



Development of a Stylized, 3D Video Game to Teach Dhivehi Figurative Phrases

Liyaaz Yoosuf¹ and Mariyam Nadhira¹

¹*Department of Computer Science, Faculty of Engineering, Science and Technology, The Maldives National University, Maldives;*

**Corresponding: Liyaazy1@gmail.com;*

Abstract: This project attempts to address the issue of Dhivehi figurative phrases being lost as the younger generation barely knows any of them, with little effort being given to it by school. This is proven using primary research. This is done by developing an educational video game that shows scenarios where one of those figurative phrases are applicable. Secondary research was done to analyze existing educational games and it was found that they had some issues that needs addressing. Godot 4 was the game engine used for this project. Considering how Godot is designed to be worked with, a slightly customized methodology, Component-Based Scrum was used. Flowcharts were used to show the flow of the gameplay as well as interfaces. Finally, the implementation of the game, how the important parts were programmed, important interfaces' working was discussed. Finally, the game was tested for effectiveness, which showed a 13.89% increase on average on the students' marks. The results of the beta test showed that even though students liked what was given, there is more that they would like done with the game. The main complaint was the limited gameplay mechanics.

Keywords: Game Development; Educational Game; Language; Education

1. INTRODUCTION

Dhivehi figurative phrases, known as “Adhabeebas”, is a significant part of Maldivian language and culture. However, despite being part of the school curriculum for students of grades 8 to 10, less care is given to teaching them to students and the students struggle to learn and understand them. Current Dhivehi Secondary School Certificate (SSC) and Higher Secondary School Certificate (HSC) exams have a total of two marks when it comes to questions involving Dhivehi figurative phrases, which is what lead to a decline in attention to these figurative phrases. The purpose of this project is to develop a 3D, stylized video game designed to teach Dhivehi figurative phrases to students between ages 12 to 16. The primary objective of this project is to develop a prototype of the game with two levels, each with a different story that explains a Dhivehi figurative phrase. Characters and some assets for the game would be modelled, rigged and animated as needed using Blender 3D. Others were

Received: 16 June 2025

Accepted: 6 September 2025

Published: 30 November 2025



Copyright © 2025 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

obtained from Blenderkit. Background music and ambient noises would be included to make the game more appealing, obtained through Pixabay. A simple navigational structure would be made that allows the players to select desired profiles and levels and change certain game aspects such as music volume. Character voices would be included. This project would address the educational gap faced by these students through an interactive and engaging learning experience and would contribute to the effective teaching and preservation of Dhivehi figurative phrases for future generations.

2. LITERATURE REVIEW

2.1 Introduction

Figurative phrases are a significant part of any language. They are used to make literature more elegant and engaging. They also represent culture and history, as several figurative phrases refer to cultural activities or things used in the past. Dhivehi figurative phrases are divided into categories:

- Harubas: Figurative phrases that give advice or tell the person to do something.
- Misaalu: Similes.
- Misaalubas: Figurative phrases that compare a situation to a similar situation or event that has happened in the past.
- Majaazu: Metaphors.
- Majaazee Misaalu: These are metaphorical similes.
- Muskulhibas: Figurative phrases that do not give advice or tell the person to do something. These figurative phrases are about facts.

There are a few more as well [1].

According to Dhivehi teachers interviewed for the preliminary research of this project, very little attention has been given to teaching Dhivehi figurative phrases to students, as the current curriculum does not give enough importance to it. Students would have only a few lessons on learning the figurative phrases. However, even those are simply the figurative phrases with meanings and no further explanation. Furthermore, due to the less emphasis on Dhivehi figurative phrases, the students' interest in the figurative phrases has also dwindled. The figure below is from a survey conducted on school students of Maldives between grades 5-10, as part of the project's preliminary research. It can be seen that over 60% of students only know 5 or fewer figurative phrases.

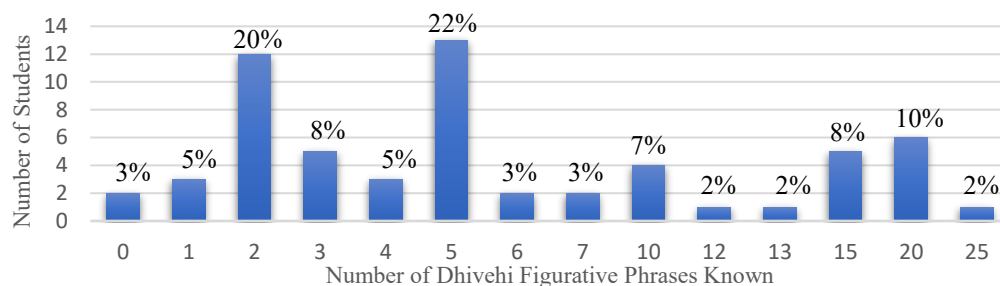


Figure 1. Number of Dhivehi Figurative phrases Known by Students

The purpose of this literature review is to gain insights through research of documentation, scientific papers, articles, academic journals and information from surveys and interviews, to determine user requirements, analyse and compare existing educational games.

2.2 User Requirements

To identify user requirements, preliminary research was done in two ways.

2.2.1 Survey – Students

A survey was conducted on school students through Google Forms. It was used to collect information on the students' knowledge of Dhivehi figurative phrases. The data comprised of data from 63 students from 15 different schools of Maldives.

2.2.2 Interview – Dhivehi teachers

Three Dhivehi teachers from three different schools were interviewed and asked about the current state of teaching Dhivehi figurative phrases as well as the students' attitude towards learning figurative phrases and their understanding of them. Figure 2 below shows how confident students are with their usage of Dhivehi figurative phrases.

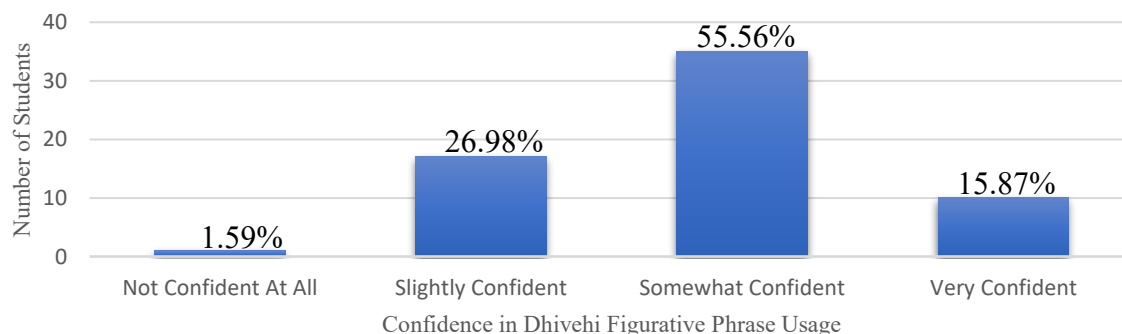


Figure 2. Confidence of Students in Their Usage of Dhivehi Figurative Phrases

As seen above, 84% of students are not very confident in their idiom usage. They do not know which figurative phrases exactly to use in which situations. According to Dhivehi teachers, in exams students only use figurative phrases in story writing and even those are a few students, because they are discouraged from using them in exams due to not knowing

which idiom to use in which scenario. Therefore, the game must try to improve the students' understanding of figurative phrases and their usage.

Secondary research was also done to determine further requirements for the users. This research showed that it is important that the game follows applicable educational game design principles to ensure its effectiveness. While the main elements of a game are mechanics, story, aesthetics and technology, educational games must have a learning objective element. The main goal of game design is to create an appealing experience. For this, certain game design principles must be upheld. [2]

- Balance of gameplay and learning – The game must not have too much of either. A proper balance could make the process of learning enjoyable and rewarding and can motivate lifelong learning. [2]
- Interactivity – The player must have meaningful interactions in the game. Each interaction must have a purpose to it and be related to the learning objective. The game environment must respond to the players' actions. This helps maintain high levels of engagement and improves the learning of students.
- Immersiveness – The player should experience the learning objectives while role-playing as this character of that world. Furthermore, multisensory immersion should be achieved through the use of sound effects, music, animations, videos, 2D and 3D graphics, character voices, and other media elements. This increases their focus on the game. Through immersion, the learning context would be enjoyable and motivative.
- Adaptive Problem Solving – The challenges or problems given to the players to overcome must be within the players' abilities and skills. A well-designed game would have skill-level adjustments to the challenges and create motivational tension by giving a suitable challenge as per the player's current skill.
- Feedback – Feedback is important for students to evaluate their current capability and areas needed for improvement. The feedback must be immediate, specific and connected to the goal being worked for. It could be corrective feedback to guide the player in case of failure. Providing feedback for progress makes the player feel committed to further achievements. Evaluative feedback is more effective at motivating the player by giving the player encouragement, hints or direction upon failure.
- Freedom of Exploration – Games being virtual worlds, carry no real-world consequences, and they should encourage the player to experiment and figure out a solution freely. They could explore, take risks, and learn from failures without the fear of a negative consequence. Freedom of exploration is also achieved by giving open-ended challenges. This encourages experimentation, creativity and critical thinking. [3]

2.3 Related Works

This section would compare the characteristics and effectiveness of some existing educational games.

- LearnMem1 is a game designed to teach students, aged 16-17, about the basics of computer memory concepts. It was developed in accordance to the Greek high school Computer Science curriculum. It was a maze game developed using Game Maker 6.0. It was designed such that as the students played the game, they would discover the learning material, and use it to think and answer the questions to earn points and ultimately complete the maze. A control group was using a website with quizzes to learn, which had the same learning materials as the game. [6]
- The Virtual Playground is a Virtual Reality (VR) game targeted to primary students of ages 8-12. The game involves completing a set of tasks designed to address arithmetical 'fractions' problems. It attempts to show the use of fractions in everyday life or familiar situations. The tasks require the player to modify the areas covered by different elements of a playground, such as swings, monkey bars, slide, roundabout, crawl tunnel, and sandpit. Each element covers an area that is initially incorrect and must be redesigned by the students using fractions calculations. The players are required to place blocks to construct an area for each element and upon correct construction, the blocks are replaced by the element. If the placements were wrong, then the players are asked to retry. There were two versions of the game, one where the player directly interacts with the world with a guide and only the rules provided, and the other where the player verbally commands a robot in the game to do the tasks. In the robot version, the player would direct and observe the robot doing the tasks and reflect on how and why it was done that way. The robot was essentially demonstrating the correct answer and provided a guided experience. [7]
- Littlefield Laboratories is a web-based simulation game developed to study its effectiveness in teaching operations management. It is designed to solve real-life business problems. The players' goal is to maximize cash balance by addressing problems in demand forecasting, capacity planning, inventory, lot sizing, reorder point determination, and sequencing. Students are required to diagnose problems, analyze provided information, and develop a plan of implementation. The game is about a blood-testing lab whose service compromise of 4 steps. The students work in teams for 7 days and operate the lab. This is 268 simulated days in the game. A group of students who did not use the game were used as a control group for comparison. [8]
- VR-ENGAGE is a VR game with an Intelligent Tutoring System (ITS), used to teach geography to students of ages 9-10. The players communicate with the game by typing in a dialogue box. The game's virtual agents, a dragon and an angel, communicate with the player through speech synthesis and text. The goal is to find the missing pages of a book of wisdom by navigating through the environment. The students answer geography questions asked by the dragon in order to pass through the doors the dragons are guarding. By answering the questions, the players gain points and must reach a pre-determined threshold to complete the game. A non-game ITS was also developed with the same educational content and tested to compare the effectiveness of the game to a normal educational software. Pre-tests and post-tests were used for this. [9]

2.3.1 Research Synthesis

Below is a research synthesis matrix using information from the above-mentioned games, from which a conclusion would be drawn about educational games.

Table 1. Research Synthesis Table

	LearnMem1 by [6]	The Virtual Playground [7]	Littlefield Laboratories [8]	VR-ENGAGE [9]
Game's Traits	2D Sound effects and background music, Easy to learn, Gives hints, Short – 2hrs, Low complexity, Simple plot, Taught about computer memory	3D – VR, Character voices, Sound effects, No plot – only objectives, Length unspecified, Taught about fraction concepts	Online, Collaborative gameplay, Simulation game with no indication of plot, Used for 7 days – actual length unknown, Taught about Real- life business problems	3D – VR, Character voices, Has an ITS, Gives hints, Low complexity, Simple plot, Taught about geography
Target Age Group	16-17	8-12	University students – age unspecified	9-10
Effectiveness in Educating	Students who played the game learned more than the control group. Similarly effective for both genders	Direct Interaction version – uncertain due to players using instincts to solve problems Robot version – learned through reflective thought	Effective for about half of the students – more competent, more motivated to study. Control group showed more competence, used deep-learning strategy more than the control group	Overall, very effective for all students and more effective than the control group's ITS More effective for teaching students of low and mediocre academic performance. Effective for teaching normally undisciplined students
Students' response	The game was appealing	Showed interest	Appealing to about half of the students	The game was appealing
Criticisms Received	Need more complexity. Need an adventurous plot. Need to change graphics to 3D	The direct interaction version's design was not good for conceptual learning	Requires social interaction but psychological barriers were not identified and addressed. Students need to have already learned quantitative analysis in order to play the game	Not enough guidance - Some students found it difficult to navigate the environment. Need to have the same quality as commercial games – need more complexity and adventure

It can be seen from the above research that to make a good educational game, the developers must be careful with its design. The game must reach the quality of the commercial games played by the students. This means they must have adequate content in terms of gameplay and story, and must have graphics of the current generation of games [6] [9]. The issue with gameplay complexity and story could be because of the current approach of design, where each game targeted one topic or subject. If the game included other topics or subjects, they would have more content for varied gameplay and a bigger plot. Developers should consider the students' technological and psychological barriers. A game requiring social interaction may be difficult for certain students leading to dissatisfaction [8], and lack of guides on how to play can negatively impact the experience of anyone unfamiliar with game controls [9]. Lastly, the design should not allow students to bypass the learning objective [7].

2.4 Hardware and Software Requirements

Hardware requirements for a game can vary based on the complexity of the game, the graphics used, and the desired level of performance. The main hardware components focused here are processor, memory, and graphics card. The overall best processors, considering price and performance, for gaming are Intel Core i5-13400 and AMD Ryzen 5 7600 according to [4]. This game should be able to run on systems with 8GB of RAM to cater to 96.98% of gamers as suggested by the Steam survey. Unfortunately, an exact GPU model could not be determined as they are very divided among the players. Therefore, considering VRAM (Video RAM) capacity, this game should be able to run on 6GB of VRAM, which, as per the Steam survey, would accommodate to 76.03% of gamers. [5]

According to the Steam survey of February 2024, the most popular operating systems used by gamers are Windows 10 64-bit and Windows 11 64-bit, both contributing to 96.15% of gamers. Therefore, the game should run on both Windows 11 and 10 to ensure that most gamers can play. [5]

2.5 Game Engine Used

For this project, Godot 4 was used. Godot 4 is a cross-platform open-source game engine released on March 2023 by Godot Foundation. It was chosen mainly because it is open-source, uses a simple programming language (GDScript) and is lightweight. [10] [11]

3. DESIGN

3.1 Story

Level 1: The story of level 1 is based on the Dhivehi figurative phrase “Kandhikamanaage mas thelulun”. It refers to the situation where a person makes others do the work and takes the credit if things go correctly, and blames the others if things go wrong. [12]

Level 2 : The story of level 2 is based on the Dhivehi figurative phrase “Narehhaa than dhookohliyya kenbehhaa than dhamaigannane”. It means that if you give someone a small favor or leniency, they might take advantage of it and take more than what was actually being offered. [12]

3.2 Level Flow

The flowchart below shows the flow of the game levels. This is a visual representation of how all levels progress and shows the conditions of winning and failure. As seen in the storyboard earlier, each phase of a level starts and ends with a cutscene. After the opening cutscene, the gameplay section continues until the timer runs out.

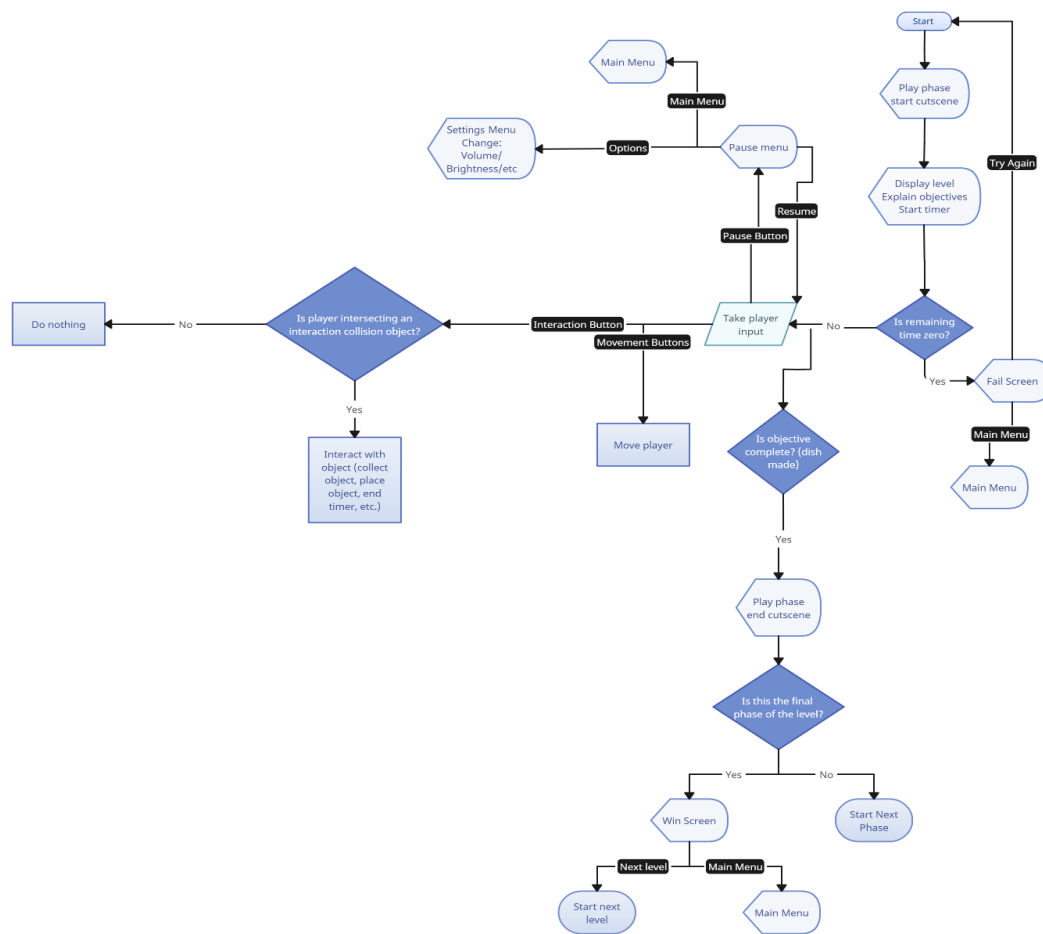


Figure 3. Level Flowchart

3.3 User Interface (UI) Design

User interface is designed to communicate information to the user and help them navigate the game. This section would discuss the UI design decisions made for the game's menus and gameplay screen. A good UI is important for user experience. [13]

3.3.1 Gameplay UI Design

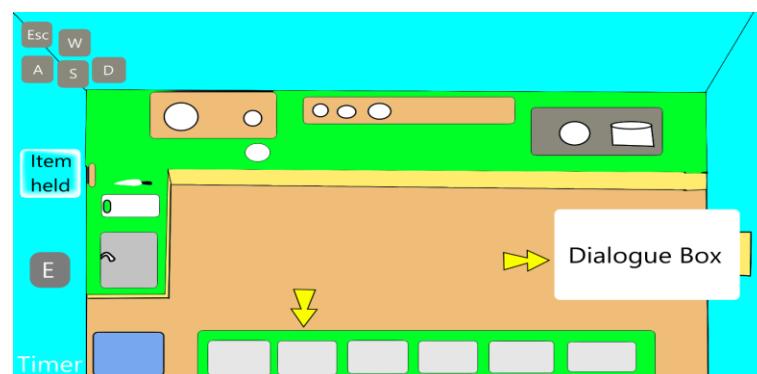


Figure 4. Gameplay UI Design

The above figure shows the UI design of the gameplay area as well as the game area itself. The design was made based on several aspects.

- The blue and green analogous color scheme is useful as it stimulates cheerfulness, which is more aligned with the casual gameplay of this game. [14]
- However, simply using analogous colors seemed a bit dull, and with that some yellowish and brownish colors were added, creating a split-complementary color scheme. [15]
- The responsive game controls are displayed on the upper-left corner of the screen which avoids the need for a tutorial. The 'E' button is for interaction and only becomes visible when the player is near an interactable object, indicating that it is the button for interaction.
- The dialogue box gives instructions on what to do.
- The yellow arrows are used to guide the player during the first interaction. It helps them connect the instructions to the gameplay.
- The "Item held" box is used to graphically indicate which item the player is holding. It serves as feedback for interactions along with the character animations.

3.3.2 Menu/Game Win/Game Over UI Design

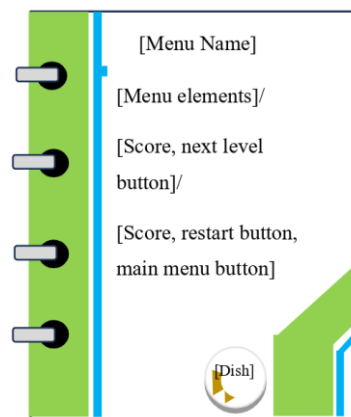


Figure 5. Menu/Game Win/Game Over UI Design

The design in Figure 7 is used for all menus.

- It maintains the restaurant theme of the game by resembling a menu book in a restaurant.
- The color choices were made based on menu references found online, which is an analogous color scheme. It also blends well with the wood textures found in the gameplay area. This way, when it appears it would not look out of place.
- The actions of these buttons can be seen in the level flowchart earlier as well as the menu flow chart below.

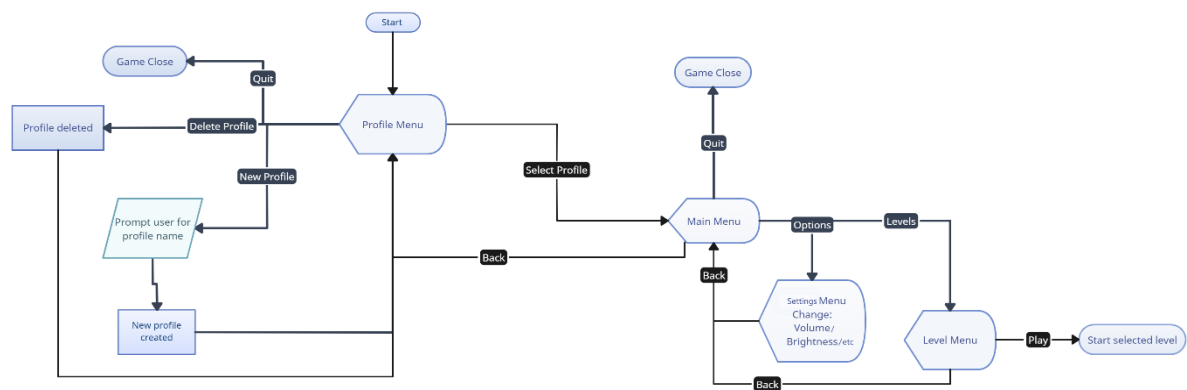


Figure 6. Menu Flowchart

4. TESTING

Testing of the project was done in two ways:

4.1 Quasi-Experimental Testing

Here students of grades 6 to 8, 2 from each participated in the testing. Students of grade 5, 9 and 10 were not there due to availability and time constraints, which is also the reason for the low number of total testers. Students S1 and S2 are from grade 6. Students S3 and S4 were from grade 7. Students S5 and S6 were from grade 8. First the students are given a quiz of 6 questions, where they would have to pick the most appropriate Dhivehi figurative phrase for the given scenario. Four options were given for each question. Then the students would play the game and redo the quiz. The questions determine two things. Four questions determine if the students can identify the situations where the learned figurative phrases apply, the remaining 2 determines whether the students can recognize scenarios where those learned figurative phrases are not appropriate. The multiple choice nature of this quiz is because it may be difficult for the students to memorize the exact figurative phrase after playing the game only once.

4.1.1 Effectiveness

The overall scores of the students are as follows.

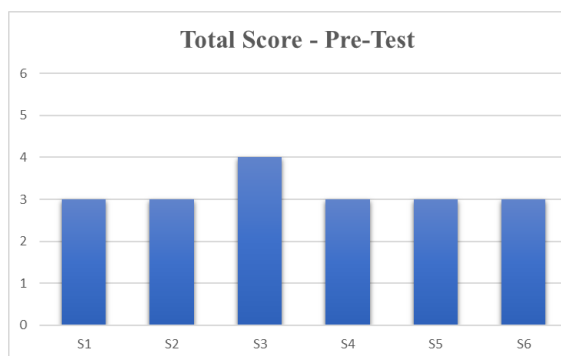


Figure 7. Graph - Total Score - Pre-Test

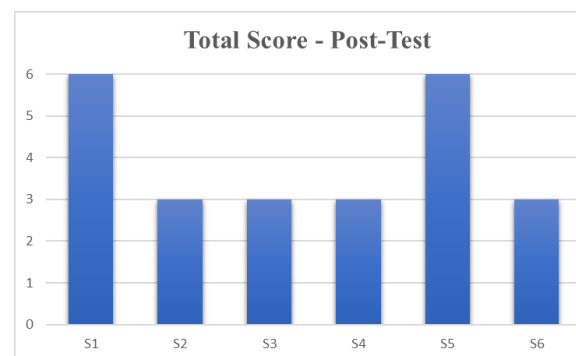


Figure 8. Graph - Total Score - Post-Test

The results shown in Figures 7 and 8 shows an overall improvement of 13.89% in the students' scores.

4.1.2 Discussion

The results of the two parts of the quasi-experimental test have shown an improvement by 16.67% for both parts, with an overall 13.89% improvement. While this suggests that the students are able to learn from the game, one students has decreased in scores. Furthermore, the multiple-choice nature of the quiz creates uncertainty in the results, that is to say, luck is a factor here that is unknown. Ultimately, the students' learning here greatly depends on how much attention they gave to the story content of the game rather than just the gameplay. It should also be noted that different students would have different learning capability.

The quasi-experimental testing was done on systems with Intel i7 8th gen processor, Nvidia GTX 1650 4GB graphics card and 16GB RAM. The game was able to run at about a 100 frames per second. Systems with the specifications mentioned in the requirements were not available due to resource constraints.

4.2 Beta Test

For beta testing, 17 players of ages 11 to 28 were given the game to play and their responses were collected using Microsoft Forms. This includes the students from the quasi-experimental test as well. As before, time constraints limited the available number of participants. The table below show the questions asked and the responses.

Table 2. Beta Test Results

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The Gameplay was Engaging and Fun	8	9	0	0	0
The Controls Were Easy to Use and Understand	12	4	1	0	0
The Game Objectives Were Clear and Understandable	12	4	1	0	0
The Graphics Were Visually Appealing (Looked Good)	9	7	1	0	0
The Sound and Music Enhanced the Gameplay Experience	7	4	6	0	0
I Enjoyed Playing the Game	9	7	1	0	0

Looking at the table above, it can be seen that the players had an overall positive experience with the game. With no responses going below neutral. However, there were certain things they wanted changed as seen in the suggestions list below. These suggestions have been summarized below.

Table 3: Suggestions to Improve the Game

Any suggestions to improve the game?

More and different Content

You could highlight the important words such as *ދަތުރު* and *ދަތުރު*

making it slightly harder where you can mess up the process with the wrong ingredients or order?

Certain UI elements could be made to be adjustable especially in the menus.

Introductory popup to give info about the hazards (water on the floor) on level 2 might've been nice.

Make the resolution higher.

player character needs to orientation to the task performing area when interacting

The walking distance between the counters can be decreased a bit.

5. CONCLUSION

This project attempts to develop an educational video game that shows scenarios where of Dhivehi figurative phrases are applicable. Existing educational games were analyzed using secondary research. Flowcharts were used to show the flow of the gameplay and interfaces. . Quasi-experimental testing showed a 13.89% overall average improvement on the students' marks. The results of the beta test showed that even though students liked what was given, there is more that they would like done with the game such as new gameplay mechanics. The testing would have been better if more testers were available. For future improvement, it should be considered to add more gameplay mechanics as well as more story to the game. Further testing could be done to determine the effectiveness based on gender and grade.

6. REFERENCE

- [1] A. Saadhiq, "Adhabee baeh bahuqe mahchah balailumeh," Faiythoora 268, vol. 23, no. 4, pp. 15-18, 1 July 2001.
- [2] K. Kiili, S. de Freitas, S. Arnab and T. Lainema, "The Design Principles for Flow Experience in Educational," *Procedia Computer Science*, vol. 15, pp. 78-91, 2012.
- [3] T. Kucher, "Principles and Best Practices of Designing Digital Game-Based Learning Environments," *International Journal of Technology in Education and Science*, vol. 5, no. 2, pp. 213-223, 2021.
- [4] P. Alcorn, "The Best CPU for Gaming in 2024," 6 February 2024. [Online]. Available: <https://www.tomshardware.com/reviews/best-cpus,3986.html#section-best-cpu-for-gaming-2024-200-to-250>.
- [5] Valve Corporation, "Steam Hardware & Software Survey: February 2024," February 2024. [Online]. Available: <https://web.archive.org/web/20240328235023/https://store.steampowered.com/hwsurvey/>.
- [6] M. Papastergiou, "Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation," *Computers & Education*, vol. 52, no. 1, pp. 1-12, January 2009.

- [7] M. Roussou, M. Oliver and M. Slater, "The virtual playground: An educational virtual reality environment for evaluating interactivity and conceptual learning," *Virtual Reality*, vol. 10, no. 3, pp. 227-240, January 2006.
- [8] T. N. Nguyen, "Motivational Effect of Web-Based Simulation Game in Teaching Operations Management," *Journal of Education and Training Studies*, vol. 3, no. 2, pp. 9-15, 26 January 2015.
- [9] M. Virvou, G. Katsionis and K. Manos, "Combining Software Games with Education: Evaluation of its Educational Effectiveness.," *Educational Technology & Society*, vol. 8, no. 2, pp. 54-65, April 2005.
- [10] A. Calvin and M. Dealessandri, "What is the best game engine: is Godot right for you?," 12 February 2024. [Online]. Available: <https://web.archive.org/web/20240407023311/https://www.gamesindustry.biz/what-is-the-best-game-engine-is-godot-right-for-you>.
- [11] M. Ranaweera and Q. H. Mahmoud, "Deep Reinforcement Learning with Godot Game Engine," *Electronics*, vol. 13, no. 5, p. 985, 5 March 2024.
- [12] Academy of Dhivehi Language, "Dhivehi Bahuge Radheef," 2024. [Online]. Available: <https://www.radheef.mv/app/>.
- [13] D. P. Kristiadi, Y. Udjaja, B. Supangat, R. Y. Prameswara, H. L. H. S. Warnars, Y. Heryadi and W. Kusakunniran, "The effect of UI, UX and GX on video games," in 2017 IEEE International Conference on Cybernetics and Computational Intelligence, Thailand, 2017.
- [14] N. Savavibool, "Effects of color schemes on aesthetic response of the work environment," *Kasetsart Journal of Social Sciences*, vol. 41, no. 3, pp. 581-586, December 2020.
- [15] M. Hartono, A. G. Santoso, C. L. Raya, B. Yulianto and Suwarno, "Audio Visual Media Components in Educational Game for Elementary Students," *ComTech Computer Mathematics and Engineering Applications*, vol. 7, no. 4, pp. 255-265, December 2016.