

Chapter 12

A Comparative Study on Undergraduate Computer Science Education between China and the United States

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ABSTRACT

With the rapid growth of the Internet and telecommunication networks, computer technology has been a driving force in global economic development and in advancing many areas in science, engineering, health care, business, and finance that carry significant impacts on people and society. As a primary source for producing the workforce of software engineers, computer scientists and information technology specialists, computer science education plays a particularly important role in modern economic growth and it has been invested heavily in many countries around the world. This chapter provides a comparative study of undergraduate computer science programs between China and the United States. The study focuses on the current curricula of computer science programs. It in part is based on the author's direct observation from his recent visits to several universities in China and the conversations he had with administrators and faculty of computer science programs at the universities. It is also based on the author's over two decades experience as a computer science educator at several public and private American institutions of higher educations. The education systems in China and the United States have different features and each of the systems has its strengths and weaknesses. This is likely also true for education systems in other countries. It would be an interesting and important task for us to explore an innovative computer science education program, which perhaps blends the best features of different systems and helps better prepare graduates for the challenges working in an increasingly globalized world. We hope the study presented in this chapter provides some useful insights in this direction.

INTRODUCTION

It is of no doubt that computer technology has thoroughly integrated into our society. For many people around the world, computers or related computing technology has now become an inseparable part at the work place and in their personal lives. We use email and cell phones for communication, GPS for directions, tablets for reading, calculators for computations, and computer software tools for both business tasks and personal leisure. Computer technology has also been playing a key role in modern economic development and in advancing many areas in science, engineering, health care, business and finance that carry significant impacts on people and society.

As a primary educational discipline for producing the workforce of software engineers and computer scientists, who are responsible for the rapid growth of computer technology, computer science studies the scientific principles and practical approaches of various computing systems, from cell phones, tablets, laptops, desktops, main frames to supercomputers. Computer science education offers a foundation that permits graduates to adapt new ideas and new technologies and produce various innovative software products and engineering solutions. In order to further promote modern economic development, many countries around the world have been investing heavily in their higher education systems and in particular, in the computer science education and research programs. For instance, in the last fifteen years or so, the number of college computer science programs in China has grown very rapidly and in fact, the discipline of computer science and technology has already become the largest undergraduate major in China (ACCE, 2005).

It is perfectly reasonable that individual countries set their own education standards and program curriculum requirements. As a matter of fact, like human languages, there should not be

a universal computer science curriculum model that is acceptable and works well in all countries. Each individual program has its strengths and perhaps also its weaknesses. This chapter provides a preliminary comparative study of undergraduate computer science programs between China and the United States. We believe this is a meaningful exercise because the programs in both countries share a similar base of fundamental courses while they are different in terms of the structure and scope of program requirements. The differences between the programs reflect a great deal about their culture differences. As the two largest economies in the world today, the United States and China play a significant role in promoting global economic growth. It would be very beneficial for both countries (perhaps also other countries in the world) to learn from each other about computer science curriculum development and to explore new ideas and strategies in providing computer science students with the academic training and experiences needed for their professional success and leadership in today's global environment.

The chapter is organized as follows. In Section 2, we present and discuss three representative undergraduate computer science program models in American institutions of higher education. They represent programs in large research universities, public regional universities and small private liberal arts universities, respectively. In Section 3, we present and discuss the undergraduate computer science programs from three Chinese institutions, representing different institution types in China: top tier national research universities, second tier regional comprehensive universities and third tier technology focused universities. Then, in Section 4, we compare computer programs from both countries in terms of some factors that are closely related to curriculum design and development. We provide some concluding remarks in Section 5 and future research directions in Section 6.

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