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King's Scroll: An Educational Game to Practise Code Prediction

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ABSTRACT

Learning to program can often be a daunting task. The syntax of new programming languages might be intimidating and on top of that compilers are unforgiving. The combination of these things can be discouraging for new students. Recently there has been a push in the field of Computing Education Research to apply the Predict-Run-Investigate-Modify-Make (PRIMM) approach when teaching programming concepts. The aim is to push students to practise reading and investigating existing code before going on to write their own code, as a way to build self-confidence and boost their understanding. We present an educational game that aiming to help students practise their code prediction abilities. The game uses a simple story set in a medieval fantasy kingdom to create a welcoming, less intimidating environment. Users are presented with randomly generated pieces of JavaScript code that modify four core Boolean variables (shield, sword, cape and helmet). By making use of the state tables, students can manually walk through the code and predict the final result. A user ends the round by selecting the hero that matches the final state of all four variables. The presented heroes are further randomly assigned physical characteristics such as gender, skin tone and hair colour, promoting inclusivity and lowering the bar of entry via representation. The game allows users to indicate which language features they already know, thereby generating JavaScript code snippets that are understandable by a broad variety of students.

MOTIVATION

The PRIMM approach has been introduced in recent years as a way to teach programming concepts to newcomers. The approach recognises that starting from existing code and being able to explain it gives novice programmers more confidence [2]. It builds on previous research that demonstrated a correlation between code tracing tasks and the performance in code writing tasks [1]. These results show the value of presenting code snippets that have to be understood. Providing a way for students to verify whether they predicted the outcome correctly opens the door for immediate feedback. We present a game that focuses on the prediction of code. We opted for this medium as it has been shown that serious games can be a reliable and effective educational tool, given that users are encouraged more than by traditional means [3].

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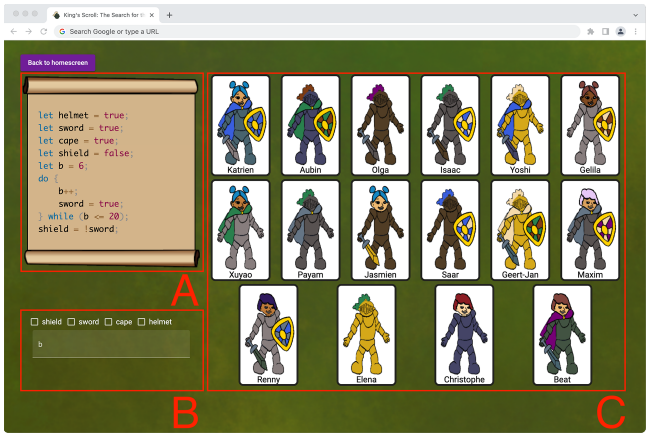

Figure 1: Screenshot of the King's Scroll game

CONTRIBUTION

We present "King's Scroll: The Search for the Chosen One", a browser-based game for desktop and mobile environments[1]. When starting the game, users are first presented with a short tutorial explaining the different parts of the game. Afterwards they are shown a settings screen on which they can indicate which concepts of the programming language they already encountered, making the game accessible from early on during their learning trajectory and allowing them to gradually increase the difficulty level as more concepts are learned. The actual game board is divided into three main sections as illustrated in Figure 1. In Section A, the user can see a scroll with the generated JavaScript code. Section B offers users tools for keeping track of a program's state as they step through it in their mind. Finally, Section C shows a collection of cards with heroes in multiple variations of the four core variables (shield, sword, cape and helmet). After predicting the outcome of the script, the user should select the hero that matches the predicted result. By providing a welcoming and interactive way for students to practise the *predict* stage of the PRIMM approach, we hope to increase a learner's satisfaction with beginners courses.

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