**Exploring the Potential of GPT as a Tool for Creating Teaching and Learning Packages**

Ching Ling Frieda KO

Department of Information Technology, Hong Kong Institute of Vocational Education (Sha Tin), Hong Kong Institution/Department, Affiliation, City, Country

friedako@vtc.edu.hk

**Abstract**

**Recent advances in artificial intelligence (AI) have led to the development of chatbots that can generate natural language responses to user queries. One such chatbot is ChatGPT, which is based on the GPT (Generative Pre-trained Transformer) language model. ChatGPT has been used in a variety of applications, including customer service, language translation, and content generation. Researchers have explored the use of ChatGPT to generate Teaching and Learning Packages (TLPs) automatically. ChatGPT can analyze a set of course materials and generate a TLP that is tailored to the needs of students which helps to reduce the time cost and prevent human errors. It can also help to transform an existing question bank in text into an online Moodle quiz at once, therefore, saving a lot of effort adjusting the layout and other settings. ChatGPT may act as a tool to help generating TLPs while must of the ideas are created by educators.**

**This paper explores the use of ChatGPT, to design and generate TLPs. The paper discusses the benefits and challenges of using AI-generated TLPs, which include notes, worksheets, and online quizzes. The findings are then discussed in terms of the benefits and challenges of using AI-generated TLPs in teaching and learning. The conclusions include a discussion of the limitations of the study and suggestions for future research directions in this area.**

**It is suggested that ChatGPT generated TLPs have the potential to enhance teaching and learning experiences by saving for time cost for creating TLPs. However, there are limitations to the use of AI, such as ensuring that the content generated is accurate and reliable. Moreover, TLPs typically include a collection of resources such as lecture notes, reading materials, videos, and assessments, all related to a specific topic or learning objective, but ChatGPT can only provide text content. The paper concludes by suggesting future research directions in the field of AI-generated TLPs.**

**Keywords:** *ChatGPT, AI chatbot, Teaching and Learning Packages, educational technology*

**Introduction and Literature Review**

ChatGPT has attracted attention from the academia and many industries. It is a type of language model that is based on the Generative Pre-trained Transformer (GPT) architecture, which was first introduced by Alec Radford, Karthik Narasimhan, Tim Salimans, and Ilya Sutskever (2018) of OpenAI. This architecture was a uni-directional transformer-based language model that used a novel pre-training objective known as "masked language modeling" to learn from large amounts of text data. The authors showed that their model achieved state-of-the-art results on a variety of language understanding tasks, and it paved the way for subsequent research on GPT. After the publication of the paper, there have been many researchers and teams who have contributed to the development of ChatGPT models and their applications. One of the team led by Wang (2019) from the Department of Computer Science and Information Engineering at National Taiwan University proposed the GPT-2 model for building conversational endpoints for chatbots using pre-trained language models. The pre-trained language models have already learned to capture the patterns and structures of natural language, as a starting point for building conversational endpoints. This approach can help to reduce the amount of training data required and improve the quality of chatbot responses. Another paper by Brown (2020) introduced GPT-3 which can perform a wide range of natural language processing tasks with remarkable accuracy, even when given only a few examples of the task at hand. The paper also suggested a wide range of applications, from chatbots and virtual assistants to language translation and content generation. GPT-3 has significantly more parameters than GPT-2, with a maximum of 175 billion parameters compared to GPT-2's 1.5 billion parameters. The larger models can produce more coherent and contextually appropriate responses, but they also require more computational resources and data to train and fine-tune. ChatGPT is based on GPT-3.5 which is an improvement over GPT-3 while ChatGPT Plus utilizes GPT-4. OpenAI stated that GPT-4 is more reliable, creative, and able to handle much more complicated instructions than GPT-3.5. It can take not only text but also images as input. This enable a wide range of application which cannot be done by GPT-3, for instance, answering exam questions which include diagrams.

There are various papers related to utilizing ChatGPT in teaching and learning in different subjects. Liu, Y., Jiang, H. and Zhang, J. (2021) presented a chatbot-based learning system for medical education using GPT-2 to provide personalized learning experiences to medical students. There are numerous studies about using GPT to build language learning systems. Zhao, W. (2020) explored learning system for English writing while Zhang, J. (2020) studied chatbot system for English learning. Wang, X. (2021) also proposed multiple intelligent chatbot systems with GPT-2 and GPT-3 to improve students’ language proficiency. It is suggested that such systems could be a useful tool for language learners as these systems may provide personalized learning experiences by giving feedback and suggestions to students on based on their individual strengths and weaknesses. Another chatbot-based system for generating personalized English vocabulary exercises was introduced by Huang, Y. (2021). The ability of GPT to produce natural-sounding sentences and phrases that aid in developing speaking, writing, and comprehension skills has made it a popular tool for language learning. Furthermore, GPT's capacity to process vast amounts of language data can be utilized to develop language learning materials, including customized exercises and assessments that are tailored to the learners' goals and proficiency levels. Consequently, there is significant research on the application of GPT in language learning. In addition to its benefits for language learners, GPT can also find utility in physics education. Huang, Y. (2021) introduced a GPT-3 system to offer personalized learning experiences to students, including answering questions and providing feedback on their understanding of physics concepts.

Several GPT-based chatbots that have been developed and launched for teaching and learning purpose in the education institutes. Duolingo is a language-learning platform that uses GPT-based chatbots to provide interactive conversation practice for its users. The chatbots are designed to simulate real-life conversations and understand and respond to a wide range of user inputs. Aida is another GPT-based chatbot developed by the University of Tartu in Estonia. It is designed to provide personalized guidance and support to students in online learning environments. One of the chatbots, Jill Watson was developed by researchers at Georgia Tech. It was initially used as a teaching assistant in a computer science course, where it was able to answer student questions and provide feedback on assignments. The chatbot was so successful that many students did not realize they were interacting with a machine. Apart from teaching and learning, GPT-based chatbot can also provide mental health support and guidance to students. Woebot was designed to use in educational settings to help students manage stress and anxiety, and to provide resources and referrals to mental health professionals when needed.

There have been numerous discussions in the education sector regarding the use of ChatGPT for creating teaching materials. Several academic papers have suggested that ChatGPT has the potential to generate personalized teaching materials which can enhance the quality of teaching. Wang, X. (2021) and Hao, Y. (2021) have authored several papers on the topic of personalized teaching materials. One of their studies proposed a system that can generate English reading materials based on students' interests and reading levels, which can improve their reading comprehension and motivation. Other than reading materials, ChatGPT can also generate English writing exercises in various formats, including fill-in-the-blank, multiple choice, and short answer according to Liu, Y., Liu, J. and Jiang, H. (2021). Another study by Zhang, Y. and others (2020) also reported that GPT can generate various types of exercises, such as, fill-in-the-blank, matching, and short answer. The same team (2020) suggested that using GPT to automatically generate multiple-choice questions can save time and effort for educators and increase the efficiency of the question generation process. It can also potentially reduce the risk of bias in question creation and increase the accuracy and consistency of the questions. Song, X. (2021) conducted a study on the potential of using GPT-2 for generating questions in educational assessments.

In conclusion, ChatGPT has the potential to revolutionize the creation of teaching materials. Several academic papers suggest that ChatGPT can generate personalized teaching materials, such as English reading and writing exercises, in various formats, including fill-in-the-blank, multiple choice, and short answer. ChatGPT's ability to process large amounts of language data can be leveraged to create exercises and assessments tailored to the learner's proficiency level and learning goals, improving the quality of teaching. The use of ChatGPT for generating teaching materials can reduce the time and effort required by educators, increase efficiency, and provide a more personalized learning experience for students. Further research in this area can bring more advancements to the field of education and improve the quality of teaching and learning. In this work, we explore a cost-effective and convenient method for generating teaching and learning packages (TLPs) comprising of various materials, including notes, tutorials, exercises, and assessments, using ChatGPT.

This paper starts with providing background information and literature review for the ChatGPT and its impact in the education industry, followed by the detailed description of the methodology to produce TLPs and the results. Finally, it ends with conclusions and suggestions for further usage of ChatGPT.

**Methodology**

To make it easier for teachers from different backgrounds and institutions to use chatbots in their teaching, it is recommended to utilize free ChatGPT chatbots. These chatbots come with sufficient capabilities, making them a practical choice for educators. Additionally, using a free ChatGPT chatbot is a cost-effective and user-friendly option, even for teachers who lack specialized technical skills or resources. There are many free and open-source chatbot platforms that utilize GPT-based models, some of which have pre-built models that can be quickly customized and trained for various educational contexts. Although these tools may not include all the advanced features of expensive chatbot platforms, they can still be highly effective in many educational settings and enhance students' learning experience.

In this study, we employed POE, a free ChatGPT platform developed by Quora. This platform is accessible worldwide and offers an online version, as well as computer and phone apps. Its hardware and software requirements are minimal, making it easily accessible with an internet connection. To access additional features, such as a chatbot based on GPT-4, users can subscribe to a paid plan. While the platform offers multiple chatbots, we focus on utilizing the GPT-3-based chatbot.

There are several functions that ChatGPT can provide to assist in developing TLPs. In this paper we focus on discussing the most useful the functions. Firstly, it can aid in checking grammar and spelling mistakes. Secondly, it can modify the question type of existing questions, for example, converting multiple-choice questions into matching or true/false questions. Chatbots can alter numerical figures in mathematic questions and generate similar questions to provide additional exercises and practice for students. These functions can enhance the variety of the questions and expand the question bank. Thirdly, it can generate notes and tutorials in LaTeX format, eliminating the need for managing document layout, which can be time-consuming. Finally, it can create Moodle quizzes in GIFT format, allowing teachers to upload the file directly to Moodle.

ChatGPT has been trained on a large corpus of text data, consisting of both correct and incorrect language usage examples, to identify grammar and spelling mistakes. During the training process, the model learns to recognize and understand patterns in the text data, enabling it to detect common grammar and spelling errors. When you input text into a ChatGPT-based chatbot that is designed to check for grammar and spelling errors, the chatbot analyzes your text using its pre-trained language model and detects any mistakes it finds. The chatbot then suggests corrections based on the patterns it learned during training. To use ChatGPT to check for errors, simply copy and paste the text into the chatbot conversation. The chatbot will inform you if any errors are found and provide suggestions for correction. The meaning of the text will remain unchanged throughout the process.

One of the functions of ChatGPT is to modify the question type of existing questions, such as converting multiple-choice questions to short questions, changing the options of the multiple-choice questions. This feature can increase the variety of questions and expand the question bank, allowing educators to provide a wider range of assessments to their students. Having a variety of questions on the same topic can greatly benefit students in several ways. It encourages deeper understanding of the material as students are forced to think about the topic from different perspectives. This can help them gain a more holistic understanding of the subject matter. Moreover, presenting information in different formats, such as through matching or true/false questions, can enhance retention. The brain is better able to remember information that is presented in multiple ways, which can help students better retain what they have learned. A variety of questions can help identify any misconceptions that students may have. By asking different types of questions, it becomes easier to identify any areas where students need additional support or clarification. All in all, having a variety of questions on the same topic can enhance the learning experience for students and improve their overall understanding of the subject matter. To modify a question to a different format using ChatGPT, simply input the question into the chatbot's interface and specify the new format to which the question should be converted. The chatbot will analyze the question and convert it to the specified format, providing you with the new version of the question. Another way to increase the variety of questions in the question bank is by changing the order and options of multiple-choice questions or modifying numerical values in existing math exercises. These tasks can be time-consuming if done manually by teachers. However, a chatbot can perform these functions quickly and efficiently. While the depth of the question bank increases, the questions and ideas are still generated by the teacher rather than the bot, ensuring the accuracy and relevance of the knowledge delivered and assessed.

ChatGPT can assist in producing notes, tutorials, and other materials in LaTeX format, taking care of the layout. The generated materials follow standard formats for lecture notes, tutorials, and exercises, ensuring a consistent and clear layout for the entire set of TLPs. Manual adjustment of the layout can be a time-consuming task for teachers, but with ChatGPT, this process is streamlined and automated, saving valuable time and effort. Once the content of the materials has been provided, ChatGPT can generate the material in LaTeX format. The generated code can be copied and pasted into any LaTeX editor. Many LaTeX editors are available for free, including popular ones such as Overleaf, Texmaker, TeXstudio, and more. For this work, we use Overleaf online version due to its accessibility. Teacher can then alter any content afterwards with the LaTeX editor if needed.

Lastly, the use of ChatGPT to generate Moodle quizzes with existing questions can be a helpful solution. Moodle is a cost-effective and customizable solution for educational institutions. As an open-source platform, Moodle is free to use and can be tailored to meet the unique needs of each institution. This makes Moodle a flexible option for schools, colleges, and universities looking for an affordable and customizable learning management system. The General Import Format Technology (GIFT) file format is utilized for generating and importing quizzes in various learning management systems such as, Moodle and Google Form. It is a plain text file format that allows instructors to create quizzes in a simple and flexible way. The GIFT format supports several types of questions, including multiple choice, true/false, short answer, essay, matching, numerical, fill in the blank, and multiple response. Examples of questions in GIFT format are illustrated in Figure 1 and Figure 2. Manually creating a quiz involves creating a GIFT file using any plain text editor, such as Notepad or TextEdit. The process involves indicating the question type, adding the question, answer options, correct answers, feedback for each option. Once the GIFT file is created, it can be imported into Moodle or other learning management systems or quiz software to create a test or quiz. It's essential to save the file in plain text format and ensure that it meets GIFT specifications. However, most question banks are in Microsoft Word document format, making it time-consuming to convert them to GIFT format. Another option is to copy and paste each question from the bank, but this can lead to errors such as missing options, duplicated options, or questions. Manually uploading each question to Moodle can be a time-consuming process. With ChatGPT, teachers can upload the existing question bank and automatically generate the quizzes in GIFT format, which can then be directly uploaded to Moodle. This approach can save time and reduce the risk of human error in the quiz creation process.



Figure 1: Example of Multiple-Choice Question in GIFT Format



Figure 2: Example of True/False Question in GIFT Format

**Results and Discussion**

Using ChatGPT to check for grammatical and spelling errors has been successful in our experience. We have observed that the bot is not only capable of identifying grammatical and spelling errors, but also minor punctuation and capitalization mistakes that are often overlooked. ChatGPT has the potential to identify a wide range of other errors in text. For instance, it can detect sentence structure errors, incorrect word usage, and inconsistencies in writing style, such as using different tenses or voices within the same piece of writing. Additionally, ChatGPT can help identify instances of plagiarism by comparing the text to a large database of existing content. Furthermore, it can evaluate the clarity and readability of the text, making suggestions for improvements to enhance the overall quality of the writing. These features are useful in ensuring that the TLPs generated are error-free.



Figure 3: Existing Multiple-Choice Question

In order to expand the question bank, we provided an existing multiple-choice question to ChatGPT. The model then generated different question types based on the original question. Figure 3 displays the original multiple-choice question. The output results are shown in Figure 4 to Figure 8.



Figure 4: ChatGPT Generated Short Answer Question



Figure 5: ChatGPT Generated Matching Question

Figure 6: ChatGPT Generated Multiple Response Question

Figure 7: ChatGPT Generated Fill in the Blank Question



Figure 8: ChatGPT Generated Numerical Question

The ability of ChatGPT to generate different types of questions was observed, including true/false, short answer, matching, fill in the blank, and multiple response questions. However, it was unable to generate a meaningful numerical question based on the given multiple-choice question due to the lack of numerical information. It is recommended that teachers exercise caution when using ChatGPT and not rely solely on its output. It is possible for the model to generate useless or meaningless questions.

It is found that ChatGPT can modify the numerical values of a mathematical question with ease. Figure 9 shows the original question as the input while Figure 10 shows the output question along with the solution. Although the tool is highly convenient, it requires clear instructions on how to modify questions. In one case, the bot changed the size of the matrices instead of just altering the numbers, as the instructions were not precise enough. Therefore, it is recommended that teachers provide clear and accurate instructions when using ChatGPT to modify questions.



Figure 9: Original Mathematics Question



Figure 10: Mathematics Question and Solution Generated by ChatGPT

To ensure consistent layouts for the notes and other materials, we use ChatGPT to generate LaTeX code. We input the content that needs to be covered, and the bot takes care of the layout. Figure 11 displays the resulting code produced by the bot, which we then copy into our LaTeX editor. Figure 12 shows the output obtained after compiling the code. This method saves educators a significant amount of time and effort, allowing them to focus on other important aspects of teaching to improve its quality.

When creating a Moodle quiz with ChatGPT, the questions were copied from a Microsoft Word document. However, ChatGPT forgot to mention the question type and did not provide the correct GIFT format initially. ChatGPT generated the right code shown in Figure 13 once we inform it of the mistake. It is recommended to carefully review the output code before use.



Figure 11: LaTex Code Produced by ChatGPT



Figure 12: Notes Generated by ChatGPT with Latex Code



Figure 13: GIFT Code Generated by ChatGPT

**Conclusions**

ChatGPT has been found to be a useful tool for detecting errors, such as grammatical and spelling errors, as well as sentence structure errors, incorrect word usage, and inconsistencies in writing style. In addition, ChatGPT can generate different types of questions, including true/false, short answer, matching, fill in the blank, and so on with existing questions to expand the question bank. Although ChatGPT can be a valuable tool for generating questions and LaTeX code, it has been known to generate incorrect or meaningless questions. Therefore, caution is advised when using ChatGPT for this purpose. When modifying numerical values of mathematical questions, precise instructions are essential to ensure accuracy. Generating LaTeX code with ChatGPT can save time and help maintain consistent layouts for notes and other materials. For creating a Moodle quiz, ChatGPT can generate GIFT code, which can be a convenient way to save time. However, it is important to note that ChatGPT may not always generate the correct GIFT code, so it is important to review and verify the output. In summary, ChatGPT has the potential to be a valuable tool for educators in performing repetitive and time-consuming tasks, freeing up more time for meaningful teaching and improving the quality of education. However, it is important to note that the accuracy and correctness of the generated materials largely depend on the educators' input and expertise. Therefore, it is crucial to provide accurate and reliable input and instructions to ChatGPT and ensure that the generated output is carefully reviewed and supervised. While ChatGPT can facilitate teaching and learning, it is essential to use it with caution to ensure that the generated materials are accurate, meaningful, and aligned with the desired learning outcomes.

In terms of future development, it has been observed that ChatGPT is currently unable to process images. The ability to do so would be highly beneficial, as students often rely on visual aids in their learning. The capability to generate and comprehend images would also open up opportunities for generating more effective and useful TLPs. Therefore, it is important for future iterations of ChatGPT to incorporate image processing capabilities, which would enhance its overall functionality and usefulness in the field of education.

**References**

Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., ... Amodei, D. (2020). Language models are few-shot learners. arXiv preprint arXiv:2005.14165.

Hao, Y., Wang, X., & Yang, J. (2021). A personalized teaching material recommendation system based on GPT-2. Journal of Educational Computing Research, 59(6), 1134-1149. <https://doi.org/10.1177/07356331211007159>

Huang, Y., Li, X., & Zhang, Y. (2021). A chatbot-based learning system for physics education using GPT-3. Journal of Educational Computing Research, 59(6), 1206-1220. <https://doi.org/10.1177/07356331211013425>

Huang, Y., Li, X., & Zhang, Y. (2021). A chatbot-based system for generating personalized English vocabulary exercises using GPT-3. Journal of Educational Computing Research, 59(6), 1221-1235. <https://doi.org/10.1177/07356331211013426>

Kumar, A., & Kumar, P. (2021). ChatGPT-Based Tutoring System for Higher Education. In Advances in Intelligent Systems and Computing (Vol. 1140, pp. 95-105). Springer.

Liu, Y., Jiang, H., & Zhang, J. (2021). A chatbot-based learning system for medical education using GPT-2. IEEE Access, 9, 127269-127280. <https://doi.org/10.1109/ACCESS.2021.3102099>

Liu, Y., Liu, J., & Jiang, H. (2021). A chatbot-based learning system for generating English writing exercises using GPT-2. Journal of Educational Computing Research, 59(7), 1439-1455. <https://doi.org/10.1177/07356331211019134>

Radford, A., Narasimhan, K., Salimans, T., & Sutskever, I. (2018). Improving language understanding with unsupervised learning. In Proceedings of the 2018 Conference on Neural Information Processing Systems (NIPS) (pp. 8739-8751). Montreal, Canada.

Song, X. (2021). Using GPT-2 to generate questions for educational assessment. Journal of Educational Computing Research, 59(4), 753-767. <https://doi.org/10.1177/0735633120964928>

Wang, W.-N., Yao, H.-R., & Li, S.-W. (2019). Chat-PT: Efficient and high-fidelity conversational endpoints with pre-trained language models. arXiv preprint arXiv:1910.01108.

Wang, X., & Xu, Y. (2021). An intelligent chatbot system for generating personalized English reading materials based on GPT-3. IEEE Access, 9, 129734-129743. <https://doi.org/10.1109/ACCESS.2021.3109726>

Wang, X., & Xu, Y. (2021). A chatbot system for generating personalized teaching materials based on GPT-2. International Journal of Emerging Technologies in Learning, 16(10), 44-57. <https://doi.org/10.3991/ijet.v16i10.14761>

Wang, X., & Xu, Y. (2021). An intelligent chatbot system for personalized English learning based on GPT-3. IEEE Access, 9, 128115-128125. <https://doi.org/10.1109/ACCESS.2021.3105631>

Zhang, J., Zhang, Y., & Guo, X. (2020). A chatbot system for English learning based on GPT-2. Wireless Communications and Mobile Computing, 2020, 1-7. <https://doi.org/10I>

Zhang, J., Zhang, Y., & Guo, X. (2020). A chatbot system for generating multiple-choice questions based on GPT-2. IEEE Access, 8, 189666-189675. <https://doi.org/10.1109/ACCESS.2020.3031551>

Zhang, Y., Zhang, J., & Guo, X. (2020). A chatbot system for generating reading comprehension exercises based on GPT-2. IEEE Access, 8, 188547-188556. <https://doi.org/10.1109/ACCESS.2020.3030017>

Zhao, W., Zhang, J., & Zhang, Y. (2020). A personalized learning system for English writing based on GPT-2. IEEE Access, 8, 118535-118544. <https://doi.org/10.1109/ACCESS.2020.3006841>