Run, Llama, Run: A Computational Thinking Game for K-5 Students Designed to Support Equitable Access

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ABSTRACT

Computational thinking is now included in K-5 classrooms and this has led to a demand for new interactive and collaborative learning tools that engage a younger audience. Block-based programming and educational games have both been shown to be effective at engaging children, however they have limitations with respect to supporting collaborative learning and equitable access. Our goal in designing Run, Llama, Run was to build on the positive aspects of block-based programming and educational games while also addressing these limitations. Furthermore, we are using Run, Llama, Run as a platform to explore the trade-offs between digital and tangible interfaces to understand how best to support equitable access while maintaining learning, engagement, and collaboration.

KEYWORDS

Educational Games, Equitable Access, Block-based Programming, Computational Thinking, Tangible Programming

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1 PROBLEM

The majority of educational games for K-5 students are digital games played on a computer or tablet (e.g., Scratch-based games on Code.org [3]). Some educational games are tangible and require no access to digital devices (e.g., board games). Games can also be hybrid and include both digital and tangible elements. For example, hybrid educational games may include a digital coding experience with a tangible simulation (e.g., a digital block-based program that controls a tangible robot [2]), or conversely they may include tangible coding blocks that are simulated digitally (e.g., Osmo [1]).

We believe it is essential that new learning tools and activities, including educational games, be designed to provide equitable access to children with and without digital devices. Towards this goal we have created Run, Llama, Run, which supports both a hybrid digital-tangible interface as well as a fully tangible interface. Run, Llama, Run aims to be accessible for as many K-5 students as possible through a hardware and resource-conscious design that minimizes the need for expensive hardware while still providing an engaging learning experience. This leads to the second goal of our work: to better understand the impact on learning and engagement when a game utilizes tangible and hybrid interfaces. To this end, we propose to evaluate the two versions of Run, Llama, Run in a K-5 classroom.

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2 APPROACH

Run, Llama, Run is an educational game designed to teach K-5 computational thinking through block-based programming. The game comes in two forms: a hybrid tangible-digital and a fully tangible game. The tangible-digital version of the game provides a series of challenges on a digital interface, such as a tablet, and allows the students to complete the solutions to the challenges with a series of 3D printed blocks. The students then upload a picture of the blocks to watch a character on the screen act out the solution. The fully tangible version is a cooperative version of the tangible-digital version. Instead of a digital device, students are put into pairs to work together to solve a paper version of the challenges using the same 3D blocks. The students are given a printout of a character to act out the solution together. Through this approach, Run, Llama, Run is designed to help children practice computational thinking and to encourage cooperation and engagement.

3 EVALUATION

Our next research step is to utilize Run, Llama, Run to understand the trade-offs of a tangible interface compared to a hybrid digital-tangible interface. We plan to study the following questions: (1) Is there an observable difference in the completion of in-game learning objectives between the two Run, Llama, Run interfaces? (2) Is there an observable difference in engagement and collaboration? (3) Did the children find the game fun and would they play the game again? In order to answer the above questions, we plan to evaluate Run, Llama, Run in two K-5 classrooms where we can observe game play as well as ask students questions after completion of the game.

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