ChatGPT & RPG Game: A New Option for Student to Study with Artificial Intelligence

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Abstract. This essay is discussing integration of ChatGPT into a role-playing game (RPG). Currently, students are having a large workload on their study. However, this may lead to them to lose their interests. To improve effectiveness, we designed an educational purposed role-playing game and add ChatGPT into the game. To build the game, we had done processes of investigation, low-fidelity prototype, and user evaluation. Generally, we are discussing the question about whether involving AI into the education would improve the effectiveness of study. With the AI involved role-playing game with study purpose, this can open a brand-new study method and provide a more interesting study process for students. It will also be more effective when answering the question with the chatbot than searching in the search engine cause chatbot can generate real time response for users.

Keywords: AI-Game Interaction, Web/game design, Educational use in gaming

1 INTRODUCTION

1.1 The current development of AI language model

In the recent days, a large language model (LLM) developed by open AI, is becoming popular with a high volume of users. From the end of 2022 it was released, it suddenly gains a large number of users. In a three months period, it increases to around 100 million of users, it breaks the record of the fastest growth of users in application [1]. The development of ChatGPT has gone through 4 different models. In 2018, it firstly released GPT-1 model, it was basically made through Transformer framework via unsupervised learning. After two years in 2019, the GPT-2 model released. This model is included with a larger number of parameters with the purpose training. Then with further development, GPT-3 is equipped with the ability to understand the context in the text and be trained with contextualized learning. It then derives the version of GPT-3.5, which is the model of ChatGPT using nowadays. Currently, the GPT model developed to GPT-4 which allows user to input images and then generate a text output. The main

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basically uses Natural Language Processing (NLP) model to be trained and generate responses [3]. Among students, more than 58% of them uses ChatGPT on their studies for answering questions or write an essay [2]. It clearly indicates that the usage of artificial intelligence has a tighter bond with education. The development of these large language model creates a brand-new learning environment for students.

1.2 Status quo of study and educational game

Since the release of ChatGPT, some concerns have raised on education. Student can use ChatGPT to provide them accurate answers in many questions. Since then, some problems, such as students tend to cheat by using ChatGPT may raise, it can help them to generate the word of written assignments [3]. Another concern for students today on education is they might get bored when study using traditional method, this may lead to a decrease in the effectiveness on study. Students nowadays are getting bored with study, including the comprehension of study content, and unable to follow the progress on study [4]. Since then, some studying purposed game are released to resolve this problem. The studying purposed game could achieve the effect of "motivation" on student. Since the motivation, students can generate more output on their study progress along with a more efficient process. Students in the recent years are in what we called "digital society". Many of the leaning progresses are equipped with technology [5]. Developing a high-quality learning game would have a huge benefit on the education. It is highly demanded for teachers and students to have a high-quality educational game. Another significant case is that during COVID-19 pandemics, when students are having online lessons, they feel board and demotivated. However, when integrating the quiz-based game into the online lecture, it is true that students appear to be more engaged [6]. We also interviewed some students who currently studying computer science. One interviewee claimed that he was equipped with a high volume of study nowadays, when he was in the state of studying for about only one hour, he will get so exhausted. Especially in the situation when there is not only computer science to study, but also all other subjects. Even though, some educational purposed games are still boring. Designers of the game do not know how to correctly use the study material in the game to maintain a high quality of knowledge gaining while as teachers do not know how to design an interesting game to attract student and make them to feel motivated in the study, this is the main issue of study purposed game we have developed today [7]. Study found that inside the educational purposed game there are multiple factors that can help to improve the motivation of users such as the background music, the action scene, the mechanics, and the good storyline [8]. Therefore, we aimed to include those elements as the main development focus.

2 INITIAL DESIGN

Therefore, we decided to combine ChatGPT with the role-playing game together to improve the efficiency and incorporate the new technology into the game to improve the interests of the game. With the introduction of AI in the game along with the novel

design of the game, players will get more engaged. The game can resolve the problem of boring and not effective on learning. The first idea of the game is role-playing, and players can take control of a character in the game. The character then can move around to chat with other NPCs. The background scene of the game is in the classroom since it's a study game. NPCs in the game will ask the player some question about computer science knowledge. While as they are being tested with their knowledge, if they have some doubt want to clarify, we designed an interface for ChatGPT which users can type their question in a dialogue box and then ChatGPT's answer will be generated by an NPC at the side of the game. After chatting with all the NPCs, the task is to compete with the teacher (NPC in the game) and a score will be generated to show the ability of the player.

The aim of the game we designed is to help computer science students who found hard to deal with the course to improve their result. Another goal we aimed to achieve is to combine people's interest with study to enhance their willingness on study.

3 SURVEY & INVESTIGATION

The design process was involved with the feedback of aimed player. We had carried out several investigations to figure out the current issue of the problem we want to resolve. We designed a survey and distributed among the aimed group of users of the game (high school and university students). In the survey, we asked 4 questions.

1) Would you prefer to play video games or study during the weekends?

2) If there is a game with educational purpose that can help you on studying, would you like to give a try for this game?

3) If you have questions during studying, what would you do to solve the problem?

4) Do you think AI would improve the efficiency for you to find a good answer for a question?

The first question is aiming to investigate on which interest (play video game or study) do more people prefer to do on their spare time. The second and the fourth question is aimed to investigate about people's point of view and their provision towards AI and technology-based study. The third question is to investigate on people's method for study to evaluate on how the game effectiveness on the studying process would be.

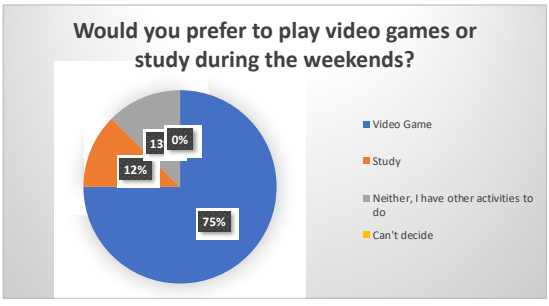

Fig. 1. Pie chart of the result of the first question in the survey

In the first chart (figure 1), 75% of respondent choose to play video game in the weekend. However, only 12% of respondent choose to study and 13% have other activities to do. This clearly indicates the most people would prefer playing video games in the weekend, and the interest is greater than study on the weekend. Therefore, we suspect, to achieve improving the interest of people on study, developing an educational purposed game would be effective to improve people's willingness on study.

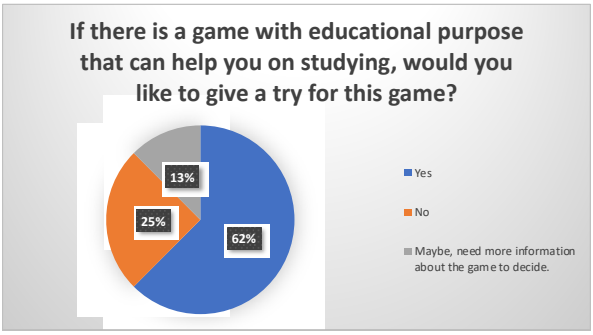

Fig. 2. Pie chart of the result of the second question in the survey

In the second chart (figure 2) 62% of respondent claimed that they would like to try the educational game we have designed, it reveals the most people have a positive attitude towards the educational game. However, another 25% wouldn't like to try the game and 13% of people are not sure and require more information. These minority of people we investigated and the most of them gave the reason of that educational game are not always interesting, sometimes would be boring. Also, some games are even misleading people with wrong knowledge they provide.

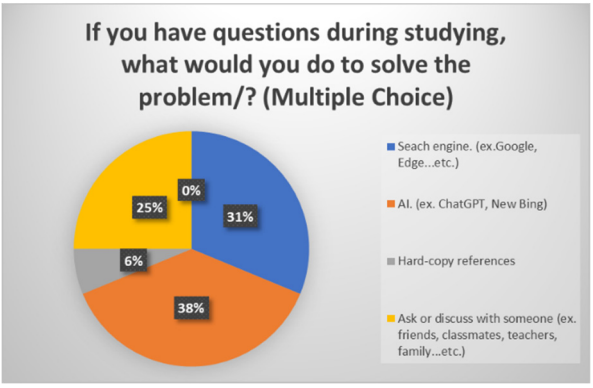

Fig. 3. Pie chart of the result of the third question in the survey

In this chart (figure 3), 38% of respondents choose to ask AI for assistant and 31% of respondents would like to use search engine. Apparently, the most people would like to use technology in their study. They claimed that using technology for study is fast

and accurate to obtain answer, especially the language model AI like ChatGPT. With a huge amount of training data, language model nowadays can generate accurate answers in a short period of time.

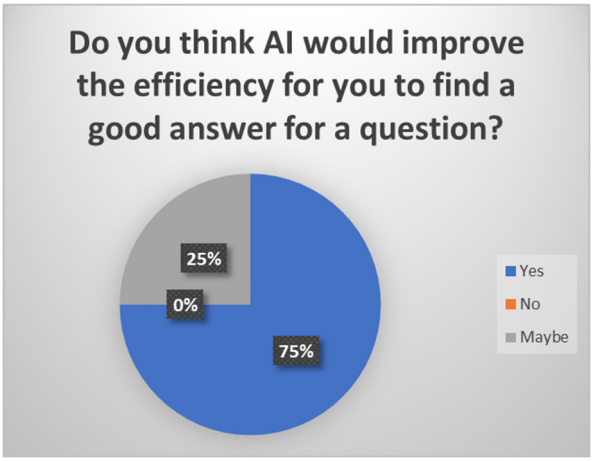

Fig. 4. Pie chart of the result of the fourth question in the survey

In this chart (figure 4), 75% of respondent think introducing AI can improve the efficiency of finding an answer for a question. No body do not believe it would not improve efficiency. By the response of this question, the most people are having a positive provision towards AI driven educational game.

Over this survey, we concluded that people would be interested with educational purposed game if the game is integrated with AI. We also understood the main improvement towards the attitude of people on traditional education-based game and the AI driven educational based game is the introduction of AI. This is because people feel more effective and interested with the fast, accurate responses in the game. Moreover, another argument claims that implementing AI into the educational purposed game can improve the judgement and the learning capability for students and educators, since AI make administration easier and faster the decision-making speed.[9]

4 PARTICIPATORY DESIGN

The aimed users for the designed project are students who are studying computer science. It is a quiz-based game. Users need to answer a several questions related to computer science and do different challenges to enhance their knowledge on computer science.

To test about the expectation of users to the product, I ask three aimed users on the problem they faced right now and their expectation.

The status quo of studying is currently a tough job for students. Students need to study a lot of subjects nowadays. A respondent claims that he is becoming so tired after

1 hour of studying process. Another respondent says he think ChatGPT can help him to solve a lot of problem, but it never boosts his interest on study.

After understanding the idea of the game, respondents listed three points that they expect the game to resolve for them.

- Sometimes they cannot understand some of the question when they need to answer. In this case, they require the help of AI.
- There is nobody to give feedback and ask question at every time. So, this cannot help them to find their shortage and improve their ability cause feedback from others is an essential element for making improvements.
- When asking question, they don't know some key words sometimes.

Respondents then give some expectations for the game. The first point must be interesting to use, cause the aim of this project is to increase the interest in people on studying. Secondly, users expect the game can be helpful to explain clearly and accurately for some concepts, this will increase their understanding for come abstract concept. Thirdly, they expect the game and ChatGPT in the game can be helpful for 24 hours, so they can receive feedback and ask questions at any time. They also wish the AI could understand some abstract concept for example some glossary in computer science.

5 LOW-FI PROTOTYPE

With our investigation and the suggestion from potential users, we generated the prototype of our original design. On the left side, there is an NPC answering as ChatGPT (using OpenAI) and a dialogue box which allows user to type question in. The inner box is the game content. The game scene is to be set in the classroom since it is an educational-based game.

The second part, also the main part of the game, the NPC will generate some questions for player to answer, all questions are based on multiple choice, as the prototype showing above. While user type question in the dialogue box, the AI will answer the question directly and sometimes with the game, they can provide real-time feedback for users. The feedback to users on study would make user easier to identify their current problem and therefore they are able to figure out to solve their problem and improve studying efficiency.

However, during the participatory design stage, a user identified a problem that the time the dialogue box appear is too short. When the ChatGPT generate a long answer, users are unable to follow the sentences in the dialogue box. Users may also intend to see some previous answers during the game but the deficient of the current model is unable to save the dialogue like using ChatGPT on the web.

Therefore, we designed a new interface which a folding dialogue window is added. Users can view the chat history in dialogue window, so they are able to follow what did ChatGPT says. They can open the window to view the chat history at any time. It resolves the problem of users.

The entire project is constructed using the JavaScript language (figures 5 and 6). We employed JavaScript to craft various objects with distinct attributes, each representing different facets of the game, such as NPCs, maps, and walls. We utilized functions with conditional statements to orchestrate in-game events and employed diverse elements for storing various data types, including integers for NPC location and size, Boolean values to manage event toggles, and more.

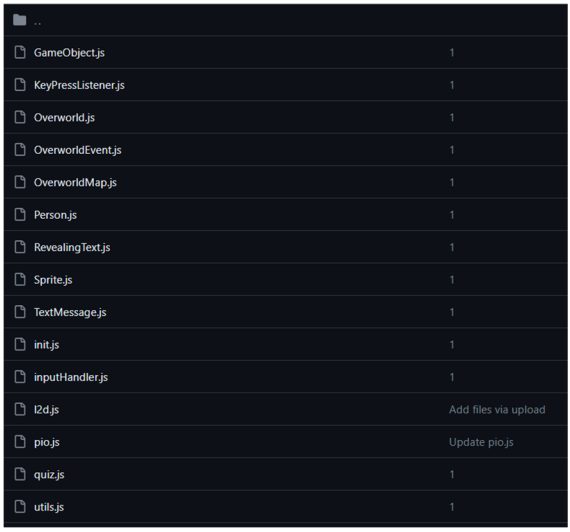

Fig. 5. Screenshot of the main part of game

```
class GameObject {
  constructor(config) {
    this.id = config.id || null;
    this.isMounted = config.isMounted || false;
    this.direction = config.direction || "right";
    this.x = config.x || 0;
    this.y = config.y || 0;
    this.sizex = config.sizex || 0;
    this.sizey = config.sizey || 0;
    this.wall = config.wall || false;
    this.ifdialogue = config.ifdialogue || false;
    this.sprite = new Sprite({
      gameObject: this,
      id: config.id || null,
      sizex: config.sizex || 0,
      sizey: config.sizey || 0,
      src: config.src || "https://tianbinliu.github.io/CSA-FinalProject/images/character/adventurer-v1.5-Sheetflip.png",
    });

    this.behaviorLoop = config.behaviorLoop || [];
    this.behaviorLoopIndex = 0;

    this.talking = config.talking || [];
    this.event = config.event || false;
  }


  mount(map) {
    //If we have a behavior, kick off after a short delay
    setTimeout(() => {
      this.doBehaviorEvent(map);
    }, 10)
  }
```

Fig. 6. Example of JavaScript Code that created object

To enhance the user's learning experience, we have employed the OpenAI API within the game. This integration enables users to pose questions to non-player characters (NPCs) while engaging in the learning process. To ensure that the AI responses closely emulate human-like interactions, we have established an API endpoint and leveraged one of OpenAI's dependencies. This gives a persona to the AI, encompassing background information such as name, age, gender, and character traits.

Moreover, our website is hosted on AWS (figures 7 and 8), utilizing Tmux for efficient session management and session Persistence which allows us to close the AWS tab while keeps the API running. Furthermore, we have acquired a dedicated domain name for our website, adding a professional touch to our online presence.

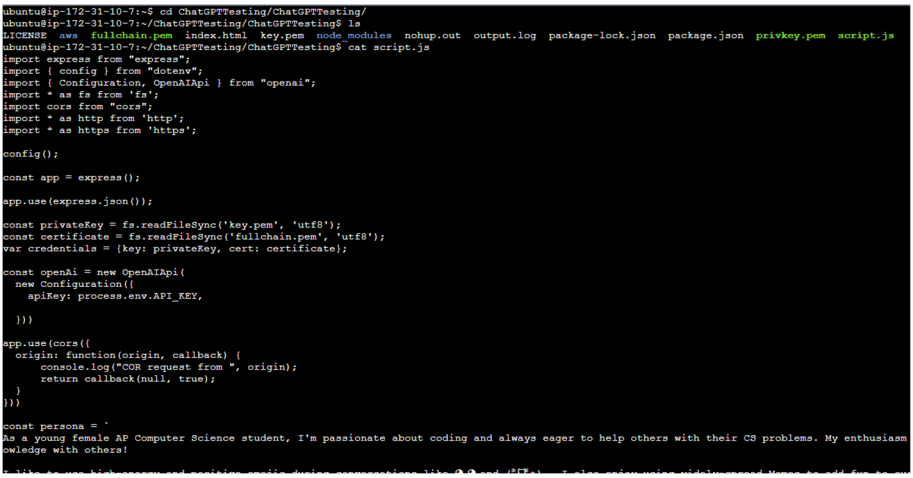

Fig. 7. Project hosting in AWS

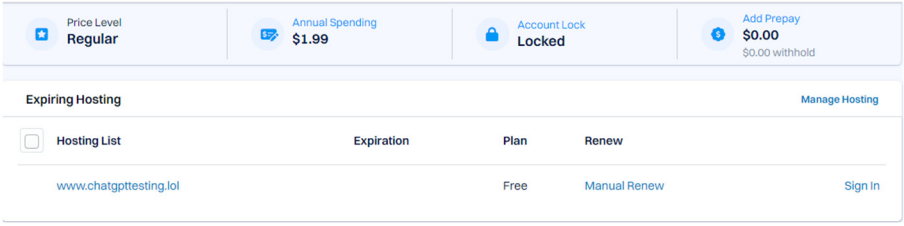

Fig. 8. Page that manages the domain name

6 FURTHER DEVELOPMENT

When we firstly designed the menu of the game, users claimed that it looks too monotonous, and lack of interests as shown below.

As our goal to develop an interesting and unusual role-playing game, the interface must be interesting at the first place. Research suggested that better user interface will improve the sense of experience of users and therefore improve the user efficiency,

because better user interface let user feels like to take a greater control to the interface.[10] Therefore, according to the theme and content of the game we added some new elements into the game and improved the design of the interface. Including insert a video background, make it changing brightness automatically (when the curser move closer to the centre, the brightness increases automatically, vice versa). As shown below (figure 9), our changed menu interface.

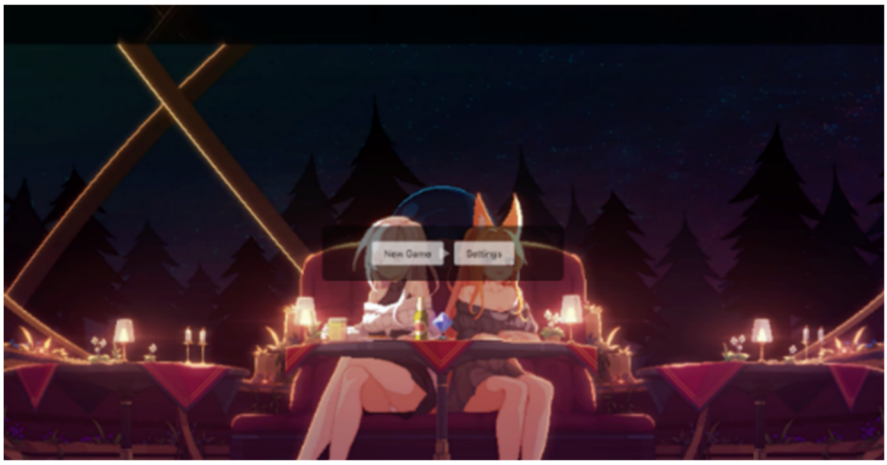

Fig. 9. Changed game menu

By using javascript we can easily set up the animation of changing brightness. We first set up a “div” with black background color that fully covered the whole screen as if there is a black mist upon the menu, and created a JavaScript event listener that tracks mouse movement and used various elements to store its location on both x and y axis. Then we used the math method and Pythagorean theorem to calculate the distance from the mouse to the centre of the screen and also the maximum distance from the center for the menu and buttons to be fully opaque as well, and used them to calculate the opacity for the black mist overlay, or the brightness of the screen should be. Lastly, we assign the obtained opacity value to the 'div' element, ensuring that the opacity of the mist and the screen's brightness change in response to mouse movements, as captured by the JavaScript event listener (figure 10).

```
document.addEventListener('mousemove', function (event) {
  const mouseX = event.clientX;
  const mouseY = event.clientY;
  const windowCenterX = window.innerWidth / 2;
  const windowCenterY = window.innerHeight / 2;

  // Calculate the distance from the mouse to the center of the screen
  const distanceFromCenter = Math.sqrt((windowCenterX - mouseX) ** 2 + (windowCenterY - mouseY) ** 2);

  // Calculate the maximum distance from the center for the menu and buttons to be fully opaque
  const maxDistanceFromCenter = Math.sqrt(windowCenterX ** 2 + windowCenterY ** 2);

  // Calculate the opacity for the black mist overlay
  const mistOpacity = distanceFromCenter / maxDistanceFromCenter;

  // Set the opacity of the black mist overlay
  blackMist.style.opacity = mistOpacity;

  // Calculate the opacity for the menu and buttons based on the distance from the center
  const menuOpacity = 1 - distanceFromCenter / (maxDistanceFromCenter * 0.8);
  const buttonOpacity = 0.8 - distanceFromCenter / (maxDistanceFromCenter * 1.2);

  // Ensure the opacity values are within the valid range [0, 1]
  const clampedMenuOpacity = Math.max(menuOpacity, 0);
  const clampedButtonOpacity = Math.max(buttonOpacity, 0);

  gameMenu.style.opacity = clampedMenuOpacity;

  for (const button of menuButtons) {
    button.style.opacity = clampedButtonOpacity;
  }
});
```

Fig. 10. Screenshot of code

7 CONCLUSION

In conclusion, the essay main explored the development progress of a new studying AI technology and its effect onto users to resolve the current studying issue of users or deficient of the current educational technology. With the introducing of AI in educational area, users will achieve a higher standard of effectiveness on acquiring knowledge. Furthermore, it reveals people's optimistic attitude towards the current development of AI.

We have concluded and proven technology such as those AI will improve the efficiency of the current educational game and users will prefer more the game with more convenient AI technology integrated in it. With continuously updating the interface satisfies users and fixing bugs in the game depends on the feedback of users, the game will achieve the effect which portrayed in our aim of this project. We also concluded that to improve the quality of a product, producer should constantly gather feedback from aimed users and then improve the quality of the product.

The current development of AI is in the beginning stage, and it has a huge development space. We do not know whether it will be beneficial to the education in a long term. Undoubtedly, it is a worthy tool nowadays but depends on the way people exploit

it. The future research of artificial intelligence is still in a long step to go. In educational area, the future development of artificial intelligence should aim to improve the efficiency and equality of education which are currently two shortages of educational system around the world. We are going to develop further onto the game, not only the AI powered quiz game, but also more meaningful objective, to improve the efficiency and equality of educational system. We are going to add some other features such as the voice input and output to let vision disabled people access to the game to improve the equality. Also the deeper research could be carry on to strengthen the accuracy and speed of model of artificial intelligence nowadays to improve the efficiency.

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Guo Murong and Liu Tianbin contributed equally to this work and should be considered co-first authors.

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