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The Da Vinci Coders

Teaching Programming with a Board Game

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Abstract

In today's society programming has become a necessary skill— some may argue as important as reading or math. Yet, children are not typically introduced to the topic of computer science until high school or even college. Further, schools that do aim to introduce programming to children at younger ages cannot always do so because of a lack of technological resources and funding. To address this issue we designed a board game that aims to teach middle school children how to read and write Java code without the use of a computer. The game goes beyond teaching basic programming and problem solving techniques and actually introduces real syntax and code to the players. After several play tests with the target audience we have found that children not only enjoy playing the game but also can actually write syntactically correct Java code when tested after play.

Game Overview

Unlike other attempts to teach programming to young children that focus solely on teaching programming concepts and principles, The Da Vinci Coders teaches actual Java Syntax. The Da Vinci Coders requires players to read real Java code in order to successfully move their tokens around the board.

Gameplay and Mechanics

Game Objectives

The day has finally come! The De Schutter Historical Institute in San Francisco, California has finally opened. You visit on opening day, amidst thousands of other excited guests and patrons. As you walk through the beautiful halls of the new museum, unnoticed at first by the security guards, you take a wrong turn and come upon a giant door with a complex lock system and a sign that reads, "Top Secret! This area off-limits to museum guests!" As you look closely at the lock, a museum employee swiftly walks up with a smile and escorts you down the hallway away from the mystery. Curious as to what lies beyond the door you assemble a team of spies who will adventure through the museum with you, closely inspecting and decoding the museum's exhibits. Your team of spies creates disguises modeled after one

of the four prized exhibits; to show your dedication to the museum and blend in with the other excited patrons. Your task is to start in your exhibit and travel throughout the rest of the museum until all of your spies have made it through the secret vault by solving a final challenge. Only then can you explore the secret exhibit and discover the secret history of games.

Game Progression

Players begin with their three tokens in their own start circle. Players have a deck of "guide cards" that correspond to their exhibit. Guide cards (see Game Components below) are written in Java code and tell a player how many spaces they can move a token forward on a given turn. Each guide card has a different result for every turn and so players must decipher the Java code in order to move their tokens around the board. When a player gets his token all the way around the board he must solve a final challenge card by translating English into Java to "unlock the secret vault" and win the game.

Education

Learning Objectives and Programming Concepts

- Strategic Thinking (achieved by allowing players to choose their own guide cards to use to maximize the spaces they move forward)
- Loops (achieved by the use of for and while loops in the guide and challenge cards)
- Ifs/Conditionals (achieved by the use of if and else statements in the guide and challenge cards)
- Booleans (achieved by the use of true/false values in the guide, guard, and challenge cards)
- ints and doubles (achieved by the use of integers and decimals in the guide, guard, and challenge cards)
- Functions/Methods (achieved by the use of guide cards as individual Java methods)

Learning Approach/Philosophy

Endogenous Fantasy: Our game is an example of endogenous fantasy (Malone & Lepper) and integrated game design (Habgood). The museum theme and spy narrative add to the learning objectives because players are literally decoding Java in order to "break into the secret vault". Further, the theme and narrative attempt to increase the entertainment value by engaging the players in competition and a story that they see themselves in so that they are learning for the sake of learning, perhaps without even realizing it. This makes the game an example of intrinsic motivation as well. The intrinsic motivation is also enforced through having optional path cards added to the board. These cards allow the players to voluntarily make the game more difficult in such a way that enhances their learning. Since the players are challenging themselves by choice, they are learning for the sake of learning.

Audience

The Da Vinci Coders is designed for middle school aged children (12 years of age and up) who have little or no coding experience. The game is created with a gender-neutral theme to encourage both boys and girls to pursue computer science.

Demo

Below is a link to a demonstration video of The Da Vinci Coders Version 1.0. Version 2.0 **will be professionally printed prior to the GLS conference** with upgraded game mechanics and aesthetics (not shown in video):

https://youtu.be/W6uw4Uu7QxM

Game Components

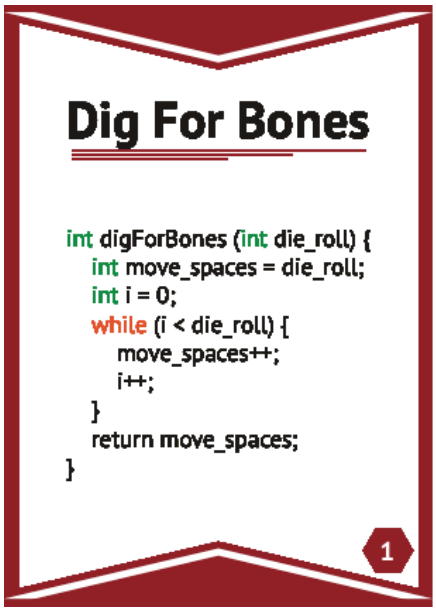

Figure 1. Example guide card.

Full game components documentation**:** https://goo.gl/AsrfvU

Rulebook

https://goo.gl/xv9jCb

Acknowledgements

https://goo.gl/zGZJc0

This game was created entirely by Miami University students.

References

Habgood, M. P. J. “Endogenous Fantasy and Learning in Digital Games.” *Simulation & Gaming* 36.4 (2005): 483-98. Web.

Malone, T. W., & Lepper, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning.*Aptitude, Learning, and Instruction, 3*, 223–253.