Chapter 55
Improving Novice Programmers' Skills through Playability and Pattern Discovery: A Descriptive Study of a Game Building Workshop

Thiago Schumacher Barcelos
Instituto Federal de Educação, Ciência e Tecnologia de São Paulo, Brazil & Universidade Cruzeiro do Sul, Brazil

Roberto Muñoz Soto
Universidad de Valparaíso – Escuela de Ingeniería Civil Informática, Chile

Ismar Frango Silveira
Universidade Cruzeiro do Sul, Brazil & Universidade Presbiteriana Mackenzie, Brazil

ABSTRACT

Game design and development has already been discussed as a viable, motivating alternative to introduce Computer Science concepts to young students. In this sense, it would be useful to obtain a deeper understanding of which skills could be developed in these activities and how such skills could be useful in future careers. This chapter presents the design and evaluation of a Game Building Workshop aimed at introducing the fundamentals of structured programming to students. The games produced by students during 12 weeks were evaluated and the results confronted with students' questions and comments made along the workshop meetings and a final interview. The results indicate that students explored novel programming concepts in order to add features that were not initially planned for the proposed games. These additional features solve playability issues that are highly influential to the experience of the students as game players. Students also reused previously applied solutions to solve similar problems that appeared in subsequent activities. This is an indication that students developed or exercised analogy and abstraction skills during the workshop activities.

DOI: 10.4018/978-1-4666-7363-2.ch055

INTRODUCTION

Along the last decade, students' enrollment rates in undergraduate courses related to Computer Science (CS) and Information Technology (IT) have been decreasing in various countries. Muratet et al. (2009) identified a 25% decrease in the number of students enrolled in Computer Science careers in a French university between 2005 and 2009. Crenshaw et al. (2008) reported that the interest of North American students for CS courses declined by 50% during the '00 decade. Hernandez et al. (2010) compared the student enrollment rate in CS courses of a top Brazilian university to the same rate in a university in the United States and found that the same tendency for a diminishing interest appears in both countries.

It has been argued (Hernandez et al., 2010) that student enrollment in computing courses is historically related to the spread of technological advances, such as the personal computer and the Internet. Based on this argument, it would be surprising to witness a lack of students' interest for the field of computing nowadays, given the high degree of technological achievements in the past few years, besides of their pervasiveness. After all, children and teenagers deal with a growing variety of interactive computational devices, such as tablets, cell phones and portable videogames. However, the increasing exposure to such gadgets does not seem to stimulate students to pursue technology-related careers. One possible reason that has been pointed out is that students are not properly exposed to Computer Science concepts during the basic educational levels, since CS is not considered as a Basic Science in any curricula (Barcelos & Silveira, 2012; Carter, 2006). High dropout rates in introductory courses may also be related to the lack of motivating didactic strategies (Rizvi, Humphries, Major, Jones, & Lauzun, 2011).

On the other hand, the presence of some skills in specific knowledge areas may contribute to the academic success of CS and IT students. Skills related to Mathematics are often mentioned to have an influence in student achievement in CS/IT. Such studies are not new; Campbell and McCabe (1984) analyzed a sample of 256 freshmen of an north American university to conclude that SAT scores in Math, high school rank and average grade high school grades in Math are predictors for the group of students who continued in the course after two semesters. More recently, Wilson e Shrock (2001) found a similar correlation between the number of Math disciplines taken by students during high school and their performance in an introductory CS discipline. Beaubouef (2002) presents an extensive discussion about the importance of Math topics that are related to many subjects studied in CS. It may be convenient, though, to identify which are the high-level skills related to Math that should be mastered by students in order to improve their academic performance in CS/IT. As a consequence, college education would be able to deliver better professionals to the labor market.

Abstraction is, for instance, a relevant skill that is present in the field of Mathematics and that is equally important to Computing. A discussion about this topic is presented by Kramer (2007), who argues that building and understanding abstract models is crucial to object-oriented design and programming; also, selecting the most important aspects of a given real situation and leaving out unnecessary details is important to the activities of a requirements engineer. On the other hand, the process of problem solving in Math involves skills related to abstraction, such as analogy, generalization and specialization (Polya, 2004).

This chapter presents the design of a Game Building Workshop aimed at teaching the fundamentals of programming to students enrolled in Computing-related courses. The workshop was designed based on previous evidence (Bayliss & Strout, 2006; Leutenegger, 2006) that the domain of game design and construction might have a relevant impact on students' motivation. Besides that, our objective was also to understand how students might develop higher-order skills, such