Development of Students’ Programming Abilities With the Means of Non-Programming Disciplines and Activities

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ABSTRACT

This article is dedicated to the topic of discovering effective ways of developing students’ programming abilities with the means of non-programming disciplines and activities. The authors argue that the process of educating students in programming becomes effective if students participates not only in programming lessons themselves, but also dedicates a significant amount of time to other academic disciplines and extracurricular activities. For example, these other activities are solving number-theoretics and chess endgame problems. The authors find that these disciplines and activities provide efficient means for developing programming capacities and therefore, their methods are the essential prerequisites for programming course. The significance of the obtained results is that they provide an effective alternative approach to the teaching process in educational institutions where the traditional methodology does not bring the desired pedagogical effect.

KEYWORDS


INTRODUCTION

Preparation of college students for academic success in computer programming has always been a relevant topic of research of computer science educators. According to Balmes (2016), computer programming is considered a key factor in pursuing computer science courses and of all subjects constituting a typical computer science curriculum it is namely programming that students find to be the most difficult because of its contents and requirements. And as shown, for example, by Sarpong, Arthur and Amoako (2013), the current programming methodology is still far from being effective which leads to a significant amount of students who fail at computer programming courses as a direct result of their programming abilities. Due to the limited number of academic credits dedicated to computer programming, teachers have almost no space left for questions concerning development of students’ programming abilities and are obliged to put most attention to teaching specific technical

DOI: 10.4018/IJICTE.2019010109
material such as languages, libraries, tools and technologies in accordance with the educational programme. So, the question of developing programming abilities becomes a prerogative either of students’ extracurricular activities or other academic disciplines taught alongside programming.

The current article contains results of the study investigating innovative and effective methods for developing computer programming abilities of college students with the help of non-programming disciplines and extracurricular activities. The authors argue that students can form and enhance their programming capacities not only in programming lessons themselves but also by more active participation in mathematics and chess. In the authors’ opinion there is a positive significant correlation between students’ participation in mathematics and chess and their academic success in a programming classroom.

The novelty of the current study lies in the focus of the research. The authors find that not all types of mathematical and chess activities are equally useful from the standpoint of developing programming abilities and that it is problems from number theory and chess endgames that contribute the most to the formation of students’ programming thinking. The main purpose of the study is to verify the correctness of the authors’ hypothesis stating that there is a significantly positive correlation between students’ level of participation in solving number-theoretic and chess endgame problems and their academic scores in computer programming lessons. In addition, the authors discover that the academic process in a programming classroom brings the most educational value only when students are assigned those problems which contain the elements of number theory and chess endgames.

The methodology and hypothesis presented in the current article grew out mostly of the authors’ own observations concerning learning habits and extracurricular interests practiced by students demonstrating high academic performance at computer programming lessons. The hypothesis then was tested successfully in the actual educational process of low-performing students during one whole semester. The results obtained within the context of the current research can be of interest both to programming teachers who want to increase the educational value of their lessons and students who want to increase the level of their preparation for computer programming lessons.

**LITERATURE REVIEW**

Recently there has been published a vast amount of research dedicated to the topic of establishing the connection between mathematics and computer programming and the impact which mathematical abilities has on academic performance in computer programming. So Balmes (2017) studies the existing connections between mathematical and programming thinking and the impact which one type of thinking has on another. She states that mathematics is important for dealing with the programming courses as it improves the logical ability of students.

White and Sivitanides (2015) conduct practical experiments dedicated to estimating the level of correlation between mathematical and general programming abilities and skills. The results brought by their experiments confirm that the correlation exists.

Sarpong, Arthur and Amoako (2013) conduct a research to find out the causes of students’ failure in computer programming courses and come to a conclusion that there is a significant and positive correlation between academic performance of students in mathematics and programming.

Owolabi, Olanipekun, and Iwerima (2014) carry out a study in order to investigate the factors which cause computer and programming anxiety and thus, prevent students from successful study of computer programming. Their study demonstrates that computer and programming anxiety have a correlation with mathematics anxiety.

Ali, Ali and Farag (2014) perform statistical analysis of the data concerning students’ attitude towards mathematics and its relation to success in computer programming. Results of the analysis demonstrate that there exists a direct correlation between students’ attitude towards mathematics and their academic performance at computer programming lessons.
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