

## Finding Selection Sets for LL (1) Grammar with Game-Based Learning

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### ABSTRACT

LL1 Grammar is a sub-topic in Topic Four: Syntax & Semantic Analysis based on syllabus CSC569 Principle of Compiler. To find the Selection Sets of LL1 grammar, students need to solve twelve steps of operations. However, some students face difficulties to memorize these twelve steps to find the Selection Sets. Therefore, the goal of the developed game is to help them understand all steps in LL1 Grammar and to increase their enjoyment while learning. ADDIE method has been chosen as the methodology for this project because it is one of the most common models used to create an effective instructional design. Game elements such as challenge, rule, reward, theme, and progress are employed in the game. The platform chosen for the game is a stand-alone on PC. The design of the game is Role Playing Game where each of the steps has been translated into twelve cities and the player needs to travel to all of the cities in the correct order to solve the mission that has been given to them. Usability testing for the developed game involves 22 respondents from CSC569 Principles of Compiler students. The result of the test shows a positive result as most of the respondents enjoy learning using the game. Most of the respondents are satisfied with the content of the game. They enjoy the challenging part of the game. However, the majority of the respondents requested more missions. Further enhancement can be added to the game such as add online features to the game.

KEYWORDS: LL1 Grammar, Compiler, ADDIE, Role Playing Game, Game-based Learning

## 1 INTRODUCTION

A programming language is a language defined by a formal grammar, a mathematical object, something only brought into existence by a physical implementation [12]. A compiler is a program that translates programs written in a programming language into machine codes that are to be run by the same kind of machine the codes belong to [11].

The most common parsing techniques in contemporary compilers are top-down and bottom-up. The LL (1) parsing is a top-down, non-recursive predictive parsing technique that requires no backtracking and constructed over the class of grammars called LL (1) grammars [7]. The name LL(1) is derived from the fact that the parser finds a left-most derivation when scanning the input from left to right if it can look ahead no more than one

input symbol [3]. The first “L” in LL (1) indicates that input is processed from left to right. The second “L” indicates that it performs the leftmost derivation for the input, and “1” indicates that in each step only one symbol of input is used as a look ahead to predict the parsing action [7].

CSC569 Principles of Compiler is one of the core courses for students of Bachelor of Computer Science (CS230) in the Faculty of Computer & Mathematical Sciences (FSKM) Universiti Teknologi MARA [9]. LL (1) grammar is the sub-topics in Topic Four: Syntax & Semantic Analysis based on syllabus CSC569 Principles of Compiler. To find the selection sets, students need to use the twelve steps in LL (1) grammar. Therefore, LL (1) grammar is very important to find selection sets.

Game-based learning is a type of gameplay with defined learning outcomes. According to Ariffin, Oxley, & Sulaiman [2], game-based learning (GBL) refers to the use of computer games that possess educational value or different kinds of software applications that use games for learning and education purposes. The design process of games for learning involves balancing the need to cover the subject matter with the desire to prioritize gameplay [10]. Game-based learning is not just creating games for students to play, it is designing learning activities that can incrementally introduce concepts, and guide users towards an end goal [8].

## **2 OBJECTIVES**

To overcome students’ difficulties in remembering the steps to find Selection Sets for LL (1) Grammar and their lack of interest in the traditional way of learning it, there are three objectives to be fulfilled in this project.

- To design a game that helps students to find Selection Sets for LL (1) Grammar.
- To develop the designed game using Game-Based Learning.
- To test the usability of the game.

## **3 SIGNIFICANCES**

The learning game can be one of the methods to encourage target users in particular to recall the steps in LL (1) Grammar. This project is designed to help students understand all the steps in LL (1) Grammar and increase their enjoyment when studying something in the form of remembrance.

This project is also an alternative way of learning by game applications, which will help the student find Selection Sets in LL (1) grammar. Therefore, students will be drawn to learn LL (1) Grammar without using notes or books. This application is designed to provide an enjoyable experience for the user when studying LL (1) Grammar.

## **4 METHODOLOGY/ TECHNIQUES**

The research framework chosen for this project is ADDIE which stands for Analysis, Design, Development, Implementation, and Evaluation. This model helps educational designers, developers of any content, or even instructors to produce an efficient and effective teaching design by applying the ADDIE model to any educational product [1]. ADDIE is iterative, involving review and revision throughout the design process. The structure offers designers

the ability to integrate input throughout the whole system. Fig. 1 shows the cycle of the ADDIE model.

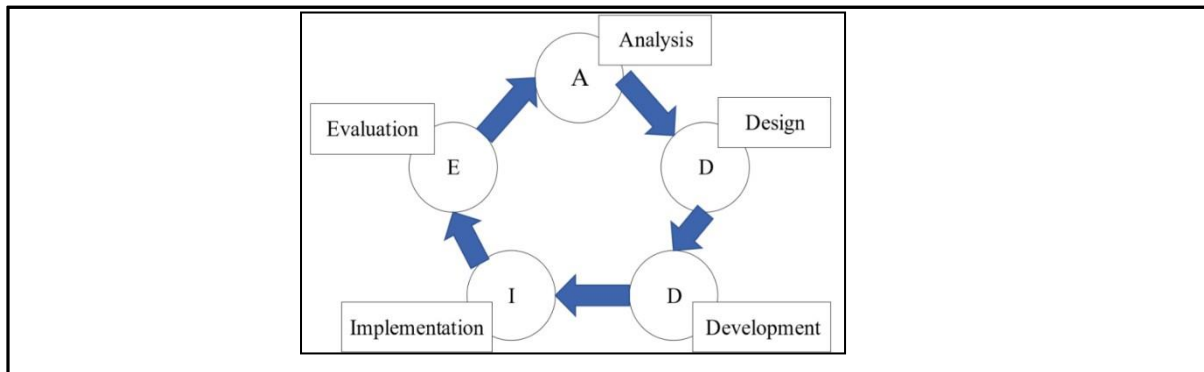


Fig. 1 ADDIE Model  
(Source: Peterson, 2003)

The first phase is to identify the target user, problem statements, and the objectives to design the use case, flowchart, and the storyboard of the game. Next, we need to identify the hardware and software to develop the prototype. Testing and prototyping of the game are being conducted in the next phase. After completing all the testing in the previous phase, the result is evaluated in the last phase.

## 5 RESULTS

Usability testing for the created game takes 22 students CSC569 Compiler Principles respondents. The test result indicates a positive outcome, as most respondents enjoy learning through the game. Many respondents are pleased with the game content. Fig. 2 shows the result regarding LL (1) Grammar comprehension throughout the game.

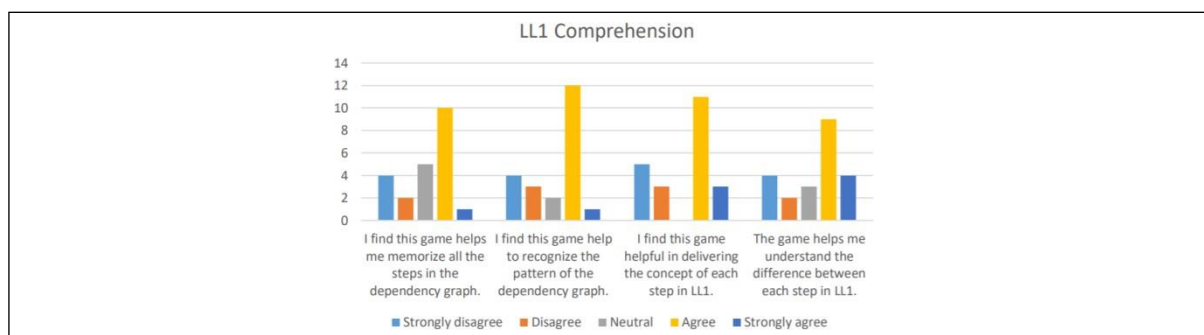


Fig. 2 Result of the LL (1) Comprehension

The opposite happens when expecting negative feedback due to the amount of time the game takes. Respondents enjoy the challenging part of the game. The game itself is long since they must travel to the twelve towns. Some of the respondents however called for more missions. The game can be further improved, such as adding online functionality to the game. Fig. 3 shows the map of the twelve towns.

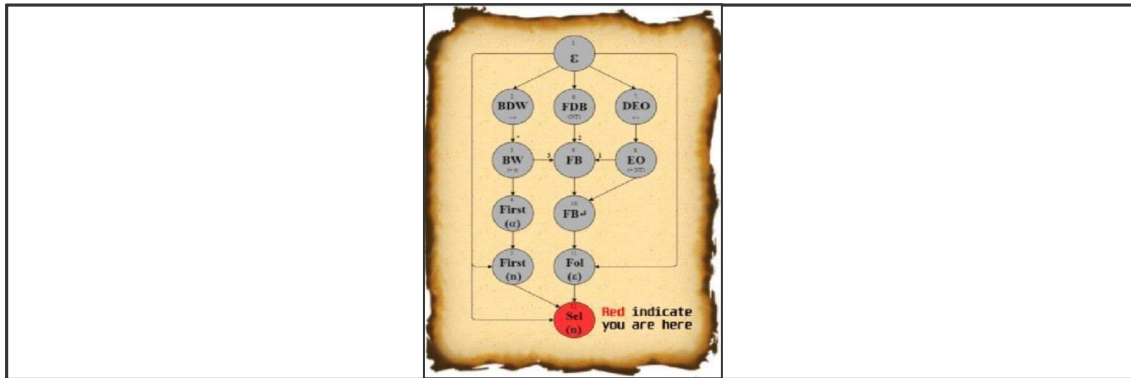


Fig. 3 Map of Towns

## 6 CONCLUSION

The game has been evaluated through usability testing. Usability testing has been done through observation and questionnaire. Based on the evaluation, usability testing gives positive feedback resulting in 86% of students like the content of the game. Overall, all the objectives of this project have been completely achieved which are to design a game that helps students to find Selection Sets for LL1 Grammar, to develop the designed game using Game-Based Learning, and to test the usability of the game.

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