

The Evaluation of Hello Snake Game in Learning Java Programming Language

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Abstract : The learning process of Java programming language can be frustrating and cause students to lose their motivation. The idea of the game-based learning approach can promote students' learning attitudes and motivate them during the learning process. The objectives of this study are to identify the requirements, develop and evaluate the usability of Hello Snake, a snake-based online game on learning Java programming language. It uses agile game development cycle that has four phases in discovering, designing, developing, and testing the game. Hello Snake was evaluated by 30 respondents who are currently enrolled as university students, and the game received more than 89% of positive feedback. It is reported that the game interface is easy to navigate, the gameplay is easy to learn, and the game elements are visually appealing with harmonious music. The findings reported that more than half of the respondents had improved their Java programming language skills after attempting the game through tests that were conducted before and after the respondents try the game. The study believes that the Hello Snake can be an alternative learning tool for students and an additional teaching tool as it can improve the students' knowledge of Java programming language.

Keywords: Educational game, Java programming, Online learning, Snake game

1. Introduction

Learning programming languages is a trend for the young generation due to the rapid evolution of technology. The key to master programming language skills is to do a lot of daily practices. However, the learning process of Java programming language can be frustrating and causes students to lose their motivation. The idea of the game-based learning approach can promote students' learning attitudes and motivate them in the learning process [1]. The game developed is Hello Snake, an educational game that combines Java programming language knowledge with the classic Snakes and Ladders board game. The game is easy to learn because of its user-friendly design and intuitive rule. The elements in the game make it more challenging and fun. The game has five main functionalities which are play, study, store, profile, and setting. Play function is where the gameplay is going on. Players can start a single-

player or multiplayer match with friends. Unlock and collect costumes by using game coin from a winning game match. Game rewards are one of the most important elements that keep players motivated to continue playing [2]. **Figure 1** shows the in-game scene of the gameplay and store.

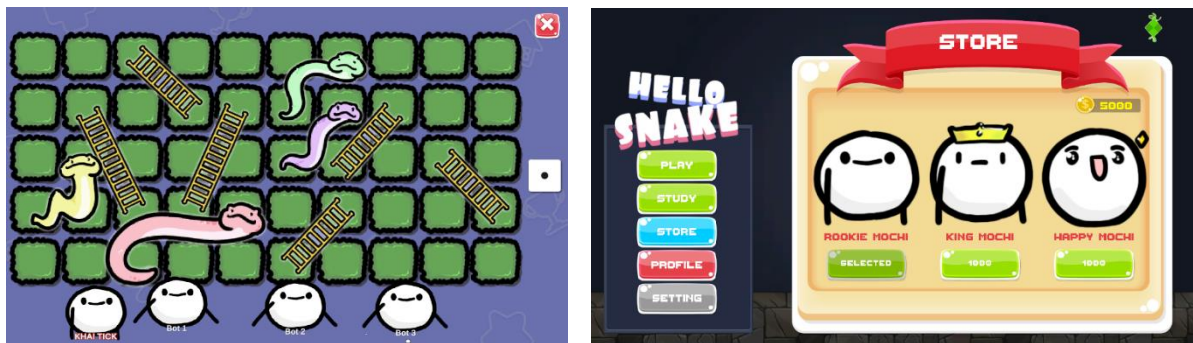


Figure 1: Gameplay and game store interface

The gameplay is the same as the classic board game Snakes and Ladders, where players need to roll the dice to move their character on the board. The goal of this game is to be the first player to reach the top and win the game. To roll the dice, players need to answer a Java programming language question correctly. They will move according to the value shown by the dice. However, if the answer is incorrect, then they will hold their position at this round. Players could climb up higher if they landed on the ladders and will fall to the lower position if they landed on the snakes. The two main elements in the game are the snakes versus the ladders which represent good versus evil that helps to make the game challenging and fun.

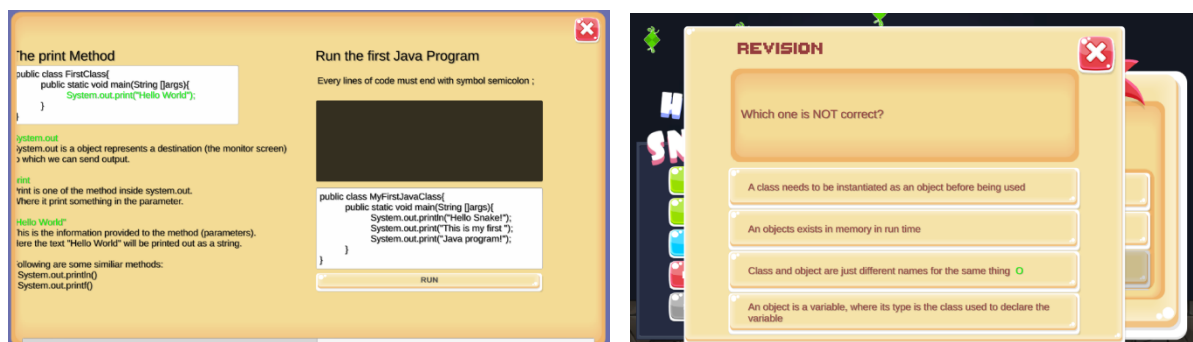


Figure 2: Study section and revision panel

In Hello Snake, players can access the study section to sharpen their knowledge as shown in **Figure 2**. It can also be used as a quick revision. Important texts and syntax are highlighted with colors and match with different backgrounds to make them more appealing. The section also added elements like buttons and output display, so the learning process is interactive. The players are also able to check the correct answer from the previous game that they have played. It is useful for them to revise so that they know the mistakes that they have made.

2. Methodology

The agile approach was used in the game development cycle (**Figure 3**). The agile approach started with improvements of discovery, design, develop and test of the features of the game and at each cycle, the same phases are repeated, and changes are made until all requirements are satisfied at the end of the development cycle [3].

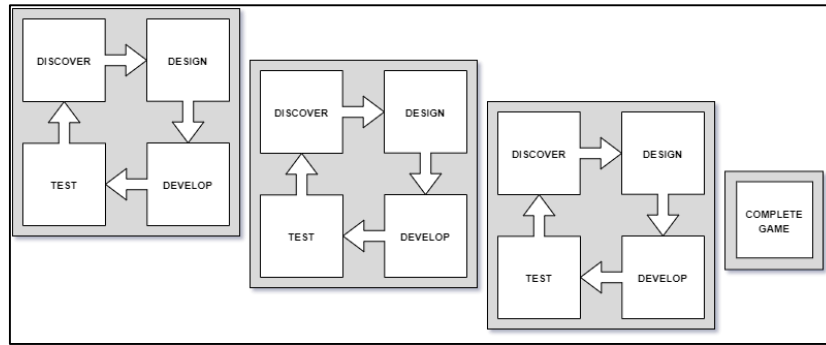


Figure 3: The agile game development cycle

Phase 1 – Discover: The study explored some existing projects that are related to the snake-based game. The basic requirements such as the gameplays and the rules of the game are identified, collected, and analyzed to get the overall idea of Hello Snake. The implementation of a game-based learning approach and understanding the ways to make an educational game fun and engaging were discovered during this phase.

Phase 2 – Design: The game is designed based on the discovery at phase 1 in terms of the contents to be included in Hello Snake such as the game mechanism, rules, and visual styles. This phase decided the game elements and the overall game look. The goal of this game is to put all the fun pieces together and produce an exciting game. An in-game database structure is required to store the programming quizzes. It will be combined with the snake game features as a section of the Java programming language quizzes. Competitive elements can enhance player's involvement and motivation [4]. As a game match goes further, the time given for the player to react will be shortened. It helps to improve player's reaction time and develop fast decision-making skills.

Phase 3 – Develop: The game is developed using Unity Engine ver.2019.2.0f1 and Microsoft Azure PlayFab for cloud data storing (database) and user authentication (**Figure 4**). Unity is deployed on Azure as it offers scalable platform to host Hello Snake game. It put ease in managing and keep all the players' data secure. Its support for cross-platform and extra features such as friend list, leaderboard, analytics adds benefit for future expansion. Photon PUN is an enhanced solution of Unity's built-in networking system, mainly used for multiplayer support of Hello Snake. Players at different regions and time zone are allowed to play together. Free GUI assets were used for the menu interface. All the in-game elements are designed, drawn, and animated made by the author.

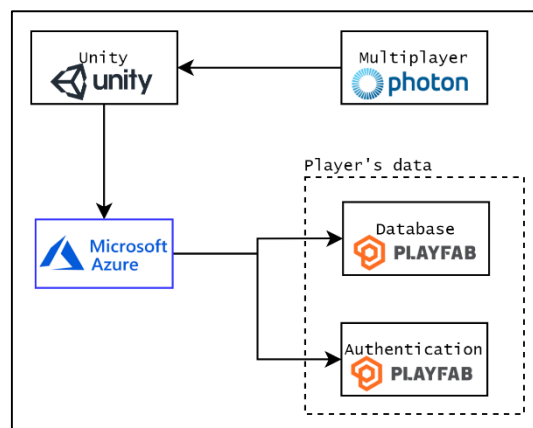


Figure 4: Game architecture

Phase 4 – Test: 30 respondents with an IT background were selected for the evaluation. They have the basic knowledge of these topics but might have forgotten some of the concepts due to lack of use

and practice in Java programming language. The game can be helpful to refresh their knowledge. The evaluation form was created as an online questionnaire (Google form) and shared through WhatsApp. The collected data is analyzed.

In the testing phase, respondents were given pre-test and post-test questions where they are required to answer a simple Java programming language test before and after they have tested the system. It can measure their improvement in understanding the Java programming language. Different test questions were used in the pre-test and post-test. However, all the questions are based on Hello Snake and have the same difficulty level, which only covers the introduction and fundamental parts of the Java programming language. The respondents can view their grades after the test. However, the correct answers will not be shown. The objective of the test is to measure their knowledge before and after they play Hello Snake, not through learning from the test. These test questions have been covered in the game quiz. Thus, it is expected that the respondents will learn and able to answer these questions after using the game, in addition to improving their knowledge.

3. Result and Discussions

The respondents are required to fill in a questionnaire on the usability, ease of use, feasibility, and satisfaction of Hello Snake. All the respondents were able to use the game with a 100% of success rate. However, several visual bugs, suggestions, and improvements can be made to this game.

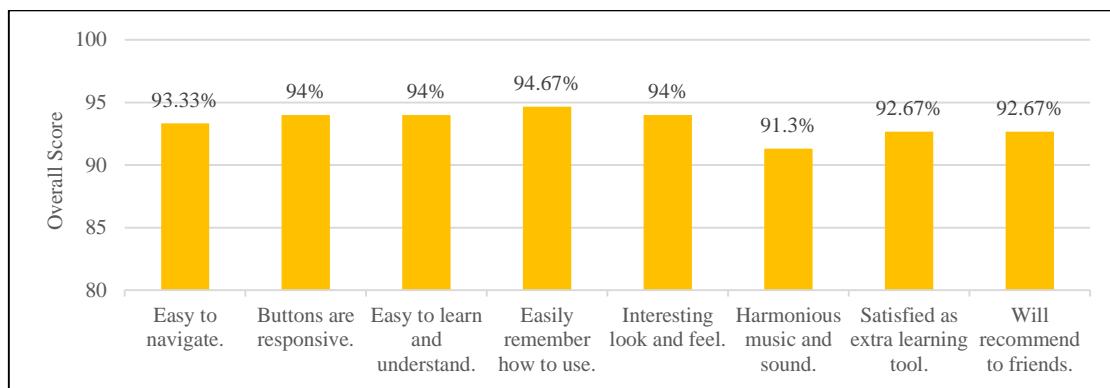


Figure 5: Game overall satisfaction feedback

Figure 5 shows the respondents' feedback on their overall satisfaction with the game based on its features. 93.33% of the respondents rated that they are satisfied with Hello Snake in terms of the navigation functions and the visual of the game. 94.67% of the respondents agreed that Hello Snake is easy to be used in learning Java programming language. Compared to all the game features, the music and sound of the game were rated 91.3% which means few respondents did not enjoy the music provided. This can be improved in an updated version as a new feature where the players can choose their preferred background music from a list.

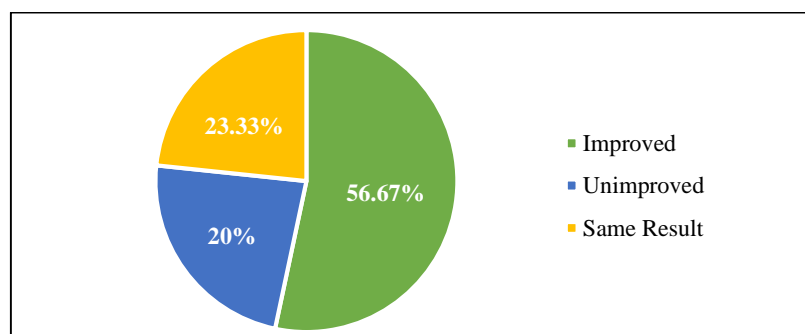


Figure 6: Respondents Java test score improvement

In terms of the effect that Hello Snake has on the respondents' Java programming language knowledge, **Figure 6** shows the comparison of the pre-test and post-test results that were conducted. Based on the results, 17 respondents (56.67%) showed improvements in their test scores while 7 respondents (23.33%) obtained the same score as before, and 6 respondents (20%) did not show any improvements. Although there is a limited number of respondents, these results can be assumed to some extent, reflect the effectiveness of Hello Snake as a learning tool still as more than half of the respondents did better after playing the game for several minutes. By using Hello Snake, they are able to see more improvements if they play the game daily for a longer time.

4. Conclusions

Hello Snake is an online-based Java programming language game based on the classic Snakes and Ladders board game. The game is an educational game that is developed as an alternative learning tool. The game is easy to be used because of its user-friendly design and intuitive rule. It also supports single-player and multiplayer, which adds the element of competition among the players.

In this paper, the game only covers basic Java topics and multiple-choice questions. However, in future work, the game design will focus on introducing new question types and unlock advanced levels of questions. By using Hello Snake, players are able to improve their Java programming language skills as it acts as a revision method through the quizzes provided in the game.

Acknowledgement

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