Chapter 7

Development of Students' Programming Abilities With the Means of Non–Programming Disciplines and Activities

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ABSTRACT

The chapter contains the results of the research dedicated to the topic that has not been given much attention so far in the professional literature – discovering effective ways of developing students' programming abilities with the means of non-programming disciplines and activities. The authors argue that the process of forming capacities of students in programming becomes effective if students participate not only in programming lessons themselves but also dedicate a significant amount of time to other academic disciplines and extracurricular activities such as solving number-theoretic 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 organization of programming teaching process in those educational institutions where the traditional methodology does not bring the desired pedagogical effect.

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. As shown, for example, by Sarpong, Arthur, and Amoako (2013), the current programming methodology is still far from being effective that leads to a significant amount of students who fail at computer programming courses as a direct result of their programming abilities. And as is stated by Mathews (2017)," beginning programming has a success rate of 67.7%, which may be a barrier to success for aspiring computer science majors". 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 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 at the programming lessons themselves but also by 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 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 tin particular 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.

The methodology and hypothesis presented in the current article grew out mostly of the authors' own observations concerning learning habits and extracurricular non-programming interests practiced by students demonstrating high academic performance at computer programming lessons. 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 academic success in the computer programming course.

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.

Mathews (2017) mentions that mathematics is a significant factor that contributes to the success in mathematics.

Lie, Hauge, and Meaney (2017) state that algorithmic constructs of computer programming are deeply connected with mathematical thinking.

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