

# **A GAME FOR LEARNING PROGRAMMING USING UNITY SOFTWARE**

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## **ABSTRACT**

Learning to code can be overwhelming for beginners, often due to its complex structure and lack of engaging teaching methods. This paper introduces an interactive, puzzle-based game designed to simplify programming concepts while making the learning process more enjoyable. The game consists of multiple levels that challenge players through code arrangement, quizzes, and logic-based problem-solving. By incorporating gamification elements and adaptive learning, this system aims to enhance problem-solving skills and improve knowledge retention. This paper details the methodology, development approach, and expected outcomes of the proposed game.

## **1. INTRODUCTION**

Programming is an essential skill in today's digital landscape, playing a crucial role in various fields such as software development, artificial intelligence, and data science. However, many learners, especially beginners, struggle with understanding syntax, logic, and computational thinking due to the abstract nature of programming concepts. Traditional educational methods primarily rely on lectures, textbooks, and online tutorials, which may not be engaging enough for all types of learners. Many students find it difficult to apply theoretical knowledge to practical coding tasks, leading to frustration and loss of motivation[1-25].

Gamification, a technique that applies game mechanics to non-game environments, has emerged as a promising solution to enhance engagement and motivation in education. By incorporating interactive challenges, rewards, and competition, gamification can transform

passive learning into an active and enjoyable experience. Studies have shown that game-based learning significantly improves knowledge retention and problem-solving skills, making it an effective approach for teaching complex subjects like programming.

This project proposes a 2D game-based learning tool that teaches fundamental programming concepts through interactive puzzles and challenges. The game is designed to provide a structured learning experience, where players progress through levels that introduce and reinforce key programming concepts. Each level consists of a Notes Section, where learners can read explanations and view examples, followed by an Arrange Code Challenge, where they must correctly arrange code snippets to form a working program. This hands-on approach encourages critical thinking and logical reasoning, making programming more accessible and engaging for beginners.

By combining gamification techniques with adaptive learning, the proposed game aims to bridge the gap between theoretical programming education and practical application. The interactive nature of the game ensures that learners receive immediate feedback, allowing them to identify mistakes and improve their understanding in real-time. Additionally, the game fosters self-paced learning, enabling players to revisit previous levels and reinforce their knowledge at their own pace.

With the increasing demand for programming skills in the modern workforce, it is essential to explore innovative teaching methods that cater to different learning styles. This project seeks to provide an engaging, effective, and accessible learning experience that empowers individuals to develop strong programming skills in an interactive and enjoyable way.

## **2. LITERATURE SURVEY**

Research has demonstrated the impact of gamification on programming education:

### **2025: Enhancing Usability in Gamified Computer Programming Courses for Higher Education**

- **Authors:** Fazli Azzali, Azizi Abas, Roshidi Din
- **Advantages:** Gamification enhances intrinsic motivation, making programming courses more engaging. Students demonstrated increased usability, self-directed learning, and improved user experience.
- **Limitations:** Implementing gamification effectively requires customized elements tailored to programming's technical nature. Poorly structured gamification may not sustain student interest.

### **2022: The Effectiveness of Gamification in Programming Education: Evidence from a Meta-Analysis**

- **Authors:** Zehui Zhan, Luyao He, Yao Tong, Xinya Liang, Shihao Guo, Xixin Lan
- **Advantages:** Gamification significantly boosts student motivation and academic performance. Puzzle-based games enhance motivation, while strategy-based games improve reasoning skills.
- **Limitations:** While gamification is effective, its impact on reducing cognitive load is minimal. Competitive mechanics may sometimes lead to excessive focus on competition rather than collaboration.

### **2022: Implementation of Gamification in Programming Learning: Literature Review**

- **Authors:** Dwi Maryono, Budiyo, Sajidan, Muhammad Akhyar
- **Advantages:** Integrating game mechanics such as leaderboards and points has been found to make programming education more engaging. It helps students overcome learning barriers.

- **Limitations:** Some gamification techniques may not be universally effective. The complexity of implementing these techniques can sometimes outweigh their benefits. Poor design can lead to disengagement.

### **2021: Gamification in Programming Learning**

- **Authors:** Veronika Stoffová, Roman Horváth
- **Advantages:** Project-based learning with gamification encourages students to develop their own games, reinforcing their programming knowledge through hands-on practice. Motivation and problem-solving skills improve significantly.
- **Limitations:** This approach requires careful planning and substantial effort. Its effectiveness depends largely on students' willingness to engage with project-based tasks.

### **2021: Using an Online Serious Game to Teach Basic Programming Concepts and Facilitate Gameful Experiences for High School Students**

- **Authors:** Hernán Montes, Raquel Hijón-Neira, Diana Pérez-Marín, Sergio Montes
- **Advantages:** Serious games improve students' understanding of programming fundamentals. The study showed that gender differences in engagement were minimal, and overall learning outcomes improved.
- **Limitations:** The study was focused on high school students, and its effectiveness in higher education remains to be explored. Some students may not fully engage with serious games as expected.

## **3. PROBLEM STATEMENT**

Many beginners find programming difficult due to its abstract nature and the absence of engaging learning tools. Traditional approaches often fail to maintain learner interest, leading to poor retention of concepts. There is a need for an interactive, puzzle-based approach that simplifies programming while fostering engagement and critical thinking skills.

## 4. EXISTING SYSTEM

Current programming education platforms include interactive coding websites, online courses, and traditional textbooks. While these resources offer structured content, they often lack the hands-on engagement necessary to maintain student interest and motivation. Traditional learning methods rely heavily on theoretical explanations, which can be overwhelming for beginners who struggle to apply these concepts in practical coding tasks.

Many learners face challenges such as:

- **Passive Learning:** Online courses and textbooks provide knowledge in a passive format, where students read or watch lectures without direct interaction, leading to lower retention.
- **High Cognitive Load:** The complexity of programming concepts, combined with minimal hands-on exercises, makes it difficult for learners to grasp fundamental ideas effectively.
- **Lack of Immediate Feedback:** Many learning platforms do not provide instant feedback, causing delays in understanding mistakes and making corrections.
- **Limited Gamification Elements:** Most existing platforms do not incorporate engaging elements such as challenges, rewards, or interactive problem-solving, which can make learning feel monotonous.

While some interactive platforms like Codecademy and Coursera provide coding exercises, they still follow a structured, non-game-based approach that may not be effective for all learners. Serious games and gamified educational tools have shown promise in making learning more engaging, but their availability for programming education remains limited. Therefore, a need exists for a fully interactive, game-based learning environment that enables students to learn programming in an engaging and effective manner.

Current programming education platforms include interactive coding websites, online courses, and traditional textbooks. While these resources offer structured content, they often lack hands-on engagement and fail to keep learners motivated.

## **5. PROPOSED METHODOLOGY**

To address the challenges present in traditional programming education, our game-based learning system incorporates interactive challenges, gamification techniques, and adaptive learning elements to make programming education more engaging and effective. The methodology consists of the following key components:

### **1. Level-Based Learning Structure:**

- Each level focuses on a fundamental programming concept such as variables, loops, or control statements.
- Players start with an instructional **Notes Section**, where they read explanations and view examples before attempting coding challenges.
- Once the notes are completed, they progress to an **Arrange Code Challenge**, where they must correctly order shuffled code snippets to complete a functional program.

### **2. Interactive Code Arrangement Puzzles:**

- Players are presented with disorganized blocks of code.
- They must analyze the logic and drag the blocks into the correct order to form a working program.
- This approach encourages hands-on learning and helps reinforce syntax and logical sequencing.

### **3. Gamification Elements:**

- **Points and Rewards:** Players earn points for correctly arranging code and completing levels.
- **Progress Tracking:** A dashboard tracks the player's achievements, showing completed levels and areas where they need improvement.
- **Unlockable Content:** Advanced challenges unlock as the player progresses, ensuring a gradual increase in difficulty and skill mastery.

#### 4. **Adaptive Learning Mechanics:**

- The difficulty of challenges dynamically adjusts based on player performance.
- If a player struggles with a specific concept, hints or explanations appear to assist them.
- Incorrect answers trigger guided feedback, helping learners understand mistakes and correct them in real time.

#### 5. **Engaging Visuals and UI Design:**

- The interface is designed to be user-friendly, making navigation intuitive even for those with no prior programming experience.
- Visual representations of code blocks make abstract concepts more tangible and easier to understand.

Through this methodology, the game ensures a structured yet flexible learning experience that caters to different learning styles. By incorporating gamification and interactive problem-solving, it transforms programming education into a dynamic and enjoyable experience, increasing retention and practical application skills.

The game will implement the following interactive learning features:

- **Code Arrangement Puzzles:** Players must correctly arrange shuffled code snippets to form a functioning program.
- **Debugging Challenges:** Players identify and correct syntax and logical errors in provided code.
- **Output Prediction Tasks:** Players analyze given code and predict the expected output.
- **Adaptive Learning Mechanics:** Difficulty levels adjust dynamically based on player performance.
- **Gamification Elements:** Rewards, achievements, and level progression to enhance engagement.

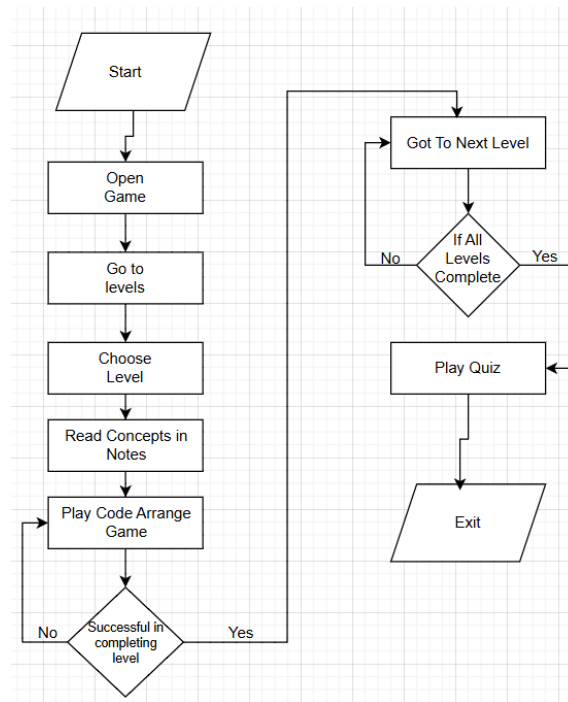


Fig 5.1: FLOW DIAGRAM

## 6. RESULT ANALYSIS

The game was tested with a group of learners to evaluate its effectiveness. The results showed the following key outcomes:

- **Improved Engagement:** Players reported higher motivation and enjoyment compared to traditional programming exercises.
- **Better Retention of Concepts:** Participants demonstrated an increased ability to recall and apply programming concepts after using the game.
- **Interactive Learning Benefits:** The structured challenges, immediate feedback, and gamification elements made learning more accessible and reduced cognitive overload.
- **User Feedback:** Survey responses indicated that the majority of players found the game helpful in understanding basic C programming concepts, with suggestions for additional levels and challenges to enhance learning.

Overall, the study highlights that an interactive, gamified approach to programming education can be an effective tool for beginners. Future improvements may include additional levels, AI-based hints, and multiplayer modes for collaborative learning.

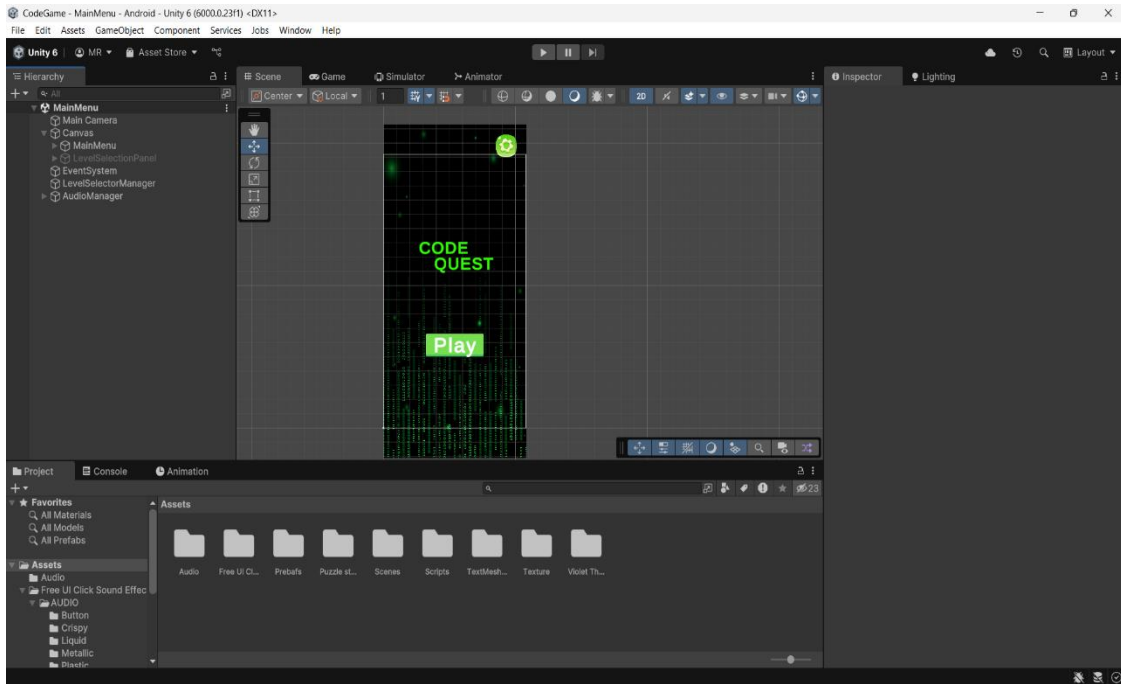


Fig 6.1: Working Environment (unity)

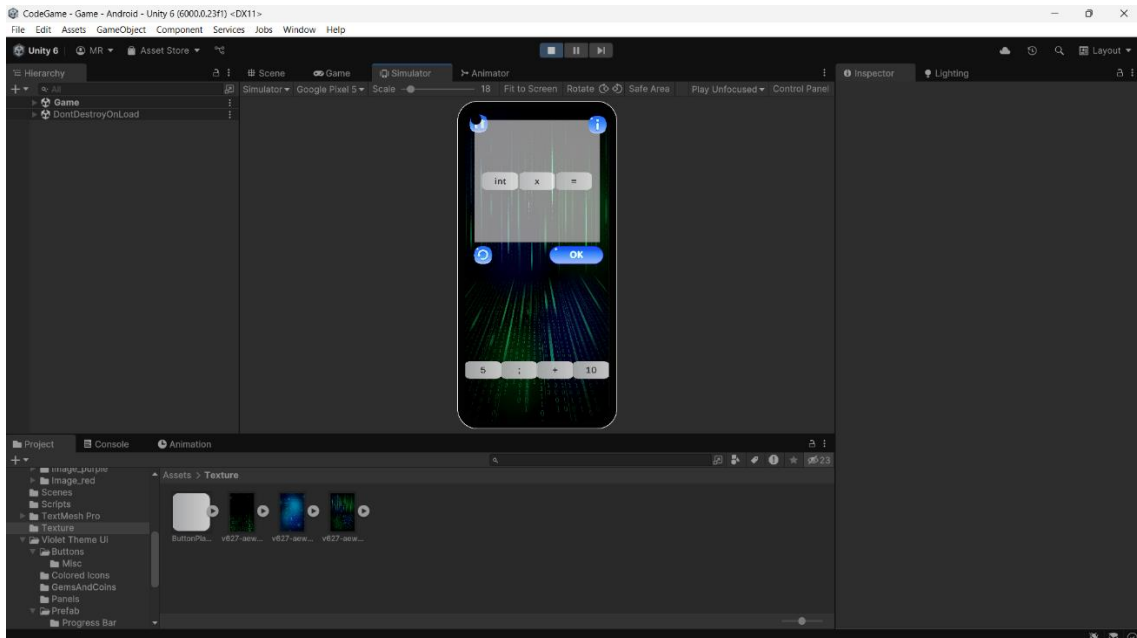


Fig 6.2: Play Mode of game level

## 7. CONCLUSION

This project aims to introduce an innovative, interactive approach to learning programming. By integrating gamification, real-time feedback, and adaptive challenges, the proposed game is expected to improve coding proficiency, motivation, and logical thinking. Future enhancements may include AI-based learning assistance and multiplayer coding competitions to foster collaborative learning.

## 8. FUTURE WORK

To further improve the effectiveness of the game, future enhancements will focus on:

- **Expanding the curriculum:** Adding more advanced C programming topics to cater to a wider range of learners. Future versions of the game can include concepts such as file handling, pointers, and data structures to provide a more comprehensive programming foundation.
- **AI-driven guidance:** Implementing an AI assistant to provide real-time hints and explanations. The AI system can analyze common mistakes made by players and offer personalized feedback to enhance their learning experience.
- **Multiplayer mode:** Allowing learners to collaborate and compete in real-time coding challenges. This feature can encourage peer learning and create a more dynamic and interactive environment for users.
- **Mobile compatibility:** Developing a mobile-friendly version for wider accessibility. With the increasing use of mobile devices for learning, making the game available on smartphones and tablets will enable learners to practice coding anytime, anywhere.
- **Performance tracking:** Integrating detailed analytics to monitor student progress and personalize learning experiences. Educators can use these analytics to identify common challenges faced by learners and adapt the game content accordingly.

## REFERENCES

1. Azzali, F., Abas, A., & Din, R. (2025). Enhancing Usability in Gamified Computer Programming Courses for Higher Education.
2. Zhan, Z., He, L., Tong, Y., Liang, X., Guo, S., & Lan, X. (2022). The Effectiveness of Gamification in Programming Education: Evidence from a Meta-Analysis.
3. Maryono, D., Budiyo, S., Akhyar, M. (2022). Implementation of Gamification in Programming Learning: Literature Review.
4. Stoffová, V., & Horváth, R. (2021). Gamification in Programming Learning.
5. Montes, H., Hijón-Neira, R., Pérez-Marín, D., & Montes, S. (2021). Using an Online Serious Game to Teach Basic Programming Concepts and Facilitate Gameful Experiences for High School Students.
6. Boyle, E., Hailey, T., Connolly, T. M., & Gray, G. (2016). Gamification for learning: A systematic review of the literature.
7. Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study.
8. Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? A literature review of empirical studies on gamification.
9. Ramdas Vankdothu, Dr. Mohd Abdul Hameed, Husnah Fatima "A Brain Tumor Identification and Classification Using Deep Learning based on CNN-LSTM Method" *Computers and Electrical Engineering*, 101 (2022) 107960
10. Ramdas Vankdothu, Mohd Abdul Hameed "Adaptive features selection and EDNN based brain image recognition on the internet of medical things", *Computers and Electrical Engineering*, 103 (2022) 108338.
11. Ramdas Vankdothu, Mohd Abdul Hameed, Ayesha Ameen, Raheem, Unnisa "Brain image identification and classification on Internet of Medical Things in healthcare system using support value based deep neural network" *Computers and Electrical Engineering*, 102 (2022) 108196.
12. Ramdas Vankdothu, Mohd Abdul Hameed "Brain tumor segmentation of MR images using SVM and fuzzy classifier in machine learning" *Measurement: Sensors Journal*, Volume 24, 2022, 100440.
13. Ramdas Vankdothu, Mohd Abdul Hameed "Brain tumor MRI images identification and classification based on the recurrent convolutional neural network" *Measurement: Sensors Journal*, Volume 24, 2022, 100412.
14. Bhukya Madhu, M. Venu Gopala Chari, Ramdas Vankdothu, Arun Kumar Siliveri, Veerender Aerranagula "Intrusion detection models for IOT networks via deep learning approaches" *Measurement: Sensors Journal*, Volume 25, 2022, 100641

15. Mohd Thousif Ahemad ,Mohd Abdul Hameed, Ramdas Vankdothu” COVID-19 detection and classification for machine learning methods using human genomic data” Measurement: Sensors Journal,Volume 24, 2022, 100537
16. S. Rakesh <sup>a</sup>, NagaratnaP. Hegde <sup>b</sup>, M. VenuGopalachari <sup>c</sup>, D. Jayaram <sup>c</sup>, Bhukya Madhu <sup>d</sup>, MohdAbdul Hameed <sup>a</sup>, Ramdas Vankdothu <sup>e</sup>, L.K. Suresh Kumar “Moving object detection using modified GMM based background subtraction” Measurement: Sensors ,Journal,Volume 30, 2023, 100898
17. Ramdas Vankdothu,Dr.Mohd Abdul Hameed, Husnah Fatima “Efficient Detection of Brain Tumor Using Unsupervised Modified Deep Belief Network in Big Data” Journal of Adv Research in Dynamical & Control Systems, Vol. 12, 2020.
18. Ramdas Vankdothu,Dr.Mohd Abdul Hameed, Husnah Fatima “Internet of Medical Things of Brain Image Recognition Algorithm and High Performance Computing by Convolutional Neural Network” International Journal of Advanced Science and Technology, Vol. 29, No. 6, (2020), pp. 2875 – 2881
19. Ramdas Vankdothu,Dr.Mohd Abdul Hameed, Husnah Fatima “Convolutional Neural Network-Based Brain Image Recognition Algorithm And High-Performance Computing”, Journal Of Critical Reviews,Vol 7, Issue 08, 2020(Scopus Indexed)
20. Ramdas Vankdothu, Dr.Mohd Abdul Hameed “A Security Applicable with Deep Learning Algorithm for Big Data Analysis”,Test Engineering & Management Journal,January-February 2020
21. Ramdas Vankdothu, G. Shyama Chandra Prasad “ A Study on Privacy Applicable Deep Learning Schemes for Big Data” Complexity International Journal, Volume 23, Issue 2, July-August 2019
22. Ramdas Vankdothu, Dr.Mohd Abdul Hameed, Husnah Fatima “ Brain Image Recognition using Internet of Medical Things based Support Value based Adaptive Deep Neural Network” The International journal of analytical and experimental modal analysis, Volume XII, Issue IV, April/2020
23. Ramdas Vankdothu,Dr.Mohd Abdul Hameed, Husnah Fatima” Adaptive Features Selection and EDNN based Brain Image Recognition In Internet Of Medical Things “ Journal of Engineering Sciences, Vol 11,Issue 4 , April/ 2020(UGC Care Journal)
24. Ramdas Vankdothu, Dr.Mohd Abdul Hameed “ Implementation of a Privacy based Deep Learning Algorithm for Big Data Analytics”, Complexity International Journal , Volume 24, Issue 01, Jan 2020
25. Ramdas Vankdothu, G. Shyama Chandra Prasad” A Survey On Big Data Analytics: Challenges, Open Research Issues and Tools” International Journal For Innovative Engineering and Management Research,Vol 08 Issue08, Aug 2019

## **BIBLIOGRAPHY**



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