have a desire in advancing their knowledge and skills in computer/IT so as to apply the gained knowledge and skills in their disciplines.

To address both the common and specific needs of students mainly in natural sciences on computer education at IMAU, CCIE has initiated a project aiming at creating a rationalised curriculum of computer education for students in natural sciences at IMAU based on a comparative study with the similar curricula used in other national and international institutions since 2007. This paper reports the outcomes of this comparative study.

Data collection and analysis

A questionnaire was sent to 30 Chinese universities with programs in similar natural sciences to IMAU to collect information about their curriculum of computer education in natural sciences. Statistics of the 18 universities returned the questionnaire are shown in Table 1. It is evident that all 18 universities have the common core course “Introduction to computers” required by CME. A surprise finding is that all the 18 universities also offer “Programming principles” either as a core or an elective to their students in natural sciences. Given the fact that students interact with computers through software which is a product of programming, it is understandable and reasonable for students to know the fundamentals of programming, no matter which programming language is used. Database is also offered in 5 universities. One or more courses in other subjects, such as the Internet, Web, Multimedia, and software design, are provided in a few universities as well.

Table 1: Statistics of the questionnaire from 18 Chinese universities

| Course | | Introduction to computers | Programming principles | Database | Internet/ multimedia/ Web/software design |
|--|----------|---------------------------|------------------------|----------|---|
| Number of institutions offering the course | Core | 18 | 10 | 1 | 1 |
| | Elective | | 8 | 4 | 4 |

Comparisons are also made with computer courses for students of agricultural and environmental sciences at the University of California, Davis (UCD) and that of agricultural sciences at The Pennsylvania State University. Their curricula consist of three tiers of common cores, disciplinary cores, and advanced electives, in which the common cores have 3 fundamental courses that cover contents of both “Introduction to computers” and “Programming principles” in Chinese universities.

A rationalised curriculum of computer education to natural sciences

The results of data analysis support a new framework of “2 + D + X” structure for computer education to non-computer science disciplines. In this structure, the 2 represents the common core course of “Introduction to computers” and “Programming principles”; the D refers to at least 2 core courses selected from a list of computer/IT subjects required by a specific discipline; the X refers to a list of electives for those students who have a desire in gaining systematic knowledge and skills in a computer/IT specialisation. Courses in both D and X can be chosen either individually or as an approved sequence by the student. If an approved sequence of courses is completed, the student is entitled to have a minor in computer/IT added to the major in natural sciences. A trial scheme of courses implementing this framework has been offered to students in different

disciplines in natural sciences at IMAU since 2008 (Figure 1). For the first offerings of four D and X courses in Semester 2 of 2008, “Web design and development”, “Java programming”, “Database and applications”, and “Computer networks”, each attracted far more students than the specified capacity of 1000 places. This trial encouraged the continuous effort on bringing a full range of proposed D and X courses for students in natural sciences.

Conclusion

The “1 + X” structure proposed by CME in 2007 for computer education to non-computer science disciplines in Chinese universities offers a higher flexibility for institutions to choose X courses for their non-computer science disciplines, but it fails in both providing all university students an equitable opportunity in gain fundamental knowledge in computers and meeting the specific needs for those students who have a desire in advancing their knowledge and skills in computer/IT. Based on the results a comparative study with the similar curricula used in other national and international institutions, a new framework of “2 + D + X” structure for computer education to non-computer science disciplines was proposed at IMAU in 2008 to address those weaknesses of the CME “1 + X” structure. This rationalised framework has received a strongly support from students in different disciplines in natural sciences at IMAU since 2008.

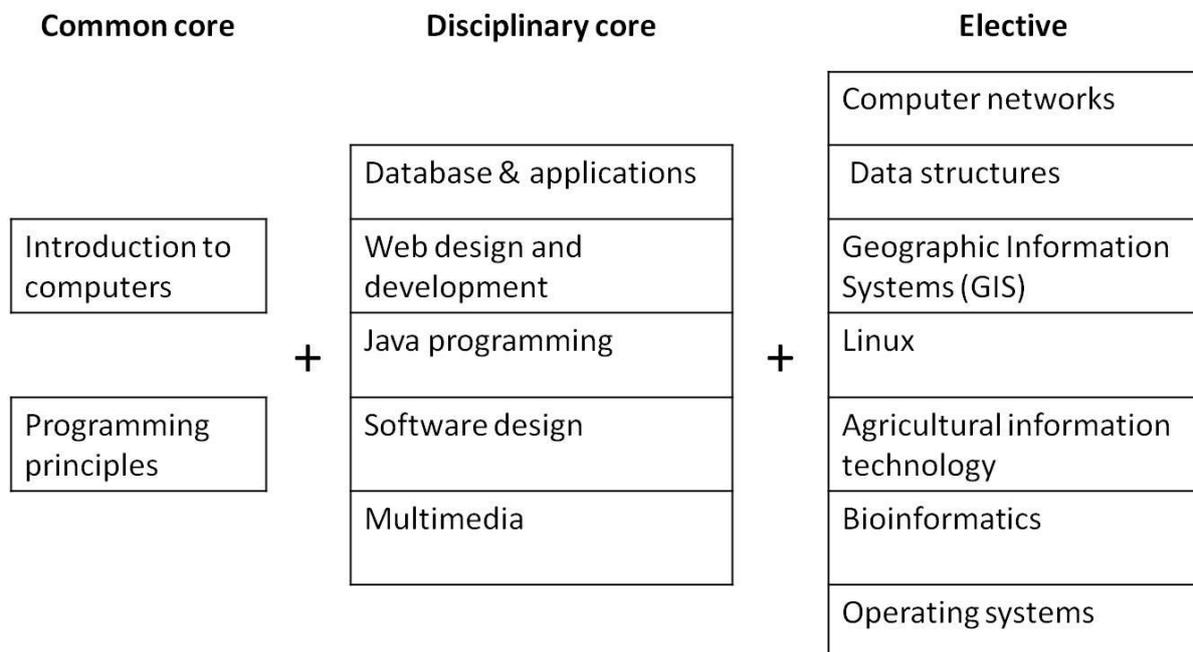


Figure 1: The “2 + D + X” structure of computer education to natural sciences at IMAU

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Please cite as: Xue, H. & Guo W.W. (2011). A rationalised curriculum of computer education for university students in natural sciences in China. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011*. (pp.1363-1366).

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