Project Proposal: Parsons Coaching

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1 Abstract

A collaborative game-based learning and assessment system has been created in the Social Addictive Gameful Engineering (SAGE) project to facilitate the development and improvement of students in grade 6-8 curricula. While Parson's Programming Puzzles has been integrated into the system, a gameful direct instruction system has not been fully implemented to show the progress of students and textual coaching of teachers. Instead of being embedded in sage scratch, the coaching messages would be better displayed beneath the intelligent tutor avatar and transition will also need to occur for other Parson's communications.

In this research project, our main focus would be on the improvement of Parson's coaching features under Gameful Direct Instruction module. Our goal is to improve the coaching features of the existing user interface and enable transitions from scratch to intelligent tutor avatar using AnjularJS and NodeJS.

2 Introduction

Research indicates that Game-based learning (GBL) activates students to make better academic outcomes[1]. Parson's programming puzzle has been developed to help students develop programming skills in an entertaining way. Students would learn to program through programming exercises of low to high levels step by step based on their performance in game of previous lower levels. In the process, students can learn many programming topics and improve their programming skills in an efficient way.

While the game design is attractive, the coaching messages provided in Parson's is currently displayed within sage-scratch, which may give student an inconsistent communication/interaction with the game environment. The users' interface especially the coaching messages remain in sage scratch and we believe coaching features would be better displayed under the tutor avatar in sage-frontend. Also, other communication messages like question hinting, submission will also be moved below the tutor avatar to improve the graphic display quality and avoid confusion. Moreover, some more features related to coaching could be added to coaching to expand coaching functions.

In Parson's game, students can update their solutions and see sprites' position and state reset. Also, their updated solutions would be compiled and

automatically run once they updated those solutions. There are more features that could be added to facilitate coaching. For example, teachers would be able to edit coaching feedback to give students personalized instructions. For objective of each game, students could find the game objective and types under the avatar. It is convenient for them if they want to train a special type of skill, and they can train specific topics. For feedback, sage coaching feedback could persist in the gameful constructionism objective evaluation system or somewhere else. Also, students can look for hints under the avatar once they decided to use them and by clicking buttons under avatar they can uncover hints. Moreover, students can find summary of their solution beneath the avatar or new window rather than in the scratch window. We would introduces more of these features and dive more into the details of how to implement them and in the later sections.

3 Related Work

There are some related work showing similarities to the current sage platform or sage initial ideas to provide automated feedback and coaching for students.

3.1 Parson's Programming Puzzles

Parson's Programming Puzzles: A Fun and Effective Learning Tool for First Programming Courses (Parsons & Haden, 2006)

This paper introduces the design of puzzles which provides every necessary line of code to solve and asks their students to order them correctly. However, this game only offers feedback like the percentage of correctly items but the detailed reason of their wrong solutions. The paper also mentioned a more stylish user interface and navigation between topics would be further improved to facilitate this game puzzle.

3.2 Learner Problem Solving Strategies

Online Identification of Learner Problem Solving Strategies Using Pattern Recognition Methods Feedback is given by system messages based on procedural knowledge of the learners in computer science education. Meanwhile, the learning strategies should be generated automatically by the system.

This paper introduces ideas of giving users' feedback of system messages using hidden Markov models based on pattern recognition methods.

3.3 Case-Based Reasoning

Using Case-Based Reasoning to Improve the Quality of Feedback Provided by Automated Assessment Systems for Programming Exercises. In this paper the author introduces some factors that can affect the students' learning outcome. The author investigated several approaches for computing incorrectness similarity, including static analysis of source code, execution traces of running programs, and comparing outputs from test cases[2].

Also, in the previous work from students in 2018 Fall, they introduced count-down time to the Parson's game and we decided to add this feature as well and show the time under the avatar for students' reference.

4 Proposal

4.1 Parson's Hint Presentation

To make the system consistent when presentation messages, the hints should presented by the Avatar. Currently, the hint is presented by a popup. We aim to move the hint message to the Avatar section. A dialog box should appears every time the hint button is clicked. Shown in Figure 1.

Furthermore, we aim to move the hint button from the current position to Avatar. As a intelligent coach, student will expect to ask the Avatar for help.

We aim to move all Parson's communication controlling interface to the Avatar. More specifically, we want to have a controlling panel for the Avatar. Student can make submission, ask for hints through this controlling panel. Similar work have been done by a previous group in 2018 Fall. We will look into here commits and further improve this feature. The controlling panel is illustrated as follows in Figure 3:

4.2 Parson's Submit Presentation

The current UI design displays the summarise message after submission as a popup window. To make this consistent, just like the hint presentation, we

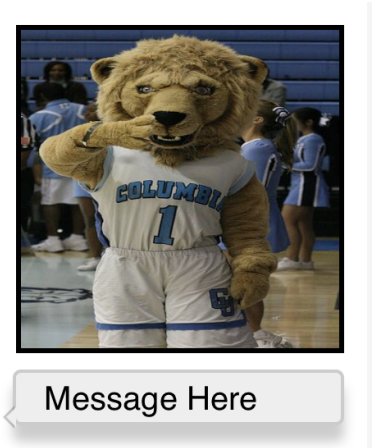

Figure 1: Message Presentation

would like to associate this message with the Avatar.

There are a number of other improvements can be done after submission. Some of them can be linked to "learning metrics". For example, the Avatar can provide other information such as recommended puzzles, learning statistics and information about other students. Avatar can display a message like "Since you have solved this problem, you could try these problem to get more badge". Avatar can tell the student what badge he/she earned after this puzzle or how many steps he/she needs to earn the next badge. Student will be stimulated to continue to do more puzzles in such way. However, we will need back-end algorithms to support these features. We will look at previous work in this area. Wang's project on Parson's Scoring System from last semester did some work in this area, we will associate their work with the Avatar to make the student have a consistent conversation with the Avatar not only during the puzzle, but also continuous stimulated the students get more things done.

4.3 Parson's Objective Presentation

We will replace the "Question" with "Game Objective", and then make the Avatar as the body to display this message. The game objective can also be displayed automatically at the start of each puzzle.

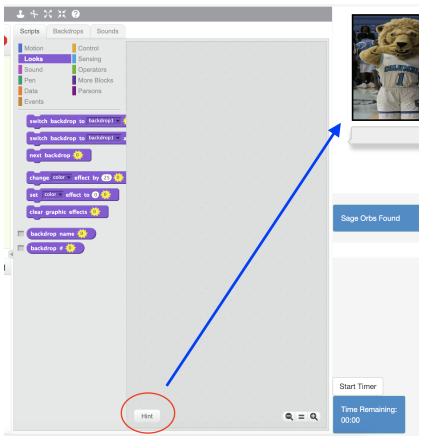

Figure 2: Old Hint Button

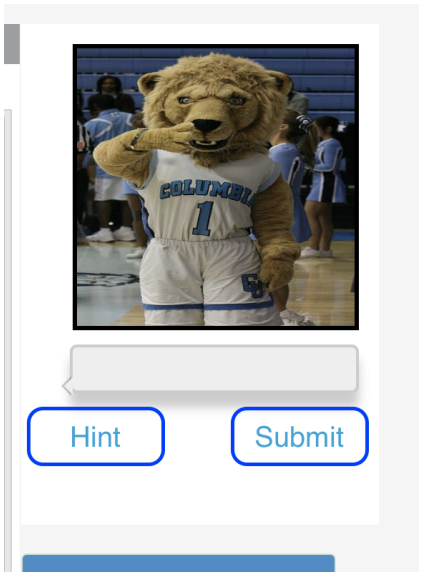

Figure 3: New Control Panel

4.4 Parson's Feedback Authoring and Presentation

The Avatar message should be customized by teachers. That includes: choose a customized default message to popup when students entering the puzzle, for example, student can be asked to watch a video before solving a puzzle; choose a preset of messages that can be displayed by the Avatar; Hint should

be displayed or suggested if a student have been struggling for too long.

To make system consistent, all messages customized by the teacher should also be display through the Avatar.

4.5 Parson's Coach Time Reminder

In current UI design, the timing section detached from the Avatar. We proposed that the Avatar can be associate with the time section. For example, the Avatar can remind student how much time they left. When there is only 3 minute left, the Avatar can display a message. Shown in figure 4 below:

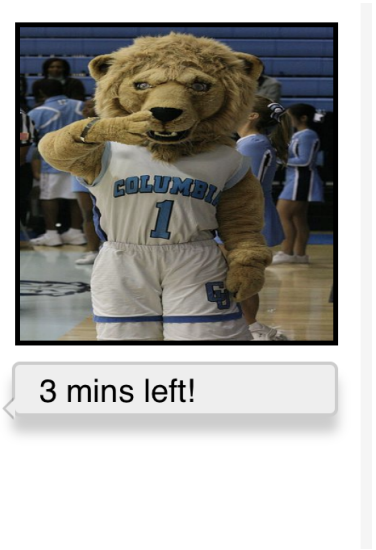

Figure 4: Time reminder

5 References

[1] A gameful change: How Gamification Can Be Used as a Communication Tool in Change Management

[2] Using Case-Based Reasoning to Improve the Quality of Feedback Provided by Automated Assessment Systems for Programming Exercises.