# Character Animation and Embodiment in Teaching Computational Thinking

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## 1 Introduction

We introduce a new approach to teach 5th and 6th graders computational thinking with the goal of increasing the proportion of minorities and, specifically, women in computing. Previous research has shown promising results when applications outside of traditional computer science are involved, and when the writing of syntax is omitted [Kelleher et al. 2007; Maloney et al. 2010].

In our approach, middle school children learn computational thinking concepts by creating choreography for a virtual character. Movement and programming tasks and activities are alternated and combined, and children learn while at the same time actively using their body. Our approach is based on embodied pedagogy, where moving one's body is used to support learning [Kontra et al. 2012].

## 2 Method

Our approach is realized in multiple sessions. At first, students alternate between learning elements of choreography and studying concepts from computational thinking. Later activities combine both concepts. At the end, the children create their own choreography, program the virtual character, and perform with it.

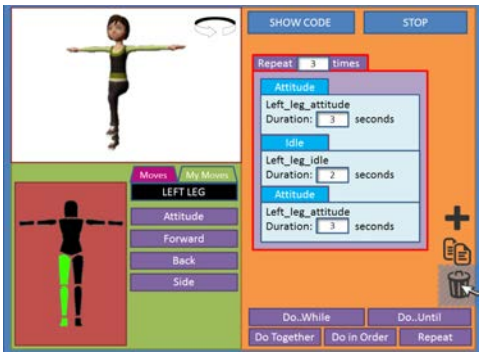


**Figure 1:** *User interface design of our future implementation*

The programming environment we are developing is inspired by tools such as Alice or Scratch. Our design can be seen in Figure 1. The animations are based on motion captured sequences to create realistic motions. Choreographies can be created using motion elements such as *RightLeg* or *Attitude* (pose where the leg is lifted and the knee bent) and control structures such as *Do in order* (processes commands one after the other), *Do together* (executes commands simultaneously), or *Repeat* (repeats a set of commands).

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## 3 First Results

For our pilot study and to help with design choices for our new platform, we use the programming environment Alice. We create a virtual character that can be animated using forward kinematics through commands such as Left_Arm_Bend_Side_Horizontal or Right_Leg_Low_Diag. In a five-week pilot study at a middle school in the southeast of the United States, nine students (8f, 1m, aged 11-12) learn computational concepts using our approach.

We observed that, throughout the study, students repeatedly stood up or moved in front of their computer (Figure 2). Through observation and interviews with the participants, we found that students used computational concepts such as loops and computational practices such as testing and debugging. Their perspectives on the purpose of computing were positively affected as students reported that they liked being able to control the character. Students furthermore expressed the wish to change the appearance of their character and to be able to create more realistic motions [Daily et al. 2014]. These results encourage us in creating a tool that fulfills those requirements. We are currently testing our approach with further students.

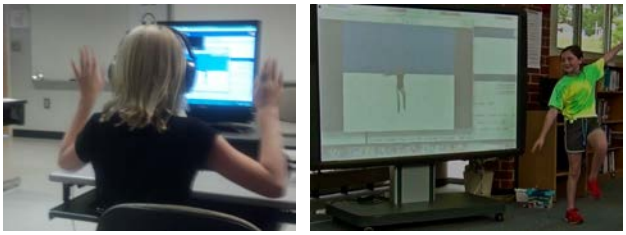

**Figure 2:** *Students programming and performing*

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