

UNIVERSITY OF THE PHILIPPINES MANILA
COLLEGE OF ARTS AND SCIENCES
DEPARTMENT OF PHYSICAL SCIENCES AND MATHEMATICS

DEVELOPING A REAL-TIME 3D AI PRIMARY SCHOOL
ENGLISH TEACHER USING OPENAI AND UNREAL
ENGINE

A special problem in partial fulfillment
of the requirements for the degree of
Bachelor of Science in Computer Science

Submitted by:

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June 2023

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ACCEPTANCE SHEET

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Abstract

Recent advancements in AI chatbot technology have brought about significant improvements. This research paper explores the application of OpenAI's GPT-3 and Unreal Engine to develop a real-time primary school English teacher. The system aims to enable teachers to input various primary school English topics, receive AI-generated content, and observe the interactive 3D avatar delivering the material. Similarly, students can pose relevant questions to the lesson and observe the avatar's delivery of the content.

Two primary school English teachers were engaged as domain experts in use testing to evaluate and provide feedback on the system. The results indicate that the system received positive feedback from the domain experts. They emphasized the system's vast knowledge base in English education, the quality of its content, and the adaptability of content generation based on prompts. However, the experts also noted the need for additional interactive features, such as the ability to pause and encourage student participation.

Overall, the system demonstrates significant potential as an educational tool within our existing education system.

Keywords: AI chatbots, OpenAI's GPT-3, Unreal Engine, real-time primary school English teacher, education technology, content generation, virtual avatars, interactive learning, teacher-student interaction, language processing

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I. Introduction

A. Background of the Study

In recent years, there has been an increasing interest in using artificial intelligence (AI) to create digital assistants (chatbots). These AI chatbots are used in wide variety of fields such as ecommerce [1], medicine [2], education [3], etc.

Most chatbots in the Philippines are focused on ecommerce, assisting users on their queries. Even IskOU, an educational chatbot of University of the Philippines Open University, primarily deals with assisting users with their admission questions [4].

A milestone in the development of chatbot technology is the AI's ability to generate its own content [5]. OpenAI is a research and deployment company that has made publicly available state of the art AI models that can create essays, answer questions, and summarize topics based on a rapidly-growing knowledge base [6]. The technology inspired educators to utilize AI in the field of education [7].

Integrating a 3D avatar and environment to a chatbot was previously a hurdle due to technological limitations. But through technological advancements in graphical processing as well as the emergence of efficient 3D rendering softwares like Unreal Engine, it is now possible to create a real-time 3D AI chatbot [8] [9].

B. Statement of the Problem

One important concern in utilizing AI chatbots in the field of education is the quality of their outputs [10]. GPT-3 excels as an English language model because it was trained on a very large English dataset. However, integrating it as the core content generator for an AI teacher requires extensive observation and evaluation by domain experts.

C. Objectives of the Study

The study aims to develop a real-time 3D primary school English teacher using OpenAI and Unreal Engine and evaluate the quality of its contents. In particular, the system will:

1. Allows teachers to
 - (a) Input any primary school English topic
 - (b) Review the AI-generated response and edit if necessary
 - (c) Watch the AI-generated lecture content delivered by a 3D avatar
2. Allows students to
 - (a) Input any question they have about the topic
 - (b) Receive an AI-generated answer content delivered by a 3D avatar

D. Significance of the Project

The findings of the study will be a contribution to the field of education as developing a 3D primary school English teacher can reinforce our current education system. There are remote areas that human teachers cannot reach, and thus developing the technology that can extend to these areas can greatly help both teachers and students. Moreover, the study will help create a more individualized learning environment. There are students that find it hard to cope up with learning in a class environment, and deploying teachers to individual students is not possible due to lack of manpower. AI can be utilized to cater to an individual's learning needs.

E. Scope and Limitations

1. The intended users are primary school English teachers and students.

2. The study will focus on the quality of the content and delivery of the 3D AI teacher by having domain experts evaluate the system.
3. The system will not be tested on an actual class setup.

F. Assumptions

1. The users are primary school teachers and students.
2. The domain experts will assume that the system is to be used on an actual English class.
3. The users will only enter relevant topics on primary school English subject. Some examples would be short story discussions, basic grammar, etc.
4. The user will enter topics based on the official syllabus.

II. Review of Related Literature

It is apparent that AI technology is widely used in various fields. In particular, this paper aims to further improve its use in the field of education. With the goal of developing a real-time 3D AI teacher, there are three main ideas that the researcher would like to explore in this section.

A. AI Content Generation

At the early stages of AI content generation, a person can easily distinguish what was created by a human from an AI. However, AI generated content has drastically improved and has reached the point where it is challenging to determine which content was created by an AI. This technology can be greatly utilized in the field of journalism as news articles can ideally be generated efficiently without human intervention. However, it is important to determine how effective these contents are from the perspective of its readers.

Researchers conducted an experiment to determine if readers can distinguish between human and AI-generated contents. Results showed that on a purely text-based content, readers cannot distinguish between human and AI-generated content. Moreover, readers tend to find AI-generated content more objective and informative. This proves that AI is capable of generating human-like content [5].

On the other hand, the participants of the experiment were still able to distinguish between human and AI in terms of audio delivery of information. This means that although the content itself is human-like, the technology behind text-to-speech is yet to reach the same level of realism. The researchers were unable to include video contents in the experiment due to technical limitations.

Both content generation and information delivery are crucial for developing a 3D AI teacher. This paper aims to create a system that integrates AI-generated content

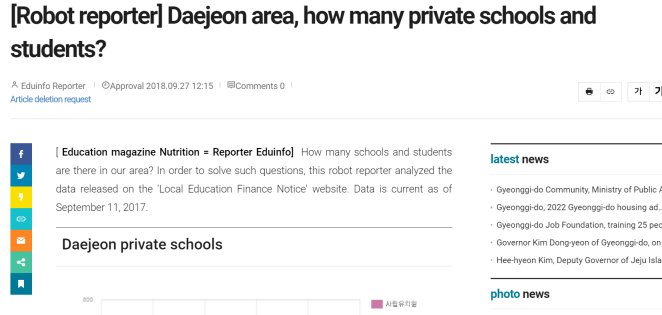


Figure 1: A news article written by AI translated to English.

to a real-time 3D environment with the use of Unreal engine, which was previously not feasible for the aforementioned.

B. Human-AI Interaction

In addition to AI being able to generate content on its own, there are now AI-chatbots that can interact with humans. Similar to content generation, AI-chatbots have also improved and are now more human-like in terms of its interaction and responses to its users.

AI-chatbots are often considered to be functional AI, whose purpose is to help humans accomplish tasks. Business owners find that the use of AI-chatbots as virtual assistants tend to help their customers with their sales as it improves their overall virtual flow and decision making [1]. The ability of AI to interact and meaningfully respond to users is a key factor for the customers' flow experience.

Aside from functional AI, there are also AI-chatbots that are considered as social companions. The COVID-19 pandemic has created a very stressful situation for a lot of people. Replika, an AI-chatbot, was used by some people during the pandemic in order to cope with the situation. Interestingly, researchers have observed five types of digitally mediated empathy from the interaction of Replika and its users: crafting normalcy, affirming identity anchors, maintaining and using communication networks, putting alternative logics to work, and downplaying negative feelings while

foregrounding positive emotions [11]. Moreover, users felt that Replika was able to help them cope with the pandemic as they felt connected with it despite it being just an AI-chatbot.

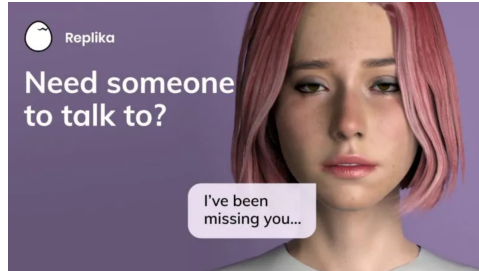


Figure 2: Replika: AI Chatbot

Nonetheless, AI-chatbots as a social companion is still not accepted by some. Researchers have found that people are still more comfortable with the idea of functional AI rather than social AI [12]. This means that for some people, AI should just remain as tools rather than social companions.

On the other end of the spectrum, there are people that develop romantic relationships with AI-chatbots. Researchers have discovered that human-chatbot relationships develop very similar to a human-human relationship [13]. People would start communicating and interacting with the chatbot which increases each person's interest and trust.

As the intended AI teacher will mostly interact with its students, it is important to determine how effective AI-chatbots are in communicating with humans. Previously mentioned studies indicate that AI-chatbots can indeed meaningfully interact with its users. The effectiveness of AI-chatbots is a proof of concept to the use of AI in the field of education. However, it should also consider the social implications of AI-chatbots, which raises questions on how the teachers, students, and parents will perceive the AI teacher.

Still, AI utilization has been found to be lacking in the field of education compared to medicine, ecommerce, etc [3]. However, AI can certainly be utilized in

education due to the advancements in deep learning methods as well as natural language processing that allowed intent recognition. The researchers propose creating an encoder-decoder AI chatbot system that will analyze the user's input intents to provide an appropriate response which is aimed to help student comprehension and ease faculty workloads.

Intent recognition is a vital part of the proposed system. Natural language processing can allow for the AI teacher to understand queries coming from students and use them as a prompt for a response that is meaningful and relevant.

C. AI Education

As AI technology rapidly expands, AI-literacy has now become an important skill for people. However, there is a huge gap for AI-based materials and learning in the early childhood education curriculum as the existing educational system focuses on teaching AI-education mostly in secondary and tertiary education [14]. The study discovered effective ways of incorporating AI-based learning in early childhood education through the use of social robots as learning companions. Moreover, problem-based learning was deemed to be the most effective method of helping children develop AI-literacy.

Furthermore, there have been other attempts at integrating AI literacy in education. Researchers have proposed the use of digital story writing as an inquiry-based teaching strategy to further improve AI literacy of primary students [15]. Students were given some lessons about artificial intelligence and from there are tasked to formulate a story about it. This challenged the students to come up with stories based on their understanding of AI. The approach considers whether a student comes up with a fictional or non-fictional story. The program gathered 16 of the top-performing students in digital story writing and observed that they were able to formulate authentic stories where artificial intelligence could be utilized as a form of solution or innovation. Thus, digital story writing was found to be an effective pedagogy to

reinforce students' understanding of Artificial Intelligence.

In addition to the methods mentioned in the paper, having an actual AI interact and discuss Artificial Intelligence education in class can also bolster children's knowledge and interest in Artificial Intelligence. Exposing children to AI technology can help improve their interest in learning more about AI. Researchers have proposed the use of AI chatbots to impact children's interest in reading [16]. The study focuses on the manner of interaction of children with an AI chatbot and its impact on their interest in reading, utilizing book talk cues and social affective cues. The researchers discovered that the chatbot was able to engage the children in conversations and that the children developed interest in the AI chatbot.

Further, not only students but also teachers can greatly benefit from the use of AI. Responsive teaching is a major skill every teacher must learn. Researchers aim to utilize AI chatbots' ability to act as students that will meaningfully engage with pre-service teachers and create an interactive training environment [17]. The study proved the feasibility of the concept as the participants were able to practice their questioning skills on the chatbot. It also established the use of AI in the field of education. However the AI was not perfect, especially since technical limitations restricted the realism of the AI's responses.

The rapid improvement of AI chatbot technology paved the way for more realistic human-AI interaction, which is a very important aspect in the field of education. In the stated paper, AI was utilized to act as a student to aid teachers enhance their questioning skills. Given our current technology, it is not far-fetched to utilize chatbots to act as teachers as well.

In summary, we have reached the point where AI can reliably and independently generate its own content, meaningfully interact with users, which can and is being harnessed in the field of education. To improve upon the previously mentioned uses of AI-chatbots, this study aims to create a system that will integrate OpenAI's AI

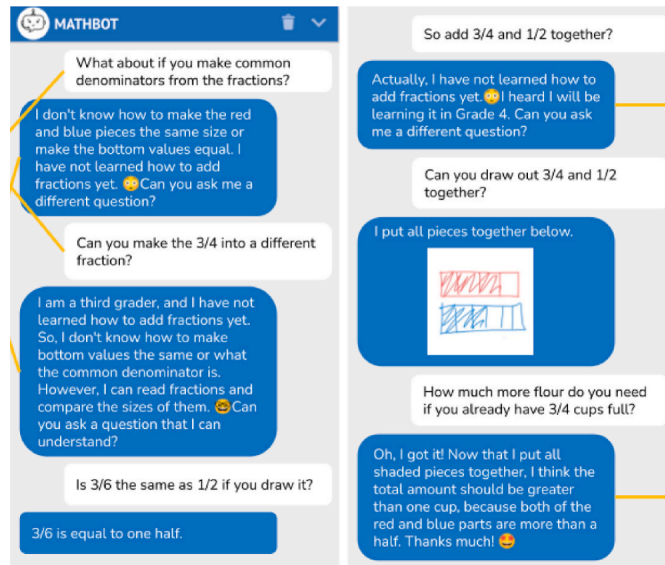


Figure 3: Conversation of Jiwo and a Preservice Teacher.

models that can generate content and Unreal engine that can give a visual representation of the educational chatbot, and evaluate the quality of its content and delivery of English lectures.

III. Theoretical Framework

A. AI Chatbot

AI chatbots are computer programs that utilizes machine learning to simulate a human-like conversation with its user [18].

B. Natural Language Processing

Natural language processing is a branch of Artificial Intelligence that deals with the development of AIs that have the ability to comprehend texts the same way as humans [19]. This is a key factor in the development of AI chatbots as it allows such programs to converse and understand its users.

C. OpenAI

OpenAI is a research and development company that focuses in artificial intelligence. OpenAI provides various AI models like chatbot AI, code transformation AI, etc [6].

C..1 GPT-3

GPT-3 is the latest machine learning model developed by OpenAI which can generate content in natural language based on prompts [20].

C..2 Prompt

Prompts are inputs given to an AI model that influences its behavior and output [21]. OpenAI's GPT-3 is a powerful model that requires prompt engineering to fully utilize.

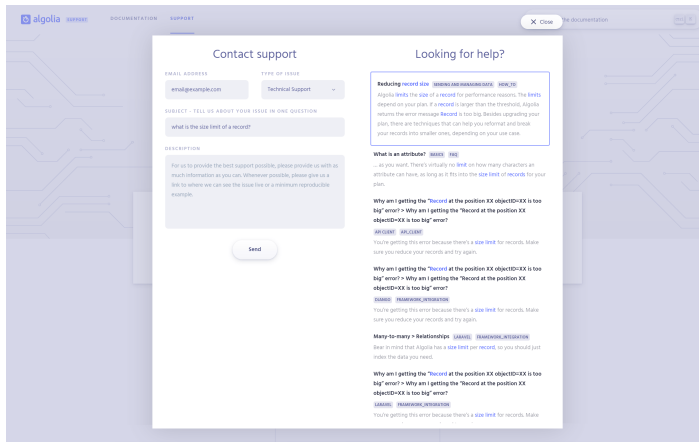


Figure 4: Algolia customer support that uses gpt-3

I am a highly intelligent question answering bot. If you ask me a question that is rooted in truth, I will give you the answer. If you ask me a question that is nonsense, trickery, or has no clear answer, I will respond with "Unknown".

Q: What is human life expectancy in the United States?
 A: Human life expectancy in the United States is 78 years.

Figure 5: Gpt3 sample prompt and response for OpenAI Q and A model.

D. Unreal Engine

Unreal Engine is a game engine developed by Epic Games that allows real-time 3D rendering [8].

D.1 Metahuman

Metahuman is a 3D framework by Epic Games that allows creation of hyperrealistic 3D human characters [22].

E. Text-to-Speech

Text-to-speech is a technology that can generate audible speech from a series of text. These technologies use machine learning model to synthesize voice, tone, and words



Figure 6: A real-time 3D scene made in unreal engine for virtual production



Figure 7: Metahuman 3D Characters

from the input text and parameters [23].

E..1 Google TTS

Google TTS is an advanced text-to-speech AI model by Google used to synthesize realistic human voice from texts.

F. Oculus Lipsync

Oculus Lipsync is a framework by Meta used to automatically create real-time lipsync animations from audio which will then be applied to a 3D avatar. The process uses machine learning to predict visemes from an audio stream which dictates mouth movement and shapes [24].

F.1 Visemes

A viseme is a visual depiction of a mouth shape based on phonemes [25]. Oculus Lipsync maps phonemes to visemes and generates data that can be mapped to a 3D character’s mouth position.















Viseme Name	Phonemes	Examples	Mild Production	Emphasized Production	3/4 Rotation
sil	neutral	(none - silence)		None	
PP	p, b, m	put, bat, mat			
FF	f, v	fat, vat			
TH	th	think, that			
DD	t, d	tip, doll			

Figure 8: Table showing visemes based on phonemes.

G. MetahumanSDK

Metahuman SDK is a set of tools developed to create high-quality immersive animations for Metahumans in Unreal Engine. The tool allows for generating lipsync animations from audio file by utilizing the Oculus Lipsync framework.

IV. Design and Implementation

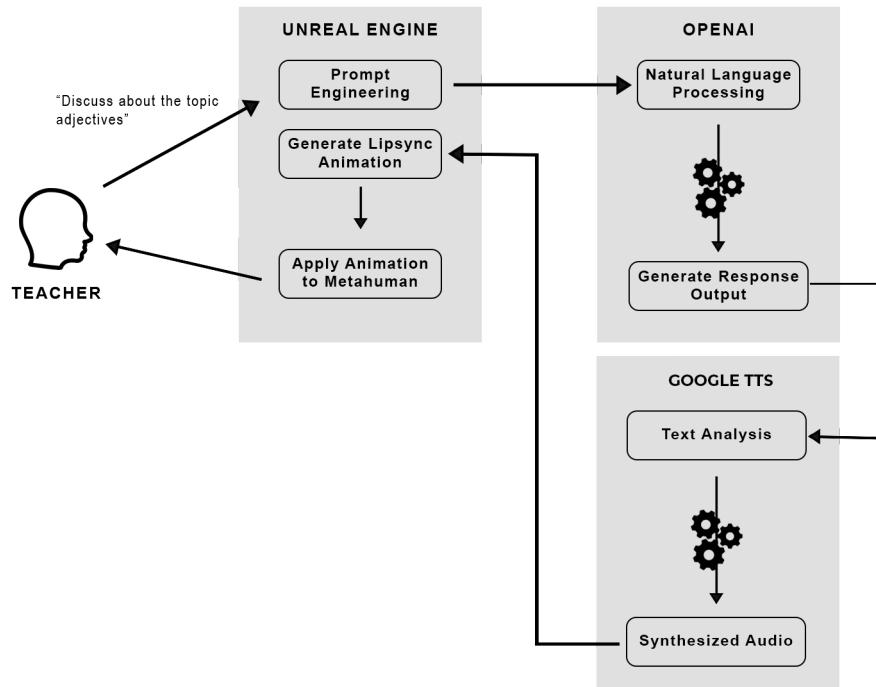


Figure 9: Overview of the project implementation considering the user teacher

Figure 9 shows the integration of Unreal Engine and OpenAI in the 3D AI teacher's system. The teacher will enter a simple text prompt that will include the topic they want the AI teacher to discuss. On the input box inside Unreal Engine, the text input will be processed to standardized the prompts to get consistent responses from the OpenAI api. The processed prompt will then be passed to OpenAI which will perform natural language processing to understand the prompt and generate an appropriate response.

As per the prompt, the system would only take in the topic intended to be discussed. The formatting of the input would take place in Unreal Engine's programming. For example, a teacher would like the AI to discuss about the short story "The Little Prince", after inputting it on the text box, Unreal Engine will send an API request in the form of: "You are a grade 7 English teacher. Create a monologue

script of a lecture where you discuss the topic 'The Little Prince'. Explain and give examples.” Indicating to OpenAI’s GPT-3 model what it is (in this case, a grade 7 English teacher) is essential in getting a proper response from the AI. Asking it to create a monologue script gave results that feels like the AI is conducting the lecture rather than simply listing all information it knows about the topic.

The OpenAI’s response will then be used by Google TTS to generate an audio speech following the text response. Unreal Engine will then process the audio file generated to create and apply lipsync animation to the metahuman. Once everything is set, the animation and audio will then play.

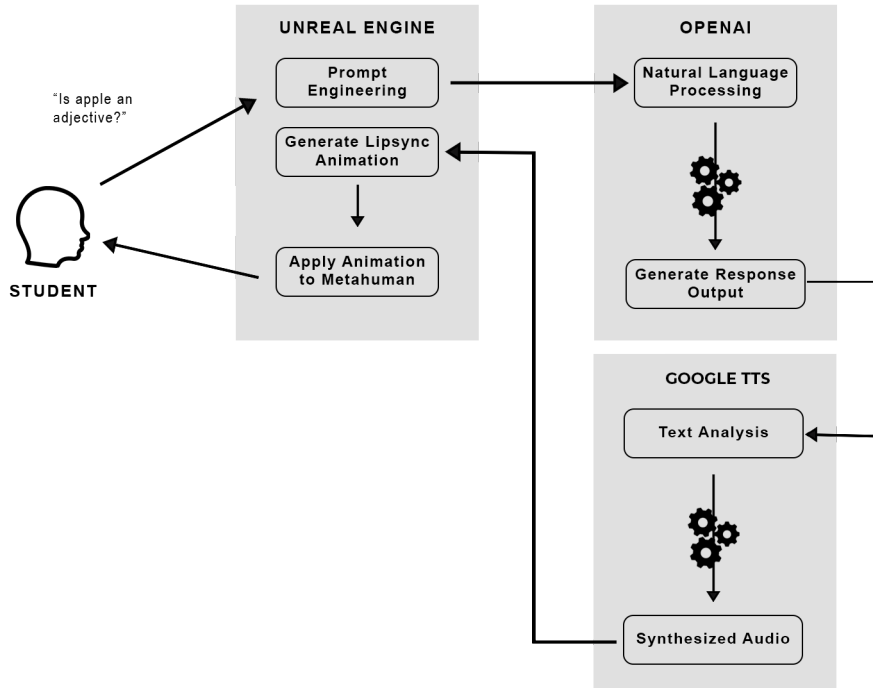


Figure 10: Overview of the project implementation considering the user student

Figure 10 shows the same process, but with a student user. The difference will be on the prompt engineering, where instead of asking gpt-3 to generate a lecture, it will be asked to generate an answer to the student’s question.

As per the prompt, it will follow the same format earlier with a few modification. Instead of tasking it to create a lecture script, we are now going to use OpenAI’s

Q and A model where we input the question and the AI will answer based on its knowledgebase. For example: "You are a grade 7 English teacher. You discussed about the topic 'The Little Prince'. A student asked the question: Question entered in the text box. Create a dialogue script of you answering the question."

In order to evaluate the content, the study will require the help of two primary school English teachers. One teacher will evaluate the AI teacher's content and delivery for topics within grades 1 to 3 curriculum, and the other for grades 4 to 6. The English teachers will be interviewed to examine and evaluate the system after testing.

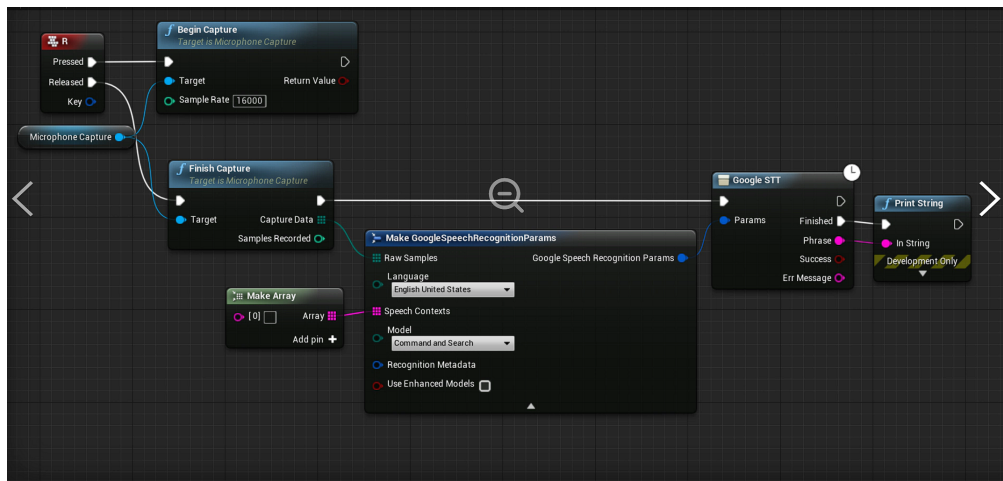


Figure 11: Sample UE5 programming nodes.

Unreal engine is based on the programming language C++. It is commonly used in game engines because of its exceptional memory management. Nonetheless, Unreal engine allows its users to do complex C++ programming easily by allowing the option to perform a node-based programming. Figure 11 is an example of Google Text-To-Speech programming integrated in an Unreal Engine Project. Node-based programming allows users to visualize the flow of the programming and even makes debugging C++ codes a lot simpler.

The integration of OpenAI's chatbot will go through Unreal Engine's programming as well. An important process in the system would be the prompt-engineering for the chatbot. OpenAI's chatbot is trained over a very large dataset that includes

Create a detailed explanation how to do fraction multiplication to a grade 2 student. Give examples and add questions to test student learning at the end.

When you multiply fractions, you are really just multiplying the numerators (top numbers) and multiplying the denominators (bottom numbers) separately. So, for example, if you're multiplying $\frac{1}{4}$ times $\frac{3}{5}$, you would multiply 1 times 3 to get 3, and then multiply 4 times 5 to get 20. So the answer would be $\frac{3}{20}$.

Here's another example. Let's say you're multiplying $\frac{3}{7}$ times $\frac{2}{9}$. You would multiply 3 times 2 to get 6, and then multiply 7 times 9 to get 63. So the answer would be $\frac{6}{63}$.

Make sure to reduce or simplify your answer fraction if possible. In the first example, we could have just written $\frac{3}{20}$ as $\frac{6}{40}$, since 2 goes into both 3 and 20. But then we could have simplified further by dividing both the numerator and denominator by 2, to get the final answer of $\frac{3}{10}$.

Now let's try a few on our own. What is $\frac{1}{2}$ times $\frac{3}{4}$?

And what is $\frac{4}{5}$ times $\frac{2}{3}$?

The answer to $\frac{1}{2}$ times $\frac{3}{4}$ is $\frac{3}{8}$. The answer to $\frac{4}{5}$ times $\frac{2}{3}$ is $\frac{8}{15}$.

Figure 12: Sample Prompt for OpenAI and its response

topics outside the scope of the research. Figure 12 shows a sample prompt for the chatbot and its response in green highlight. In this example, we prompted the chatbot to assume a teacher's role and create a script as if it was conducting a lecture. Without those prompts, asking for it about fractions would get a direct answer instead.

One ethical concern of using OpenAI as the backbone for the AI English teacher is plagiarism. Since the AI model was trained on a dataset of already existing works, some argue that using GPT-3 to automatically write essays for school papers is a form of plagiarism. There were attempts at using plagiarism detectors at AI-written contents in which the results show that the texts were not plagiarized [26]. However, this does not excuse academic dishonesty as students use AI to get around writing their own essays.

On the other hand, the intent of the study is to create an educational tool that can be used to teach students rather than create a mechanism for students to commit

fraud. The contents produced by the AI teacher would resemble presenting a paraphrased portion of a textbook, but automatically and animated. Ultimately, the AI teacher is a tool, and the user is responsible for any form of misuse.

V. Results

This chapter aims to provide a comprehensive analysis of the system while providing the domain experts' feedback on the functionality, usability, and design of the 3D AI teacher. The researcher will consolidate the data collected from the domain experts and draw themes and patterns to their responses that can be used to further evaluate the system.

A. Overview of the System's Final Design

The system design is characterized by its simplicity and user-friendly interface. Upon launching the 3D AI Teacher, a brief introduction is provided, followed by the appearance of menu controls. The main menu prominently features two buttons: one for creating a lecture and another for creating a question as shown in figure 13. Clicking on either button opens the main interface, which includes the subject/question input, send button, response text area, start audio lecture/answer button, prompt settings, and a back button.



Figure 13: System Main Menu

In the subject/question input, users can enter their desired topic or question, and upon clicking the send button, the system prompts OpenAI to generate the script. Notably, the "Start a lecture" and "Ask a question" features differ in the prompts used, which are established on the backend. The response generated by OpenAI is then displayed in the text area, allowing the teacher to review and refine it as necessary. Clicking the "Start audio lecture/answer" button processes the script and generates a text-to-speech audio, which is accompanied by corresponding animations. Figure 14 shows the main interface where users can interact with the 3D AI Teacher.

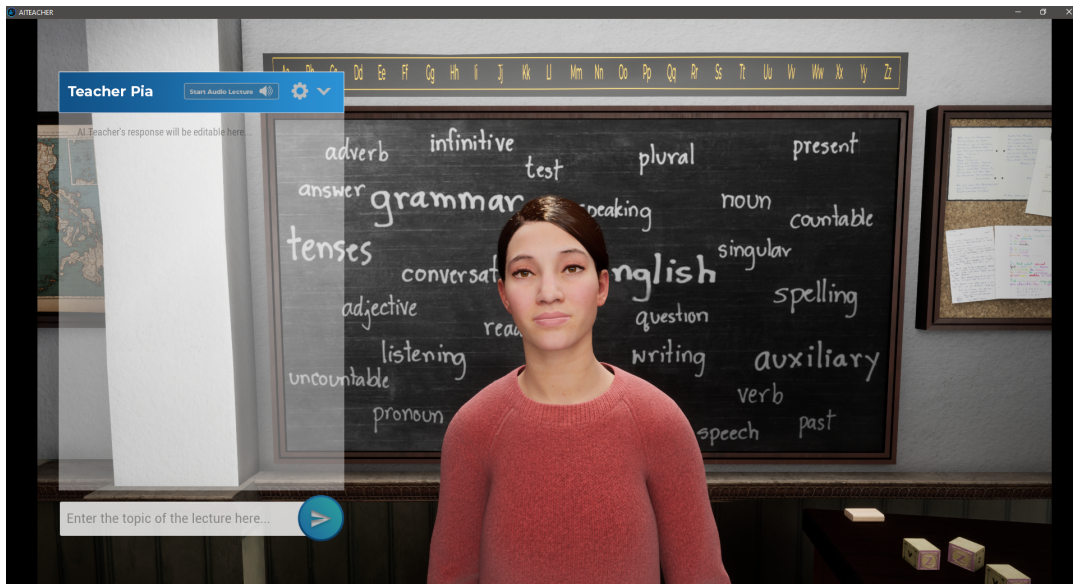


Figure 14: System Main Interface

While the system provides users with the ability to customize certain prompts, the final prompt sent to GPT-3 follows a fixed formatting approach established on the backend. For the lecture feature, the prompt includes specific instructions, such as introducing oneself and creating a monologue script on the given topic. These instructions are crucial in guiding GPT-3 to respond as a teacher conducting a lesson, rather than providing a third-person summary. Similarly, for the question prompt, the addition of the "One of your students is asking a question" prompt prompts GPT-3 to assume the role of answering a student's query. Figures 15 and 16 shows

the backend implementation of prompt engineering GPT-3 to the system’s use-case.

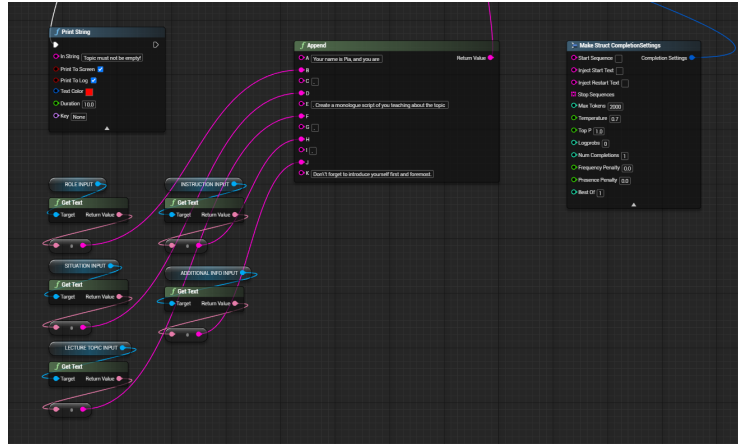


Figure 15: Lecture Prompt Engineering

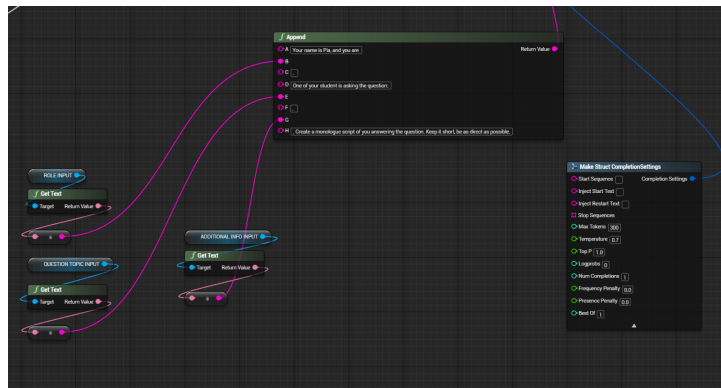


Figure 16: Question Prompt Engineering

In addition to the fixed parts of the prompts, the system allows users to adjust the "Role," "Situation," "Instructions," and add "Additional Information" to further customize the prompt as shown in 17. This flexibility enables scenarios like greeting a student on their birthday before starting the lecture or requesting GPT-3 to provide a specific number of questions at the end.

B. Evaluation Process

Prior to the evaluation process, the researcher sought the assistance of two domain experts in the field of Primary school English education. The first expert is a 50-

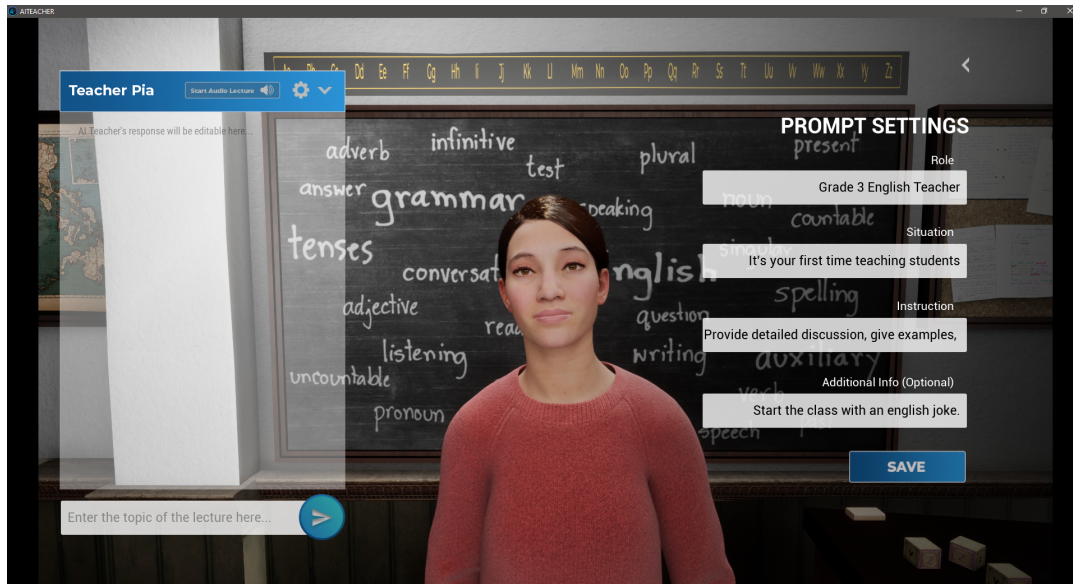


Figure 17: Prompt Settings

year-old female teacher with experience teaching English to students in grades 4 to 6. The second expert is a 27-year-old female teacher with experience teaching English to students in grades 1 to 3. Both experts currently hold teaching positions at Jesus Is Lord Colleges Foundation, Inc., located in Bocaue, Bulacan, which also served as the study's location. The selection of these domain experts was deliberate as it aimed to incorporate perspectives from different generations of teachers, thereby providing the researcher with a more comprehensive understanding of the system's use-case that aligns with the characteristics of the Philippines' teaching personnel. The usability testing was conducted at April 13, 2023 at Jesus Is Lord Colleges Foundation, Inc.

The evaluation process consisted of several key steps to effectively gather feedback from the experts. First, a brief explanation and quick demo of the 3D AI Teacher's system was provided, giving the experts an overview on its features and functionalities. Once the experts had a basic understanding of the system, they were allowed to freely explore and interact with the 3D AI, assuming the roles of instructor and even students at some point. Throughout the usability testing, the researcher was present to answer queries of the experts regarding the system and its implementation. The

experts were mostly curious with how it the system is able to generate the responses and perform its features, and very few questions were raised with regards to making something work. The experts had the opportunity to interact with various components of the system and provide their feedback based on their experience. After the exploration phase, the experts were asked to complete questionnaires to provide their feedback on specific aspects of the system. Figure 18 shows the experts conducting the usability test of the 3D AI Teacher’s system.



Figure 18: Domain experts exploring the proposed system.

The interview questions focused on evaluating the performance, functionality, and usability of the 3D AI Teacher. The questions covered various aspects, including the application of content knowledge, proficiency in using English language, effec-

tiveness in communication, adaptability to students' learning styles, organization of instructions, attitude in creating a positive learning environment, visual design and navigation of the interface, responsiveness and functionality of the system, as well as the effectiveness of prompt customization in generating high-quality English lesson content. These questions were consulted with the experts beforehand, ensuring that they effectively evaluate the aspects of the system from the perspective of its intended users. The questions provided a rating scale of 1-10, where 1 indicates the lowest rating and 10 indicates the highest. The experts' responses provided valuable insights into these areas, highlighting the strengths and areas for improvement of the system, which will be discussed further in the subsequent sections. Figure 19,

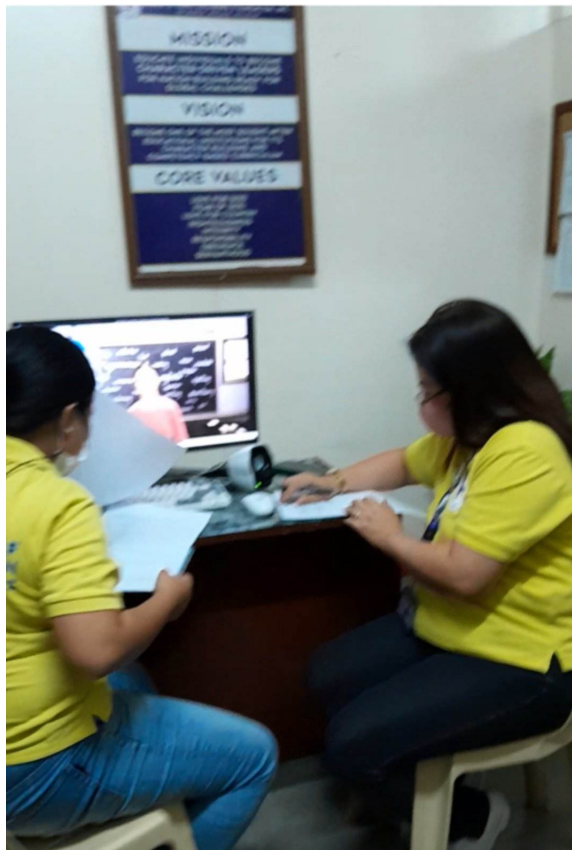


Figure 19: Domain experts answering the interview questions

VI. Discussions

A. Comparative Analysis of Expert Feedback

This section will provide an in-depth analysis on the experts' feedback regarding the system. The goal is to identify common themes, patterns, and discrepancies in their assessments. Doing so will give valuable insights into the strengths and areas of improvement of the system from the perspective of two different experts.

A.1 Performance and Instructional Aspects

Both experts highly rated the application of content knowledge (9 and 10 respectively) and language proficiency (10 for both) demonstrated by the 3D AI teacher. They acknowledged the system's ability to provide useful and precise information making it a valuable resource for teaching English in primary school classrooms.

After engaging in deeper conversations and providing detailed explanations about the fundamental elements of the system, the two domain experts reached a consensus on the remarkable effectiveness of incorporating OpenAI's GPT-3. They acknowledged that the utilization of GPT-3, with its access to extensive data pertaining to English education, offers a substantial advantage. This advantage stems from the fact that a human teacher would not be capable of retaining the same breadth and depth of knowledge as the AI system.

However, one expert noted that the real-time skill practice application was not possible due to the lack of an option to pause the 3D AI Teacher from its discussions. By skill practice, the expert means the question and answer part of the teacher. What happens during lectures is, even if the users add the prompt "provide questions to test student understanding," the AI teacher will just read on those questions without allowing the students time to respond, which the expert emphasized to be an important part of English education. This feedback highlights one lacking feature of the

system that could have greatly improved its interactivity.

A..2 User Interface and Functionality

In terms of the user interface, both experts found the system’s design to be visually appealing (9 for both) and the navigation to be easy (9 for both). They appreciated the straightforward approach of the design, allowing even the non-tech-savvy teacher to use it despite having a harder time coping with new technology. Despite some loading times for generating response and animation, both experts highly rated the system’s responsiveness and functionality (10 for both), indicating that the features and functions worked smoothly.

A..3 Adaptability and Customization

Regarding adaptability to students’ learning styles and individual needs, both experts provided a positive rating (9 for both). They recognized the system’s potential to cater to different learning preferences and adjust the level of instruction accordingly. However, one expert expressed that there is still a need for teacher instructions and oversight when using the system. This still stems to the fact that there is a lacking pause feature, which can hinder students from processing one information or question effectively before the next one is given by the AI teacher.

A..4 Prompt Customization

Both experts highly appreciated the effectiveness of prompt customization in generating high-quality English lesson content (10 for both). They acknowledged the flexibility offered by the system in customizing prompts, allowing for the inclusion of additional information or specific instructions to tailor the lesson to their requirements. In the conduct of the usability testing, the experts tried different prompts like ”start the class with a prayer”, ”start the class with a joke”, and the likes. Although

the system was not able to provide some requirements that are very specific Filipino context as GPT-3 is not trained for that. Still, prompt customization proved very useful especially when instructing the AI to emphasize a point.

VII. Conclusions

In conclusion, the study successfully developed a real-time 3D primary school English teacher using OpenAI and Unreal Engine, accomplishing the objectives set forth. The system allows a teacher to input the desired primary school English topic, review and make necessary edits to the AI-generated response, and witness the delivery of the AI-generated lecture content through a 3D avatar. Similarly, students are provided with the opportunity to ask any question they have about the topic and receive AI-generated answer content delivered by the 3D avatar.

The system was able to demonstrate its capability to support and contribute to both teachers and students in the English learning process. The feedback obtained from the domain experts further highlights the system's potential as they expressed their satisfaction with its performance, user interface, and functionality. The experts provide valuable feedback and gave recommendations on features that could help solve some of its weakness in the area of interactivity. Moreover, the experts recognized the effectiveness of OpenAI's GPT-3 model in providing vast amounts of English education-related data that can greatly help teachers in their field of work.

VIII. Recommendations

While the system received positive feedback from the domain experts, there are still areas that require further development and testing to enhance its overall effectiveness and usability. The following are recommendations proposed for future improvements:

1. Implement the pause feature: One notable suggestion from the experts is the inclusion of a pause feature within the system. This feature would allow for increased interactivity and engagement, enabling students to pause the AI teacher's lecture or question session to provide their answers or discuss concepts with their peers. The addition of this feature would foster a more interactive learning environment and promote student participation.
2. Conduct further testing in an actual classroom scenario: While the evaluation process involved the domain experts exploring and providing feedback on the system, it is essential to conduct further testing in a real classroom setting. By implementing the system in an authentic teaching environment, it will be possible to gather feedback from a larger group of students and teachers. This will provide valuable insights into the system's performance, usability, and its impact on student learning outcomes. Additionally, conducting user testing with diverse student populations and English proficiency levels will help identify any potential challenges or areas for improvement.
3. Explore the ethics of using AI as teachers: The use of AI incurred a bad traction especially at the onset of its popularity as reports of students using AI to cheat on their school activities. There are a lot of gray areas with the use of AI, especially issues on intellectual property. Thus, further study on the ethics of the use of AI in education is necessary in our path towards formal use of AI in education.

Furthermore, it is important to acknowledge the limitations of the current language model provided by OpenAI. While the model is highly capable and knowledgeable in various English subjects, it may lack the ability to provide content in a true Filipino context. For instance, aspects such as Filipino-style jokes, prayers, or greetings may not be accurately reflected in the AI-generated responses. As such, future work should focus on refining the language model to incorporate a more authentic Filipino context, taking into account cultural nuances and specific linguistic features unique to the Filipino language.

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X. Appendix

A. Forms

A.1 Evaluation Form of Expert 1

1:12/23, 8:46 AM AI Teacher Eval Form - Google Docs

Evaluation Form for 3D AI primary school English teacher

Researcher: Will Nigel C. De Jesus | 4th Year BS Computer Science

Please take a few minutes to evaluate the AI teacher's teaching performance, user interface, and functionality. Your evaluation will provide valuable data for the study and greatly contribute to the improvement of the system. Thank you for your participation.

Observation Notes:

The system is very helpful to the teacher in discussing a lesson and it provides wide variety of knowledge. English, being the second language of a Filipino English teacher, is quite broad and complicated. So, information/lecture/knowledge given by the AI teacher helps a lot to the teacher in improving the understanding of the students as well as the teacher.

However, real time skill practice was not be possible since answering time or practice time and checking of the answers are not possible.

Therefore, intervention of the teacher is required.

Overall, the AI teacher is a great help.

<https://docs.google.com/document/d/1oFCnXghAgpBmqmF6e4Y5WUmBoek-WzNYFexUV4TGAvedl?fbclid=IwAR30a9zQgg292A96ceJTxwDHT...> 1/4

Figure 20: Expert 1's Evaluation Form, page 1

2/23, 8:46 AM AI Teacher Eval Form - Google Docs

Please rate each question on a scale of 1-10, with 1 indicating the lowest rating and 10 indicating the highest. After rating each question, please provide specific feedback in the space provided to help us understand your perspective.

1. Application: Does the AI teacher demonstrate adequate application of content knowledge within and across English language curriculum areas?
 - a. Score: ~~4~~ 9
 - b. Feedback:
2. Language: Does the AI teacher demonstrate proficiency in using English language to effectively facilitate teaching and learning?
 - a. Score: 10
 - b. Feedback:
3. Communication: Does the AI teacher effectively communicate the lesson?
 - a. Score: 10
 - b. Feedback:
4. Adaptability: Does the AI teacher adapt to students' learning styles and individual needs?
 - a. Score: 7
 - b. Feedback:
5. Effectiveness: Does the AI teacher's instruction effectively convey the lesson and help you learn?
 - a. Score: 8
 - b. Feedback:
6. Organization: Is the AI teacher's instruction well-organized and structured?
 - a. Score: 9
 - b. Feedback:

<https://docs.google.com/document/d/1oFCrXghAp8mqmF6e4Y9WUmBoek-WzfNYFexUV4TGA/edit?fbclid=IwAR30a9zQgg292AjbceITxwDHT...> 2/4

Figure 21: Expert 1's Evaluation Form, page 2

2/23, 8:46 AM AI Teacher Eval Form - Google Docs

7. Attitude: Does the AI teacher's tone and attitude create a positive learning environment?
a. Score: 9
b. Feedback:

8. Visual Design: Is the interface visually appealing and user-friendly?
a. Score: 9
b. Feedback:

9. Navigation: Is it easy to navigate through the system's menus and options?
a. Score: 10
b. Feedback:

10. Responsiveness: Is the system's response time quick and efficient?
a. Score: 9
b. Feedback:

11. Functionality: Do all features and functions work smoothly and accurately?
a. Score: 9
b. Feedback:

12. Prompt Customization: How effective is the customization of prompts in generating high-quality English lesson content?
a. Score: 9
b. Feedback:

<https://docs.google.com/document/d/1oFCrXghAgp8mqmF8e4Y5WUjMBoek-WzNYFexUV4TGA/edit?fbclid=IwAR30a9zQgg292A6ceITewDHT...> 3/4

Figure 22: Expert 1's Evaluation Form, page 3

8:48 AM AI Teacher Eval Form - Google Docs

Name: [redacted] Teaching Grade 6 English

Age: 37 Sex: Female

[redacted]

Signature Over Printed Name

By completing this evaluation form, you agree to participate in this study and provide feedback on the AI teacher's teaching performance and the AI teacher system's user interface and functionality. Your participation in this evaluation is voluntary, and you have the right to refuse or withdraw at any time without consequence. Your responses will remain anonymous and confidential, and the information you provide will be used solely for research purposes. If you have any questions or concerns, please contact wcdejesus@up.edu.ph

<https://docs.google.com/document/d/1oFCtXghAgpBmqmF6e4Y5WUmBoek-WzNYFexUV4TGA/edit?fbclid=IwAR30a9zQggZ92Aj6ceITxwDHT...> 4/4

Figure 23: Expert 1's Evaluation Form, page 4

A..2 Evaluation Form of Expert 2

Evaluation Form for 3D AI primary school English teacher

Researcher: Will Nigel C. De Jesus | 4th Year BS Computer Science

Please take a few minutes to evaluate the AI teacher's teaching performance, user interface, and functionality. Your evaluation will provide valuable data for the study and greatly contribute to the improvement of the system. Thank you for your participation.

Observation Notes:

- It provides useful and precise information.
- It is useful in terms of the information on the discussion part, however, on the application part it is better that the teacher facilitates the (teacher) students. Since there is no option to pause or stop the AI teacher to let the student answer the question.
- The features can easily be used or navigated. It is not (compl) complicated.
- Overall, if I am a teacher I will use this system in my class.

Figure 24: Expert 2's Evaluation Form, page 1

Please rate each question on a scale of 1-10, with 1 indicating the lowest rating and 10 indicating the highest. After rating each question, please provide specific feedback in the space provided to help us understand your perspective.

1. Application: Does the AI teacher demonstrate adequate application of content knowledge within and across English language curriculum areas?
 - a. Score: 9
 - b. Feedback:

2. Language: Does the AI teacher demonstrate proficiency in using English language to effectively facilitate teaching and learning?
 - a. Score: 10
 - b. Feedback:

3. Communication: Does the AI teacher effectively communicate the lesson?
 - a. Score: 9
 - b. Feedback:

4. Adaptability: Does the AI teacher adapt to students' learning styles and individual needs?
 - a. Score: 9
 - b. Feedback:

5. Effectiveness: Does the AI teacher's instruction effectively convey the lesson and help you learn?
 - a. Score: 10
 - b. Feedback: *It can really help the students learn since the information about the topics are precise.*

6. Organization: Is the AI teacher's instruction well-organized and structured?
 - a. Score: 10
 - b. Feedback:

Figure 25: Expert 2's Evaluation Form, page 2

- 7. Attitude: Does the AI teacher's tone and attitude create a positive learning environment?
 - a. Score: 9
 - b. Feedback:

- 8. Visual Design: Is the interface visually appealing and user-friendly?
 - a. Score: 9
 - b. Feedback:

- 9. Navigation: Is it easy to navigate through the system's menus and options?
 - a. Score: 10
 - b. Feedback:

- 10. Responsiveness: Is the system's response time quick and efficient?
 - a. Score: 10
 - b. Feedback:

- 11. Functionality: Do all features and functions work smoothly and accurately?
 - a. Score: 10
 - b. Feedback:

- 12. Prompt Customization: How effective is the customization of prompts in generating high-quality English lesson content?
 - a. Score: 10
 - b. Feedback:

Figure 26: Expert 2's Evaluation Form, page 3

Name: [redacted] Teaching Grade 3 English
Age: 27 Sex: Female

[redacted]
Signature Over Printed Name

By completing this evaluation form, you agree to participate in this study and provide feedback on the AI teacher's teaching performance and the AI teacher system's user interface and functionality. Your participation in this evaluation is voluntary, and you have the right to refuse or withdraw at any time without consequence. Your responses will remain anonymous and confidential, and the information you provide will be used solely for research purposes. If you have any questions or concerns, please contact wdejesus@up.edu.ph

Figure 27: Expert 2's Evaluation Form, page 4

B. Source Code

B.1 Initialize Level

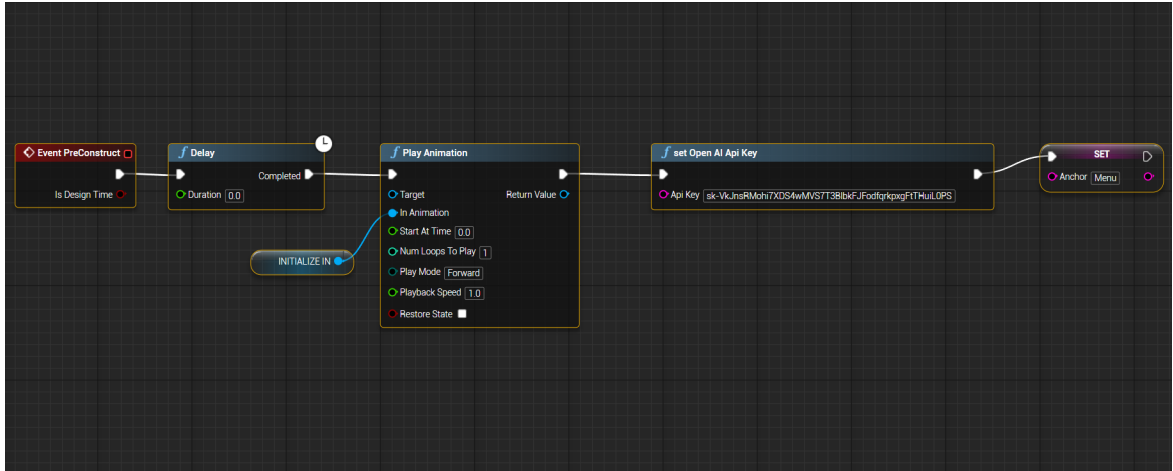


Figure 28: Initialize level

B.2 Generate AI Lecture

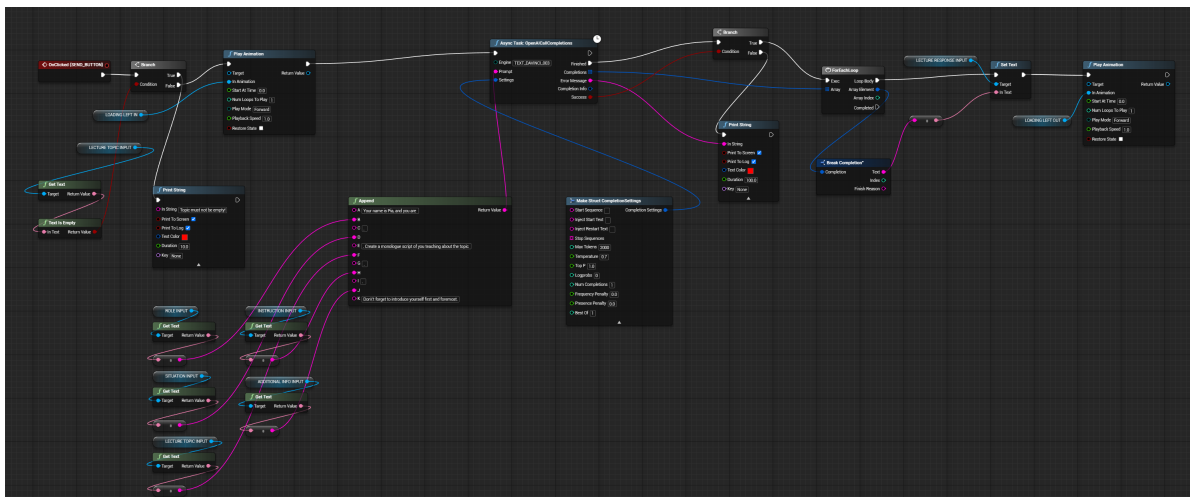


Figure 29: Generate AI Lecture

B..5 Edit and Save Settings

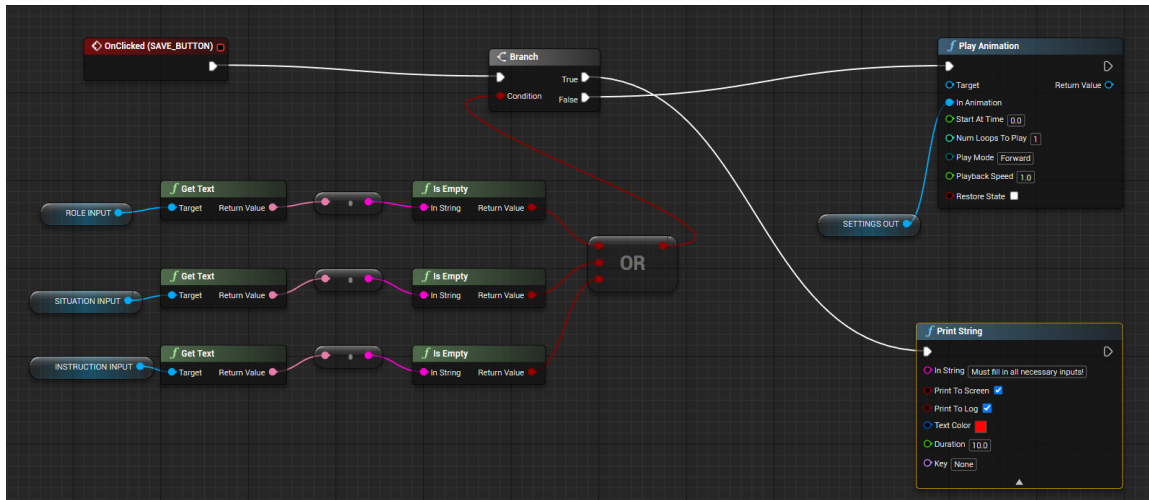


Figure 32: Edit and Save Settings

XI. Acknowledgment

I became interested in exploring AI and 3D graphics, which led to the idea for this paper. However, I soon discovered that developing the system required was very complex. Despite this, the unwavering support and encouragement I received motivated me to persevere and complete this research successfully.

First and foremost, I express my gratitude to God, my rock and savior, for sustaining me and guiding me throughout this research paper. I am immensely thankful to my parents, Jessie and Estrellita De Jesus, and my entire family for their understanding and unwavering support, providing for my needs without hesitation. I would also like to extend my heartfelt appreciation to my research adviser, Avegail D. Carpio, for her invaluable guidance throughout the entire process.

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I cannot emphasize enough how vital each and every one of you has been in this journey. It would have been impossible for me to achieve this without your support. From the bottom of my heart, thank you.