Application of Real-World Problems in Computer Science Education: Teachers’ Beliefs, Motivational Orientations and Practices

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ABSTRACT

This article describes how it is due to the fact that computer science is present in many activities of daily life, students need to develop skills to solve problems to improve the lives of people in general. This article investigates correlations between teachers’ motivational orientations, beliefs and practices with respect to the application of real-world problems in undergraduate courses. A questionnaire was applied to twenty-eight teachers of an undergraduate computer science course. Data from the questionnaire was analyzed using statistical methods. The results show that the majority of the teachers, especially those who interact with companies, believe that the insertion of real-world problems in the classroom is important. However, some teachers are not willing to adopt this practice. This is linked to reasons such as the need for more flexible curricula and a better teaching qualification with respect to collaborative problem solving.

KEYWORDS

Computer Science Education, Real-World Problem Solving, Teachers’ Beliefs, Teachers’ Orientational Motivations, Teachers’ Practices

INTRODUCTION

Computer science is pervasive in the 21st century. There is no other field like computer science that impacts every other field. The last decade has revealed extraordinary advances in science, in part, by great improvements in the computational power. Researchers have benefited from these advances by developing techniques for modern computers that allow us to better understand systems with increasing complexity and realism.

In addition to influencing the development of science, computer science has become an indispensable tool in all fields of human life. From traditional physics and engineering to biology, medicine, economics, arts, sociology and more exotic fields like fashion or criminology. The world becomes progressively more digitized and interconnected, with smart phones and smart

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homes continually computing something for us, intelligent systems that control transportation and production, and early warning and decision support systems that protect our safety and well-being (Krzhizhanovskaya et al., 2015).

The extremely rapid development of computer technologies, which undoubtedly affect all fields of human activity, also affects the labor market. The labor market for information and communication technologies has changed radically. Consequently, the current labor market needs directly affect computer teaching and learning, as new skills are required.

Companies often require that computer science graduates possess the following skills: problem analysis, system approach, focus on output, accuracy and consistency (Poulova & Klimova, 2015). Problem analysis refers to the ability to approach a problem broadly and to consider connections, the ability to structure the problem, and its generalization or specification. System approach is the ability to see all the important aspects of the problem. Focus on outcome refers to the preference for a goal rather than a way to achieve it, problem solving, persistence, and active approach. Students should show accuracy and consistency by transforming the discovered expectations and specifying customer requirements into a practical solution.

Another important point is that, at the present time, employers need staff that has specific combinations of information technology experience and expertise in domains such as e-health, e-finance and digital media. For example, companies such as Microsoft, Amazon, Facebook and Google seek out employees with interdisciplinary expertise in communication, visual arts, digital media and computing (Gardner et al., 2015).

According to ACM curriculum guidelines for undergraduate programs in computer science, as computer science expands to include more interdisciplinary work, new programs in the “Computational Biology” or other “Computational X” formats should be developed (Curricula 2013).

Current market demands lead to major challenges in computer education. The growing diversity of topics potentially relevant to an education in computer science and the increasing integration of computing with other disciplines create particular challenges for computer education. It is particularly difficult to balance the enormous growth of the area with the need to maintain realistic and implementable recommendations in the context of undergraduate education.

In fact, the development of curriculum guidelines for computer science has always been a challenge, but nowadays it is crucial. Although the field of computer science continues to expand rapidly, it is not feasible to proportionally expand the size of the curriculum. There is also a technical skills gap between your curriculum and the main applications in the industry.

The evolution of current and future computing technologies requires a growing pool of engaged professionals who can develop models, algorithms, and software tools and efficiently leverage the computing resources available in a multitude of hardware and middleware, supercomputer, and cloud environments (Shiflet & Shiflet, 2014).

Students need to acquire the ability to intelligently use computer technology. A graduate in computer science must break conventional knowledge silos and train qualified personnel who are better able to apply computational techniques to a wide variety of problems in several areas of knowledge (Gardner et al., 2015).

Computer science courses should not only prepare students for a traditional academic career, but must also meet a need for highly trained staff in business and industry, focusing on skills needed for their career such as the ability to move more easily between and collaborate with interdisciplinary teams. The need for these skills has been documented in numerous studies. There is a need to graduate a graduate who can contribute to the global setting for the economy and society (Gardner et al., 2015).

RELATED WORK

Some current research asserts a paradigm shift towards multidisciplinary education (Cesar et al., 2017, Potkonjak, 2017, Neumann et al, 2017, Krzhizhanovskayaa et al., 2015, Gardner et al, 2015,
Republic of Ireland
[www.igi-global.com/chapter/republic-ireland/12313?camid=4v1a](www.igi-global.com/chapter/republic-ireland/12313?camid=4v1a)

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