

Design to Improve Educational Competency Using ChatGPT

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Abstract

Various artificial intelligence neural network models that have emerged since 2014 enable the creation of new content beyond the existing level of information discrimination and withdrawal, and the recent generative artificial intelligences such as ChatGPT and GPT-4 create and present new information similar to actual data, enabling natural interaction because they create and provide verbal expressions similar to humans, unlike existing chatbots that simply present input content or search results. This study aims to present a model that can improve the ChatGPT communication skills of university students through curriculum research on ChatGPT, which can be participated by students from all departments, including engineering, humanities, society, health, welfare, art, tourism, management, and liberal arts. It is intended to design a way to strengthen competitiveness to embody the practical ability to solve problems through ethical attitudes, AI-related technologies, data management, and composition processes as knowledge necessary to perform tasks in the artificial intelligence era, away from simple use capabilities. It is believed that through creative education methods, it is possible to improve university awareness in companies and to seek industry-academia self-reliant courses.

Keywords: *Artificial Intelligence, Bigdata, ChatGPT, Competency, Literacy.*

1. Introduction

The pandemic phenomenon caused by so-called COVID-19 rapidly accelerated the digitization of social systems due to changes in positive perceptions of science, technology, information, and communication. Artificial intelligence (AI) [1, 2, 3, 4], which was applied in a limited area, triggered a new paradigm shift in all areas, including society, economy, and education, due to the increase in the quality and of digital technology. AI has developed dramatically due to technological innovations such as Bigdata [5, 6, 7, 8], Cloud Computing, and Machine Learning (ML), and the use and expansion of AI have increased rapidly. Moreover, in the case of Korea, various policies are proposed with the aim of educational innovation by utilizing AI and Edu-tech to develop higher education such as AI basic and AI mathematics and the transition to digital education.

Therefore, in order to utilize Generative AI [9, 10] in the educational field, a review of technical and teaching,

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and learning aspects is essential, and an empirical review of the possibility of using the literature and the possibility of using it should be preceded. Therefore, this study aims to suggest the direction of education using Generative AI through benchmarking related to educational application plans in the field of university education. In the era of the 4th industrial revolution, education proposed as a framework for a paradigm shift in education emphasizes the educational use of AI to close the educational gap through digitalization, networking, and AI, automation of basic learning, collaboration-oriented learning, and universal learning. In the early days of using AI, the focus was on developing and developing AI focused on computer education, but these days, the scope of use is gradually expanding due to the use of platforms such as online evaluation systems, such as providing feedback on learner responses or adjusting task performance according to learners' levels. Various learning elements are being considered to apply AI to the educational field, and it is necessary to analyze and prepare for the improvement of teaching and learning problems, AI ethics, and critical thinking skills about AI that can arise during class with a clear purpose of what to embody and achieve through the use of AI. Education is a field where the possibility of using AI is rapidly increasing. Due to this situation, a macroscopic and microscopic review is essential for the successful application and use of AI in the educational field, and it is necessary to search for the direction of using AI through preemptive consideration of AI technology in universities.

2. Related works

We would like to look at the concept of Chat Generative Pre-trained Transformer (GPT) (ChatGPT), which is the background knowledge of this study, and look at the background technology of ChatGPT.

2.1. ChatGPT

The development of giant speech models such as ChatGPT was driven by the rapid development of hardware (HW) and software (SW). These macro-language models must use billions of parameters to learn vast amounts of text data because they must be accompanied by advances in SW and HW. This makes it possible to perform various Natural Language Processing (NLP) tasks over a wide range, and models that can generate high-quality text data were created. The ChatGPT model of OpenAI was developed thanks to the success of early language models such as Word2Vec and GloVe, and today's ChatGPT was able to learn vast amounts of text data. ChatGPT's transformer-based architecture is also suitable for learning vast amounts of text-based data because it uses pre-learning techniques for vast amounts of text data.

In 2017, Transformer was introduced as an innovative method in the field of NLP in the paper 'Attention is all you need'. The architecture uses a technique called attention, which allocates importance to the importance of each word in a sentence so that the network can better capture the relationship between words and sentences when creating text. Another development of ChatGPT is the possibility of using vast amounts of text data. With more text data available from information on the Internet and social media platforms, it has contributed significantly to dramatically improving the performance of NLP models. The earliest GPT was released in 2018, and it had about 117 million parameters, which is relatively small compared to later versions. Even so, it was possible to generate high-quality text data that can be used for various NLP tasks, and to learn a rich language used in various contexts. Since then, OpenAI has increased its learning parameters, with GPT-2 released in 2019 having approximately 1.5 billion parameters and GPT-3 released in 2020 having approximately 175 billion parameters. The current ChatGPT, also called the GPT-3.5 version, is named after the 3.5 beta was released in November 2022. Some studies suggest that ChatGPT passes a U.S. professional legal certification test, passes a U.S. medical license test, creates a guide to quantitative transactions, generates

concepts about bioinformatics, and generates coding. When GPT-4 is released soon, it is expected to make another breakthrough in the field of language models.

2.2. Background technologies of ChatGPT

(1) Generative AI and language models

Background technologies such as natural language processing, Generative AI, Deep Learning (DL), transformer, Ultra-Large AI, cloud computing, pre-learning, and human feedback-based reinforcement learning were utilized in OpenAI's development of the first GPT model and development into the current ChatGPT. NLP is a field of AI that processes and uses human language through machines. NLP includes tasks such as translation, emotion analysis, text classification, summary, and Q&A, and requires the process of analyzing, understanding, and processing human language using algorithms. Existing NLP technologies used statistical methods, but recently, ML technologies such as DL have been introduced, and their performance has developed sharply compared to existing statistics-based NLP models. In 2013, after Word2Vec, a word embedding model that learns patterns between words from a vast corpus of text through a neural network model, Google's BERT and OpenAI's GPT are representative DL-based language models in the DL field. A language model is a NLP model that predicts the word that will come next to a word to complete a sentence. Likewise, a language model is to select the word that is most likely to come to the blank among the candidates for words that can come to the blank, similar to humans. BERT uses a method of matching the blanks located in the 'middle' of the sentence using a mask language model, while GPT uses a model of matching the 'next' word. BERT is a two-way model that can take into account both the front and back contexts of the blanks, so it has the advantage of extracting the overall meaning of the sentence, and GPT has the advantage of generating sentences because it learns sequentially from the front and calculates the probability of the next word. GPT-3.5 shows strength in text generation because of the one-way language model, as described above.

MIT Technology Review selected Generative AI as one of the top 10 technologies to pay attention to in 2023. Generative AI is an AI that creates new and original content based on existing data or models, and includes text, images, audio, code, video, and simulations. The Generative AI learns the patterns and relationships of the data and then creates a similar new example based on that information. For text generation models, large-scale texts are learned and then the knowledge is used to create new sentences or stories with consistent contexts. ChatGPT is also an Ultra-Large Generative AI model that works by pre-learning vast amounts of data and then generating new texts, and has the potential to create new opportunities in various areas such as fiction, poetry, marketing, advertising, and entertainment.

(2) Transformer neural network model

The NLP model improved performance more rapidly than the existing statistics-based model with the introduction of DL technology. If so, it is necessary to find out how ML and DL technology differ from each other. ML collectively refers to an AI training method that learns data patterns from a machine model, and DL is a technology that applies an artificial neural network to ML inspired by the principle of neural information transmission. ML performs pre-processing through human manual manipulation, along with effective feature extraction methods and statistics-based learning for learning, and this pre-processing has a significant impact on performance. However, in DL-based AI learning, human pre-work process is omitted, and through algorithms, the rules are learned and answers are found by themselves from the original data. It is the number of parameters that determine the difference in performance of DL. A parameter is a model learned through DL where it plays a role similar to a synapse that transmits information in human nerve cells. The more training

data and parameters, the less the error between the actual value and the output value of AI decreases and the closer to the correct answer. This representative language model is OpenAI's GPT, and it is a model that can generate and infer language by itself through DL.

One of the biggest problems of DL was the processing of large amounts of data. In 2017, Google released the Transformer algorithm. Existing algorithms learned data using the Recurrent Neural Network (RNN) method, which processes data sequentially. Since this method only cyclically considers correlations with front and rear words, it causes the problem of forgetting information of the previous word when a sentence or conversation is prolonged. On the other hand, Transformers can learn context and meaning by detecting relationships between words that are far away, and can also improve learning speed by processing data in parallel rather than sequentially. According to NVIDIA, the learning computing power of general AI models has grown about 275 times in the two years since the Transformer model, compared to a 25-fold increase in the two years. OpenAI's GPT-3, Google's BERT and AlphaFold, and Facebook's RoBERTa are models that have applied the Transformer method. In Transformers, the left encoder block is strong against Natural Language Understanding (NLU), and the right decoder block is strong against Natural Language Generation (NLG). When Transformers' encoder blocks and decoder blocks proved to perform well in natural language processing, each block began to develop separately. Google created a model called BERT (Bidirectional Encoder Representation from Transformers) by stacking only the encoder blocks, and OpenAI created a model called GPT by stacking only the decoder blocks. In the task of classifying texts, BERT outperformed GPT of the same size, while GPT was mainly used in AI models that summarize, translate, or write texts into new sentences. In other words, BERT has an advantage over GPT only for models of the same size. The transformer block model has a lot of learning data, and the larger the model size, the better the performance, so the GPT (super-large AI) of the large model shows excellent performance not only in NLG but also in NLU. Therefore, numerous companies are competing through models that have huge stacks of transformer decoder blocks, which are GPT-based models.

ChatGPT is an AI chatbot based on GPT-3.5, a Large Language Model (LLM). ChatGPT is a representative ultra-large AI applied with a LLM that can learn large amounts of data and make comprehensive inference like humans. This is because countless parameters are required to create such a super-large AI, and the larger the number of parameters, the more information the model can get from the training data and predict new data more accurately. Super-large AI is used not only in natural language processing, but also in areas such as image/video recognition, predictive analysis, and recommendation systems. Leading companies include Microsoft (MS), Google, Meta in U.S., Huawei, Baidu in China, and Naver, Kakao, LG in Korea.

The combination of Ultra-Large AI with cloud technology is essential, and cloud computing is capable of handling large amounts of computing resources in the development and operation of Ultra-Large AI models and the processing of requests from large users. Cloud computing refers to a technology that allows users to access IT resources such as servers, databases, and storage that exist in virtualized spaces through the Internet and use various IT services such as SW, networking, and data analysis. Since Generative AI technologies and systems such as ChatGPT require numerous reasoning and calculation, the cloud is considered an optimal development environment due to the high requirements of processors, networks, and storage. OpenAI processes data of more than 100 million users per month by utilizing MS's cloud service, and Naver Clover, which performs AI R&D, is expected to be integrated into Naver Cloud, a subsidiary of Naver, to create synergy in performing Ultra-Large AI services.

3. AI literacy for educational competency using ChatGPT

We would like to look at literacy and then concept and applications of AI literacy for educational competency using ChatGPT.

3.1. Concept of literacy

The dictionary meaning of literacy is the ability to read and write, and literacy began based on a technical understanding of symbols for communication. Literacy, which began with the invention of letters, began with Gutenberg's printing press, and the introduction of imaging technology centered on Edison triggered the start of visual literacy. In addition, the development and broadcasting of the UK's IMI Television System in the 1930s enabled media literacy, and the information age due to the spread of computers in the 1980s led to the term information literacy. Since then, the area of digital literacy has been newly developed due to information and communication technology. In addition to the change of literacy theory according to the changes in the media, literacy theory has also developed according to the purpose of literacy ability. This means that social phenomena must be considered away from education in functional aspects such as simply text education. In other words, literacy in terms of social practices has an important purpose. Therefore, the capacity for critical thinking has become important through literacy, and this phenomenon sees that literacy has the meaning of social participation, not just a functional dimension.

3.2. Concept of AI literacy

It is necessary to understand AI technically and socially due to the change from digital technology that assisted humans to AI technology similar to humans, and it is now becoming a necessity. In line with this trend of the times, the concept of AI literacy has emerged. However, efforts to recognize and research the importance of science and technology education such as Science, Technology, Engineering, and Mathematics (STEM) education in the United States have increased. However, literacy education on AI tends to be neglected. Now, understanding AI is essential as a subject that designs our lives that coexist with AI, and education for this is AI literacy education. The goal of literacy education is the basic ability to enjoy freedom of life in our society by understanding the medium for changing communication and the society in which the medium changes. In other words, it means not being restricted by your job and not being biased or misjudged due to restrictions on access to information and difficulties in interpreting symbols by using the same symbol in society and culture.

AI literacy refers to adapting to cultural changes and acquiring the necessary knowledge in the era of redefining humans in the AI era, and aims to cultivate the ability to design one's future and design one's life. In addition to the functional ability to understand and utilize AI technology, AI literacy includes the ability to critically understand the AI era and the ability to use it to predict the new world that AI will create. It is necessary to be able to read social symbols that AI is used through basic mathematical learning to understand AI principles (Reading), and to be incorporated into the society of one's desire (Writing) due to the use of AI, to be able to critically think about social phenomena in the AI era. The most important purpose of AI literacy is to enable social understanding beyond functional understanding of AI, and to cultivate the ability to understand and accept both positive and negative logic within the social context in which AI is used through education for critical thinking. In summary, AI literacy is the ability to understand and utilize AI technology media, as well as the ability to communicate with society and to think critically about AI society through this.

3.3. Applications of AI literacy

In order to design ChatGPT communication capacity improvement education and AI literacy education, it

is necessary to look at SW education and AI education conducted by domestic universities. By benchmarking SW education and AI education, which are being conducted as liberal arts education, and major education, we want to find a solution to design ChatGPT education and AI literacy education in universities.

SW education at domestic universities can be classified into education for SW non-majors and education courses for SW majors. The first is a curriculum to cultivate experts through convergence -linked majors, and the second is a curriculum with expertise from basic computer science to AI knowledge for SW majors. Recently, universities are strengthening their efforts to improve SW capabilities of all students by strengthening basic SW education and adding SW-related subjects, and by opening a linked - convergence major track, they are expanding opportunities for not only SW majors but also non-majors to major in AI. It is difficult to find examples of AI education at the basic level of SW education, and AI introduction or AI understanding courses are opened and taught at the liberal arts level, and AI tracks or AI departments are newly established to train professional AI personnel at the expert level of education. In addition, basic SW education enhanced by university is ubiquitous, focusing on computing thinking skills, focusing on subjects to improve SW competency. In particular, when analyzing the case of operating basic SW courses at domestic SW-centered universities, basic SW education consists of subjects that are difficult to link with AI education, and research on the development of liberal arts-level subjects for SW non-majors is insufficient. It is difficult to find an educational case for teaching professional AI programming with a liberal arts-level subject, and it is only a one-time education at the level of introduction to AI. However, AI tracks or AI departments open basic computer science/major courses such as basic mathematics, data structure and algorithms, probability and statistics, and operating system courses to educate, and educate professional competencies that AI experts should have, such as ML, DL, natural language processing, computer vision, pattern recognition, and human-computer interaction.

AI literacy liberal arts education has the characteristics of convergence liberal arts education, and the importance of convergence education has been the most important topic in education since industrial results were achieved through the combination of technology and humanities. As pointed out that university convergence liberal arts education has cross-completion characteristics, discussions on 'convergence education' are still ongoing. AI literacy liberal arts education aims to comprehensively learn not only the scientific understanding of AI technology medium but also the understanding of AI's social impact. As we have seen in the cases of domestic SW education and AI education described above, education on AI currently consists of education for the use of AI technology, and humanities education can only be found in 'AI and ethics'. Even this is being discussed at the level of science, , and ethics, and it has not been widely discussed in terms of the impact of AI on humans and society. In addition, the approach is mainly engineering-based majors, and humanities majors are seen as simple SW education. However, AI has a great influence on humans and society and used by individuals for only engineering majors to learn and understand. Therefore, in order to cultivate convergent talents through convergence education, which is the goal of education, it is necessary to mutually learn AI and AI society that both humanities and engineering majors can communicate, and AI literacy education should be conducted within university liberal arts education.

4. Design for educational competency using ChatGPT

In order to design educational competency using ChatGPT, we would like to examine the misunderstandings and limitations of GPT and design a plan to apply ChatGPT education to universities.

4.1. Misunderstandings and limitations of GPT

The user's input requesting ChatGPT is called a prompt, and if you are talking with the prompt, you can feel as if ChatGPT is learning in real time. ChatGPT responds by considering the previous question and the previous conversation whenever it answers, so ChatGPT cannot already remember when using it after accessing it again later. Since ChatGPT is a model that has been learned based on 2021 data, it should be recognized that no subsequent data has been learned. Even if ChatGPT has learned data up to 2021, there may be data that has not been learned, and even if it is learned data, it is not a structure that brings the original text as it is like the existing search engine. In other words, it is not appropriate to ask ChatGPT a question that is important in reality (truthfulness) because it is knowledge that corresponds to common sense to people, and knowledge that can be easily found through search engines (Naver, Google, etc.) is likely to give wrong answers. Language models are weak at solving problems related to numbers because they are basically a model that writes text by selecting the words that are most likely to come next. Attempts to solve numerical problems through ChatGPT may not achieve good results, so it should be used with in mind that numerical information may be incorrect in the text generated by ChatGPT. One of the characteristics of the language model is to complete the most likely answers, but does not have the ability to judge whether the answers are true or false. Although contextually plausible, the phenomenon of generating by mixing false facts is called Hallucination. Hallucination has been pointed out as a problem not only in ChatGPT but also in many language models, and care should be taken when it is important to use it. In other words, you should not completely rely on ChatGPT, such as writing a report, writing a thesis, or diagnosing a doctor.

4.2. Plan design for applying ChatGPT education to universities

Within the university's liberal arts college, a subject called 'MS's Office Application Using ChatGPT' is opened to educate students on basic office knowledge and provide a direction for corporate work efficiency using ChatGPT so that university students can help the company in its practice. For example, after acquiring MS's basic usage of Office, after learning the basic usage for Visual Basic for Application (VBA), which can help improve office work efficiency, ChatGPT can be applied to Excel, PowerPoint, and Word. ChatGPT has the ability to program in a variety of programming languages, including Python, JavaScript, Java, and C++. ChatGPT also presents direct answers to what developers had to look for through trial and error through search engines, such as how to install programs, find causes of errors, correct errors, and write simple codes. In engineering, a subject called 'Python Programming Application Using ChatGPT' is opened to use ChatGPT as a supplement to lectures, and professors provide personalized guidance and support to students. In the future, companies are expected to use ChatGPT for basic (simple repetitive) programming and choose development efficiency in a way that programmers do for core algorithms/logics themselves, so adopting a preemptive learning method of university education is also considered a good opportunity to declare universities' challenging and practical convergence education method internally and externally.

How to conduct the class by dividing the role of ChatGPT and the role of teaching and learning is as follows. First, ChatGPT can be used to introduce the basic concepts of Python programming, such as syntax, data type, and control structure to students. However, when students are new to Python, the professor's guidance is required so that the professor explains the basic concepts of Python and allows students to embody it in basic knowledge. Second, ChatGPT can be used to answer general questions students may have about Python programming. For example, students can debug code for their own programming or seek help with ChatGPT for specific library usage. When professors debug each student's code in the field, there are often cases where the normal progress of the class may not be performed. Therefore, ChatGPT will be able to help students

through personalized feedback. Third, the professor's role is to play the role of facilitator/coordinator to facilitate discussions and projects that help students learn Python. It should not be thought that ChatGPT replaces the role of professor. In other words, although ChatGPT may be a useful tool, it cannot provide the same level of support, guidance, and educational philosophy for AI literacy as professors can. Therefore, the role of university professors is to instill self-consciousness so that individuals can make decisions through students' critical thinking skills by using ChatGPT as a supplementary material for lectures and providing personal guidance and support to students.

5. Conclusions

It is necessary to consider what virtues University students should have in the wave of AI. In particular, it is necessary to study guidelines to establish a basic direction of use for Generative AI, including ChatGPT, and apply it in the educational field. In addition, since ChatGPT's knowledge management method can be seen as learning data provided from humans and reorganizing it into natural sentences and writings rather than developing knowledge creatively, it is also necessary to improve the ability to judge the authenticity based on critical thinking skills for ChatGPT's response. Therefore, it is important to consider AI literacy, which is the ability to critically operate the contents organized by AI, along with the ability to communicate with AI, and it is time to think about how to apply AI literacy in our educational field.

The core purpose of this study is to improve our students' preemptive practical skills through maximizing the utilization plan of ChatGPT and to embody critical thinking skills about AI literacy to learn to accurately judge their decision-making. Due to this necessity, students' opinions and research were conducted in class on how to cultivate students' AI literacy through the technical background of ChatGPT and communication for the use of ChatGPT through the analysis of ChatGPT trends of domestic and foreign companies. When a company intends to launch a function, product or service to the market, it does not immediately launch a product on the market, but examines the response of customers, finds improvements after feedback, and releases them to the market. Now, it is necessary to apply the Agile methodology to education. It is believed that universities will be able to grow more competitively than 他 University in the current situation where the school-age population is decreasing by quickly applying it to classes in line with changes in the education market and finding improvements when problems arise and continuously improving the quality of education.

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