The Use of Animation as an Educational Tool

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Abstract

The difficulties encountered by beginning students of computer science are well known. One of the explanations for these difficulties is that students do not have a mental model of how a computer works. This can explain why they have difficulties in performing a simple task such as following the execution of an algorithm or a program (Ben-Ari, 2001). Intuitively, it seems to be that visualization of algorithms (in particular, animations), might help construct the needed mental models. However, many empirical studies do not support this intuition. These empirical studies are based on the use of animations for a short period of time, followed by an evaluation of their influence on the students' understanding.

The study presented in this work integrates animation into a year-long course, rather than a short-term experiment. The experiment was carried out on tenth-grade high school students studying an introductory course on algorithms and programming. The animation system that was used in the experiment, Jeliot 2000, was a new version of Jeliot, an existing animation system; the modifications were designed so that Jeliot 2000 would be appropriate for these students.

The experiment was conducted in two classes, one using Jeliot 2000 and the other one was a control group. This was an action research study that involved both quantitative and qualitative evaluation methods. This study was a first attempt to evaluate animation integrated in a complete course, rather than an evaluation of a single episode. The long-term usage of the animation enabled the students to feel comfortable with the tool, so that the anxiety associated with using a new tool disappeared as the time passed.

The research and the evaluation of the results were done during 1999-2000. The research was designed to detect difficulties that students face while learning new concepts in computer science, and to evaluate the contribution of animation to overcoming those difficulties. As shown in previous studies, I found that there was no improvement in the performance of all students, in spite of the long-term use of animation. The study shows that the strong students did not need the animation in order to understand a new concept, while the weak students could not deal with the tool. However, I found that the animation significantly improved the understanding of mediocre students.

The concrete model that the animation provided to the mediocre students was the reason that those students performed better, especially those who received individual instruction using the animation. The main improvement was manifested in their ability to explain the way the computer performed an operation and their ability to follow the execution of an algorithm or a program. The use of animation did not harm the grades of the stronger students nor of the weaker ones. For the mediocre students, the animation made the difference between success and failure. I found that the animation group used different vocabulary than did the control group, a vocabulary taken directly from the animation. This vocabulary was central to their understanding of new concepts.