

**SYNTAX RECALL: ENHANCING CODING SKILLS THROUGH 2D TEXT-BASED  
INTERACTIVE COMBAT GAME**

Undergraduate Thesis

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**RAFAELLA R. BAÑEZ  
AALIHYA M. RIVERO  
RYAN CHRISTIAN M. ROBLES**  
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## INTRODUCTION

### Background of the Study

In today's technology driven world, where technology progresses rapidly, Computer Science and Information Technology departments are continuously seeking innovative methods to enhance the programming capabilities of the students. In response to this problem, the proposal "Syntax Recall: A 2D Text-Based Combat Adventure Game" arises as an entertainment application that the students can use to enhance programming capabilities.

Programming is a difficult subject to learn as it requires cognitive and meta-cognitive abilities. It requires students to understand the syntax and definition of the programming language they choose and apply their own knowledge and creativity to run and solve problems (Eteng, L., et. al, 2022). Traditional method of learning a programming language isn't as effective as it used to be. As technology in education has progressed throughout the years, with educators integrating strategies that encourage students to have a better learning, Gamification is one of these strategies. Gamification is a sequential technology of game and game-based techniques in education, therefore using games in a classroom is an excellent tool for improving academic performance (Sabornido, E. B., 2022).

In this study, we propose the development of the game SYNTAX RECALL: ENHANCING CODING SKILLS THROUGH 2D TEXT-BASED INTERACTIVE COMBAT GAME. The objective of the game extends beyond providing entertainment for students; it aims to serve as a platform where users can explore different programming languages without the need to download various IDEs. Additionally, the game will feature a library where the functionality of code can be read, allowing users to enhance their programming skills and improve their ability to recall the syntax of various programming languages.

## Statement of the Problem

This study aims to answer “How can a 2D text-based interactive combat game, utilizing AI for enemy behavior, be developed to enhance coding skills?” Specifically, this study seeks to address the following problems:

Traditional coding learning methods often fail to engage students in a fun and interactive way, making it difficult to maintain interest and encourage practical skill application. *“How can a 2D text-based interactive combat game provide an engaging environment for users to practice and enhance their coding skills?”*

While coding tutorials and exercises offer theoretical knowledge, they often lack real-time problem-solving scenarios where students can apply what they’ve learned. *“How can a game-based approach integrate real-time coding challenges that simulate problem-solving situations, helping users develop practical skills?”*

Many educational platforms do not incorporate AI in a way that adapts to a learner's progress or difficulty level, which can make learning too easy or too difficult.

*“How can AI-driven enemy behavior in the game provide a dynamic and adaptive challenge to match the user’s coding ability and progress?”*

## Objective of The Study

Generally, this study aims to explore the potential of a 2D text-based interactive combat game in enhancing coding skills by allowing users to practice programming concepts through engaging scenarios and AI-driven enemy behavior.

Specifically, the study aims to:

1. Develop a 2D text-based interactive combat game that challenges users to write code to perform actions in the game, using real-world coding skills to battle AI-driven enemies.
2. Implement in-game coding challenges that allow users to practice coding concepts, such as writing conditionals, loops, and algorithms, in the context of the game's narrative and combat mechanics.
3. Use AI that adjusts the behavior of the enemies based on the player's coding ability, ensuring that challenges scale appropriately with the learner's progress.

### **Time and Place of the Study**

The study entitled "Syntax Recall: Enhancing Coding Skills Through 2D Text-Based Interactive Combat Game" was proposed by the researchers in Cavite State University Imus campus, which began in December 2024 and the title proposal will be conducted on January 2025 this study is under the guidance of the Undergraduate Thesis professor, Mr. Ramil Huele.

### **Scope and Limitation of the Study**

**AI Opponent Module.** This module provides an intelligent opponent for the game, simulating realistic challenges to enhance the player's coding skills through interactive combat scenarios.

**Game Mechanics Module.** These are the rules that guide the player when playing the game; it dictates what actions the users can carry out within the game environment, as well as the game's response to this action.

**Tutorials Module.** Tools that teach players the rules, control interface and the mechanics of the game.

**Menu Module.** Options for starting, pausing, or continuing the game, adjust settings, and show options to save or exit the game.

**Level Module.** Specific section of a game with objectives to be completed to progress in the game, often increasing difficulty as the player progresses.

**Options Module.** Usually can be seen under the menu; allows users to adjust various settings in the game for example: volume, brightness, graphics.

**Programming Languages Option Module.** Allows users to select and change in the given options the programming language that will be used to play the game.

**Game Difficulty (Mode) Module.** Allows players to choose between easy, medium, and hard options. The users will be able to choose the desired difficulty level in the game before playing.

The limitations of this study are as follows:

This research involves a typical typing game where its twist is that it is about programming languages running on android mobile devices. This game is a working in progress application, that can be improved and introduce additional features depending on the creators and potential developers of this game. This app is a two-dimensional game with only a single user limit.

- The game supports only specific programming languages such as Python and Java.
- AI opponents or enemies are limited to non-human players and cannot accommodate human opponents.
- The development will utilize Python and Java, with Keras (API) for implementing AI functionalities.

## Definition of Terms

**2D.** A flat shape that has only two dimensions- length and width, with no thickness or depth.

**Adventure.** In video games, the player assumes the role of a protagonist in an interactive story, driven by exploration and/or puzzle-solving.

**Android.** A mobile operating system based on a modified version of the Linux Kernel and other open-source software, designed primarily for touchscreen mobile devices such as smartphones and tablets.

**Artificial Intelligence.** The simulation of human intelligence processes by machines, especially computer systems.

**Game-based learning.** Is used to define a teaching strategy that uses gaming mechanics, elements, or design concepts to improve user learning and make it more fun, interesting, and engaging.

**IDE.** An integrated development Environment (IDE) is a software application that helps programmers develop software code efficiently.

**Metacognitive.** awareness or analysis of one's own learning or thinking processes.

**Programming Language.** Language used by a programmer to communicate with a computer; set of instructions to deliver to the computer to perform and accomplish a task.

**Syntax.** Set of rules that define what the various combinations of symbols means; the rules that control the structure of symbols, punctuation, and words of a programming language.

**Turn-based.** A strategy where players take turns when playing.

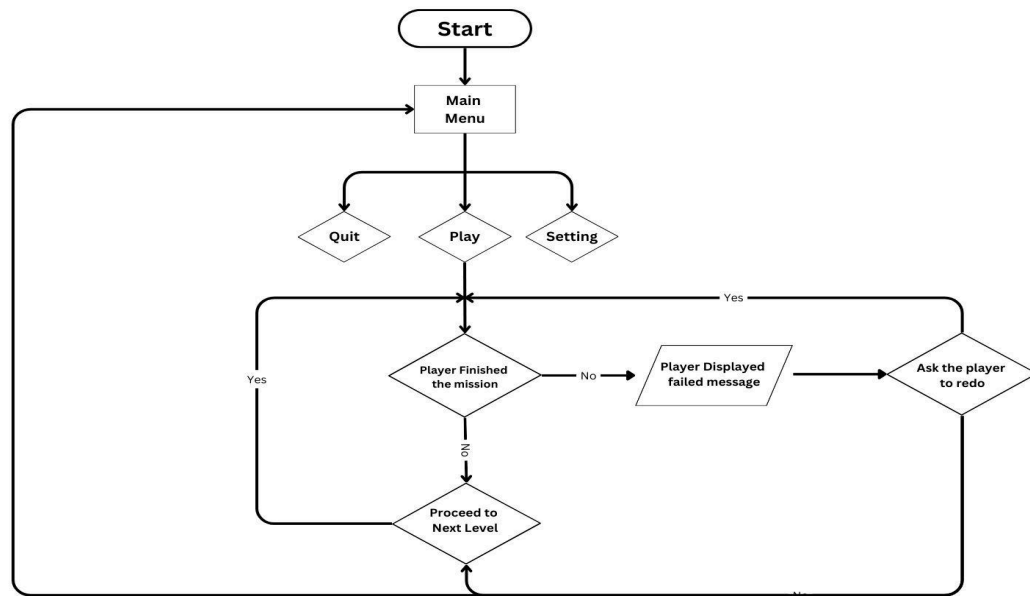
**User/Player-centric.** Refers to a method or design philosophy that puts the player's or end user's requirements, preferences, and experiences as a priority.

## **Theoretical Framework**

The theoretical framework of the study "Code Cody: A Game-Based Learning Platform for Programming Education" (Sulaiman M. S. et al., 2023) focuses on how game mechanics can support learning in programming education. The framework highlights a structured process where players complete missions, receive feedback when they fail, and are given opportunities to retry. This aligns with motivational theories, such as self-determination theory, which emphasizes the importance of building competence and encouraging persistence. By allowing players to reflect on mistakes and try again, the system helps foster a growth mindset and keeps learners engaged.

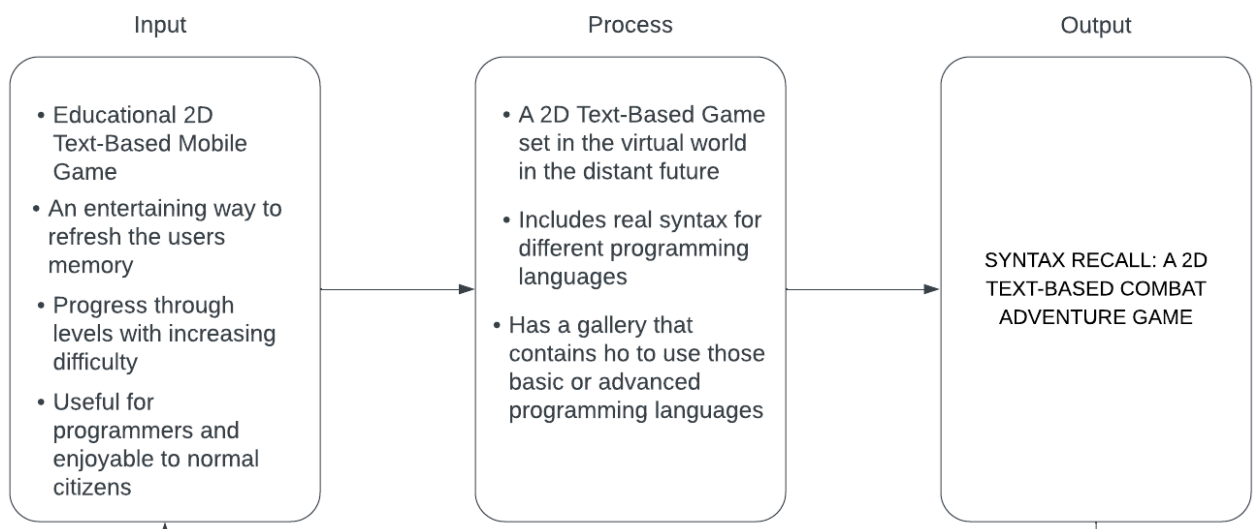
The framework demonstrates how features like level progression and feedback enhance learning by encouraging active problem-solving and gradual skill development. These mechanics follow constructivist principles, where learners build knowledge through practice and exploration. The combination of challenge and reward creates an immersive experience that motivates learners to continue. This shows how *Code Cody* uses game-based learning strategies to make programming education more engaging and effective.





**Figure 1. Theoretical Framework**

## Conceptual Framework



**Figure 2. Conceptual Framework**

## REVIEW OF RELATED LITERATURE

### RELATED LITERATURE

Game-based learning has several advantages for promoting kids' cognitive development. The development of active learning in students is one of its most important benefits. The games are easily adaptable to fit into various lesson ideas. There are also student-monitoring functions related to several games. (Tamosevicius, 2022)

According to Benefits of Game-based learning (2022) Incentives are used in games to keep players interested, and individualized learning lets users keep track of their progress and level of knowledge. Playing different games helps students gain self-awareness and self-control, two essential components of learning. They can also experience learning from their mistakes, failing, learning, and correcting without experiencing consequence when they use game-based learning (GBL).

"Developed with Educators, Reading Adventure Takes Kids on an Exciting Journey from Learning to Read, to Loving to Read" . The headline of an article written by Osmo in BYJU'S. According to the report, the startup BYJU'S developed a Reading Adventure game for kindergarten students that blends actual books with a digital narrative app including unique characters, noises, and phonics. According to the paper, kids often find it difficult to learn by traditional means, are less active, and have shorter attention spans. Using the program helped the youngsters enjoy learning and become more focused on their study sessions. (Osmo, BYJU'S, 2022).

According to an article from the Open University of the Netherlands, "Why and How Serious Games Can Become Far More Effective". The major lesson from the article is that game-based learning methods are successful. They have their own restrictions. These constraints are overcome by serious games that include learning and provide students with a method to learn while enjoying their present pastime. Thus, employing a game designed

expressly for teaching and educating children is a more effective approach to learn. (WimWestera, 2019)

Gamification is a technique that proposes dynamics associated with game design in the educational environment, to stimulate and have direct interaction with students, allowing them to significantly develop their curricular, cognitive, and social competences. Manzano-Leon, A. et. al. (2021)

According to Eteng, I., et. al (2022) that computer programming as a course requires cognitive and meta-cognitive abilities. It requires the student to understand the syntax, and semantics of the programming language selected and apply their creativity to solve problems. Learning a new language takes a long time to learn and master, however it can be minimized with the right motivation and practice over time.

**Tommy Q: Zombie Defender.** Tommy Q is able to fire at the zombies as long as the player inputs the phrases hovering above the zombies correctly. The zombies approach Tommy Q in seemingly tranquil rows carved into the grass. Playing this game can be a great method to practice typing complete words while attempting to evade the zombie apocalypse. (EPCC, 2023)

Programming is a difficult subject to learn, beginners go into coding immediately without clearly defining the specific tasks needed to be done and they'll hit a roadblock and can't get themselves "unstuck" from an error making all their strategies useless. This is very frustrating to students causing them to possibly disengage from what they are trying to solve, and this could affect their interest to carry on and learn further about programming. Villamor, M. M. (2020)

According to Sabornido, E. B., (2022) that technology in education has progressed throughout the years, with educators integrating strategies that encourage students to better their learning, Gamification is one of these strategies. Gamification is a sequential

technology of game and game-based techniques in education, therefore using games in the classroom is an excellent tool for improving academic performance. In addition, overall results of the evaluation of students in programming learning activities demonstrate good effects on student involvement with gamified learning activities and a moderate improvement in learning outcomes, as well as boosting student engagement and understanding. Caballero, L.S., et. al (2022)

The paper titled "Game-based learning: Reinforcing a paradigm transition pedagogy amid COVID-19 to complement emergency online education" . As the disease spread, teachers and professors had to find a way to keep students' attention while simultaneously increasing their creativity and critical thinking skills. This is when they switched to game-based learning. Using the student's devices, which might be mobile, desktop, or laptop. They were able to capitalize on the aforementioned requirements by using games as a conduit to increase student learning outcomes. (Cathy Mae Dabi Toquero, Dalj Andrew Sonsona, and Karen Joy B. Talidong, 2021).

An article was made last year stating that they investigated the impact of mobile games on students' communication abilities. They focus on how mobile games and mobile devices in itself have improved and influenced students and people in general in a positive way. They concluded that the current rise in popularity of multiplayer, puzzle, adventure and strategy games significantly increases the users communicational abilities. The multiplayer games especially leveled up the collaboration, negotiation and overall social skills of people.(Aiza Bheal M. Kitani, Orayza Mae T. Malasmas, Ma Teresa M. Balbin, Marivic B. Hoggan, Marcy J. Ngaya-An, Jezreel L. Maske, 2023)

## RELATED STUDIES

In a Study called "Insights from a Viral Online Typing Game" In the popular online typing game called "**TypeRacer**", teams of up to ten people compete against one another, friends, or random users to type a brief paragraph as quickly as they can. Before the race

begins, typists have up to 12 seconds to read the race prompt. This type of gamification not only enables TypeRacer to gather information from thousands of participants worldwide, producing a gigantic and multilingual dataset that is many orders of magnitude more than what can be gathered in the lab. It also encourages players to type quickly and accurately in order to succeed. The information is therefore highly useful for researching the cognitive and physical capabilities of language production. With races in 50 languages and various texts like song lyrics and code, TypeRacer is a diverse game. (Chen et al, 2021)

In another related study, "Implementation of games in learning vocabulary for English students" A game called "**Ztype**" wherein In order to take down approaching enemy ships and obstacles, players in the game control a spaceship and must input phrases that appear on the screen. As players advance through the several stages, the difficulty rises, forcing them to type more quickly and accurately in order to live. "ZType" is a fun approach to develop typing abilities because it blends fascinating gameplay with typing exercise. It is one of the best learning tools for vocabulary instruction. Students also utilize ZTYPE games to strengthen their vocabulary learning perspective. And seeks to describe student viewpoints and how English language learning is applied. (Hartono & Nugrahini, 2023)

Furthermore, in an instructional typing game "Nitro Type" its goal is to increase typing accuracy and speed while competing with other players. Users can compete in typing competitions with the goal of precisely and swiftly typing a variety of words or paragraphs to advance their automobile to the finish line. The game helps users to improve their spelling and grammar even if its major focus is on typing. (Kievlan, 2021)

According to (Yu et al., 2020) explored game-based learning outcomes including academic achievements, problem-solving, and critical thinking abilities, knowledge, learning efficiency, skills, student attitudes, and behaviors. The role of engagement in game-based learning was studied, coupled with the ways to enhance student engagement. A learning method assisted with games, i.e. Mobile Gamification Learning System, could positively

influence academic achievements and student motivation, and encourage students to engage in learning activities.

Through making 2D games, selection of sentences has been made from Java programming language as it is one of the most widely used in education and industry, its set of instructions were to be identified and represented by Java Language. In the development, the platform can now visualize programs utilizing augmented reality through the use of a new set of graphic representations that are based on roads and traffic signs for the purpose of teaching programming. (Sobrino et al., 2020)

Accordingly, research in the field of computer science education has brought attention to problems such a high failure rate, memorization, errors, idea complexity, Students struggle with motivation and lack of confidence when learning a programming language, particularly object-oriented programming. Students struggle with memorization of reserved words and encounter syntax problems when developing code. Less confidence is also caused by the slow progress of problem-solving and the development of poor software when learning programming. (Batiha et al., 2022)

Minutovka is an online word-typing game that gathers errors to build an error collection. Because of the limit the maximum game duration is within one minute, the game is called Minutovka, which means "One Minute Game" in English. A player's goal is to rapidly and accurately rewrite the words from the phrases that are randomly displayed in this amount of time. In addition to honing the user's typing skills, the player is driven to beat other players and obtain the greatest score in the daily, weekly, or overall rankings. (Toth S. et al., 2021)

In a research done at a public high school in Quezon City. The researchers used Manipulative Game-Based Learning (MGBL) to assess students' performance in Periodic Trends in Chemistry. They essentially utilized a game-based learning and student achievement model to determine the impacts on Science, Technology, and Engineering

(STE) students. This research focused on a portion of pupils who were taught using traditional approaches, while the other half were taught using games and actual manipulatives. The research indicated that introducing a game-based learning system was a worthwhile and successful method of educating pupils since it demonstrated that students were more engaged with learning in class. (Conel, Edwin B., 2021).

The research about “Game-Based Learning Activities In Teaching Grade 7 Science” which explored game-based learning in scientific education and found that science instructors at Oblate Schools highly supported its success in practice, although views varied by age group. Learning competencies in Biology and Physics were moderately achieved, but constraints included a lack of materials and individual differences among students, as revealed for a descriptive method that used questionnaires and interviews with statistical tools such as weighted mean, frequency, t-test, and F-test. In conclusion, the investigation revealed that students demonstrated learning abilities in earth science, biology, chemistry, and physics, whereas science instructors reported challenges, mostly due to limited resources and student variations. (Jennifer D. Makalintal, Dr. Nerrie E. Malaluan , 2019)

In a short paper called “A Review of Game-Based Mobile E-Learning Applications”. The study aimed to investigate the advantages of using tools such as E-Learning and Game-Based applications when used to educate students. They are said to build an engaging and immersive experience with specific goals in mind. The study concluded that continuing further in advancing and improving the bond of Game-Based Mobile E-Learning Applications with traditional methods would provide a powerful and efficient way of learning. The study also comments that if you put Augmented Reality (AR) and Game-Based Learning (GBL) together it would be a breakthrough for education. (Carlo H. Godoy Jr, 2020)

According to Santos O. Ombay & Dinns B. Roble (2020) when a student initially learns something, as time goes by, they tend to forget the basic and important information. To better retain the acquired information a teacher needs to bring out critical features of the

object of learning into students' focal awareness to recall the concepts. Hence, repetition provides practice to learners' need to master new skills and it helps strengthen their learning comprehension. In addition, gamification is a possible way to raise a student's motivation, engagement, and academic outcomes by adding gaming features such as challenges, prizes, and progress monitoring. Leaderboards can be used to monitor students' progress over time, promote healthy competition, and inspire pupils to raise their scores. J.O Medico, et. al (2023).

**Table 1.** Table of Comparison

Features	A	B	C	D	E	F
Year	2021	2021	2021	2023	2023	2025
User Friendly Interface	✓	✗	✗	✗	✗	✓
Progress Tracking	✗	✓	✗	✓	✓	✓
Runs on Mobile	✗	✓	✗	✗	✗	✓
User Centric Design	✓	✓	✓	✓	✓	✓
Interactivity	✓	✓	✓	✓	✓	✓

**LEGENDS:**

**A** - Minutovka



**B** - Nitrotype

**C** - Typeracer

**D** - TommyQ: Zombie Defender

**E** - Ztype

**F** - Syntax Recall

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