Teaching Computer Science with Animation: Attitudes and Ways of Experiencing

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Abstract

Animation systems—software tools that can show a dynamic view of the execution of a program—were designed to help computer science (CS) novices improve their understanding and to help teachers facilitate learning. Preliminary studies on the effectiveness of animation systems on the understanding of students have shown encouraging results. Nevertheless, the use of animation systems is not very widespread. In order to understand the anomaly between the encouraging results that the use of animation systems has on students and the fact that teachers do not use them I conducted my study.

The animation system that was used in this study was Jeliot. This tool was developed specifically for novices. This system is used for more than a decade now and has been improved over the time as a result of research on the effect that this animation system has on students. Studies show positive results on the effect that Jeliot has on the understanding of CS topic by students.

I raised two research questions: (1) What are the qualitatively different ways that teachers experience the use of an animation system as a pedagogical tool? (2) What are the attitudes that teachers have towards the use of an animation system, especially those who use the animation rarely or not at all?

The study presented here shows the results of a three-phase research project: (1) a phenomenographic study designed to describe the different ways that teachers experience the use of an animation system as a pedagogical tool; (2) a study of the attitudes that teachers possess on the use of the Jeliot animation system as a pedagogical tool—according to the theory of planned behavior (TPB); (3) an analysis based on a combined methodology of the first two methodologies.

The result of the phenomenographic phase is an outcome space of four different ways (categories) that computer science (CS) teachers experience the use of an animation system as a pedagogical tool. These four different ways include two positive ways (Appropriation and By-the-book) and two negative ones (Repudiation and Dissonant). The outcome space is ordered in a hierarchical order. The Appropriation way of experiencing is the most desired way. This teacher uses the animation system routinely in class, chooses the most appropriate option in Jeliot for the topic he or she has to teach, the teacher develops novel ways to use Jeliot. The By-the-book way of experiencing is the second in the hierarchy; a teacher in this category employs Jeliot in a canonical way, as taught in the course. The Repudiation category represents the teachers who see no pedagogical value in using an animation system; these teachers usually are very vocal and express their rejection explicitly. These teachers do not use Jeliot at all in their classes. The category at the bottom of the hierarchy is Dissonant. Teachers who experience the use of Jeliot in this way are very silent. They experience the use of Jeliot in a combined way—positive and negative—in the same context; The Dissonant teachers show enthusiasm towards the use of Jeliot, but they rarely use it in class.

The results of the phenomenographic phase relate to populations and not to individuals. But, I found that the reluctance to use Jeliot appears very close to the time teachers are exposed to the tool for the first time, Therefore, I decided to study the negative ways of experiencing, in particular, the connection between the attitudes that teachers possess towards the use of Jeliot as a pedagogical tool and the behavior of rejecting it. This phase deals with the second research question and uses the TPB methodology.

The results show that CS teachers, in general, are in favor of using technological tools in their classrooms. One of the most striking results shows that in spite of the fact that computer science teachers have positive behavioral beliefs about the use of animation systems in their classrooms, most of them feel a low level of perceived behavior control (PBC). This means that issues like control of the tool and of the class are very crucial for CS teachers. It appears that one of the most important characteristics of Jeliot—its explanations—bother many teachers. They are afraid to lose their central role in class, many of them perceive themselves as the Authority in class, and they do not need any kind of help. This low score of PBC may explain the low use of animation systems.

The third phase of the study connected between the results of the first two phases. The idea was to build profiles for each of the ways of experiencing I found at the first phase, based on the TPB predictors. In this way an educator can predict that a teacher will have negative attitudes and approach the teacher with an appropriate intervention. I found that the Dissonant group of

teachers can be divided into two subgroups: one who used Jeliot (Dis1) and the other one who rarely did so (Dis2). I went back to the phenomenogrpahic interviews and re-read the interviews of those teachers. I found that the difference between the groups was in the fact that the teachers from Dis1 did not participate in a course on Jeliot while the other subgroup did. I concluded that this shows the importance of a course on animation system, specifically addressing problems of controlling the system.

The results suggest that increased acceptance of such tools by teachers depends on integrating the tools with other learning materials and on addressing the role of the teacher in the use of software by the students. I conclude that developers and educators should give attention to control issues relevant to the tools they develop and use.