

Utilization of GPT-4 to Improve Education Quality Through Personalized Learning for Generation Z in Indonesia

Muhammad Fatihul Firdaus¹, Joseph Nugraha Wibawa², Fajri Fathur Rahman³
Faculty of Computing
President University
Bekasi Indonesia

muhammad.fatihulfirdaus@student.president.ac.id, joseph.wibawa@student.president.ac.id, fajri.rahman@student.president.ac.id

Abstract— The Golden Generation or Generation Z, an important part of the 2020-2035 demographic bonus, will face unique educational challenges, such as low literacy rates and uneven access to technology across regions[1]. To support the potential implementation of personalized learning for Generation Z in Indonesia, a research study was conducted to investigate the potential use of GPT-4, an artificial intelligence that uses the GPT language model and the latest Natural Language Processing (NLP) technology. Quantitative, qualitative, and literature study research methods were used to evaluate the effectiveness and accuracy of GPT-4 in the Indonesian educational context. Data was collected from sample testing and reference to previous GPT-4 research, and results were analyzed using predefined evaluation methods. The results of the analysis showed that there was an improvement in terms of coherence and knowledge with the GPT-4 model compared to previous models. To maximize the potential of GPT-4 in education, there needs to be strong support from various parties, as well as efficient adaptation to the specific needs of students and the educational environment in Indonesia [2]. With an integrated approach, ethics, and safety, GPT-4 has the potential to support inclusive and effective education for Generation Z in Indonesia.

Keywords— GPT-4, Personalized Learning, Artificial Intelligence, Education in Indonesia, Generation Z.

I. INTRODUCTION

A. Background of Problem

Education is the backbone of a thriving society, shaping the future of nations [3]. In Indonesia, a significant challenge lies in tailoring the education system to meet the unique needs and preferences of Generation Z. This generation, having grown up in the digital era, interacts with information and learning in ways that traditional education methods may struggle to accommodate. They are accustomed to having a world of knowledge at their fingertips, learning on their own terms, anytime and anywhere. The conventional classroom model may not fully engage or motivate these digital natives [4]. Instead, a learning approach that is personalized to each student's needs, preferences, and skills could better resonate with Generation Z, leading to a more engaging learning experience and improved outcomes [5].

Emerging technologies, such as the GPT-4 artificial intelligence model, offer potential solutions to this challenge. GPT-4 has demonstrated potential in various applications, including personalized learning. Yet, its application within the Indonesian education system is still in

its infancy and largely unexplored. This study seeks to delve into the potential of GPT-4 in enhancing Indonesian education quality through personalized learning experiences designed for Generation Z. The aim is to bridge the gap between traditional education practices and Generation Z's learning preferences, thereby enhancing their engagement and learning outcomes.

Personalized learning, which adapts the learning experience to each student's individual needs, preferences, and skills, can offer a more engaging and interactive learning experience. However, scaling personalized learning can be challenging due to the need for individualized instruction and feedback. This is where GPT-4 can play a pivotal role. For instance, GPT-4 could offer personalized feedback, suggest learning resources tailored to the learner's interests and skills, or even act as a virtual tutor [6], [7].

This study will explore the potential of GPT-4 in the context of personalized learning within the Indonesian education system. It will investigate how GPT-4 can be implemented to cater to Generation Z's learning preferences and needs, and how it can be used to enhance the quality of education in Indonesia. The insights gained from this study could be invaluable for educators, policymakers, and researchers interested in leveraging artificial intelligence for personalized learning. The ultimate goal is to contribute to improving the quality of education in Indonesia, by providing a more engaging and effective learning experience for Generation Z learners.

B. Problem Scope

Given the complexity and breadth of the topic to be discussed, the research team will limit the scope to specific aspects within the context of education, Generation Z, and the implementation of ChatGPT in the education system in Indonesia. The problem statement for this research includes the following limitations:

1. Focus on the generation born in 1995 and onwards [8], considering their significant role in the future of education in Indonesia and the upcoming demographic bonus [9]. 2. The application of ChatGPT as a supporting tool for learning, particularly in personalized learning aspects. 3. This research will cover the negative, positive, threats, and opportunities of using ChatGPT in the realm of education.

4. The implementation of educational technology, specifically ChatGPT, will be analyzed in terms of infrastructure and accessibility.

C. Problem Statement

Based on the aforementioned background of the issue, the researcher can formulate the problem as follows: 1. How can the implementation of ChatGPT as a learning support tool be adapted to accommodate the needs and challenges faced by Generation Z in Indonesia, considering the differences in social, economic, and infrastructural situations across various regions?

2. What are the potentials and limitations in utilizing ChatGPT as a learning platform for Generation Z in Indonesia?

3. How can the implementation of technology such as ChatGPT enhance the effectiveness of the learning process, enabling learners and educators to receive personalized instruction tailored to individual abilities?

D. Research Objectives

The objectives of this study are as follows:

1. To identify methods and strategies for implementing ChatGPT in the educational context of Indonesia, taking into account the needs and challenges faced by Generation Z, as well as the variations in social, economic, and infrastructural conditions across different regions.

2. To assess the potentials and limitations in utilizing ChatGPT as a learning platform for Generation Z in Indonesia, thereby providing recommendations for improvement and enhancement in its utilization.

3. To examine how the use of technology such as ChatGPT can enhance the effectiveness of the learning process, while providing support for learners and educators to focus on research and study activities that contribute to new discoveries and advancements in the field of knowledge.

The objective of this research is expected to provide information and insights regarding the implementation of ChatGPT in the educational context of Indonesia. Furthermore, it aims to provide recommendations and solutions to overcome various challenges encountered in the utilization of this technology.

E. Research Benefits

The implications of this research are far-reaching, extending to various stakeholders in the education sector [10]. For the government and policymakers, the findings of this study could serve as a wake-up call, underscoring the

potential benefits and possibilities of incorporating technologies like ChatGPT into the education sector. The goal is to prompt them to consider the potential of such technologies in shaping the future of education in Indonesia.

Educational institutions and educators also stand to gain valuable insights from this research. The study is expected to shed light on the potential and challenges of implementing ChatGPT as an effective learning support tool. It aims to guide educators in adapting their teaching methods and strategies to harness the full potential of ChatGPT, thereby enhancing the quality of education for Generation Z.

For researchers and academics, this study could serve as a springboard for further research into the application of educational technology, particularly ChatGPT. It contributes to the body of knowledge on personalized learning using advanced technologies, enriching the existing literature and studies in this field.

Finally, for the general public, this research aims to raise awareness about the importance of educational technologies such as ChatGPT. It underscores the role of such technologies in improving the quality of education in Indonesia, thereby fostering public support for their adoption and use.

II. LITERATURE REVIEW

A. Definition of ChatGPT

ChatGPT is an artificial intelligence chatbot developed by OpenAI, an artificial intelligence research laboratory consisting of the non-profit foundation OpenAI Foundation and the for-profit limited partnership OpenAI Limited. ChatGPT was launched on November 23, 2022, and is built on OpenAI's GPT-3 family of large language models (LLMs) [11]. ChatGPT works by predicting the most likely next word in a sentence based on prompts and previous chat history. Although chatbots have been around for a long time, the arrival of ChatGPT has been considered a significant turning point in the development of artificial intelligence applications and has become a rapidly adopted technology in the Internet era [12].

GPT is a language model developed by OpenAI that is capable of generating response text that is virtually indistinguishable from natural human language [13]. The concept behind GPT was refined through a two-step process: generative, unsupervised pre-training using unlabeled data and discriminative, supervised tuning to improve performance on specific tasks [14], [15]. During the pre-training phase, the model learns naturally, similar to the way one might learn in a new environment, while the tuning phase involves more directed and structured refinement by the creators [16], [17].

GPT technology is a powerful tool for NLP (Natural Language Processing) tasks [17], but it has its limitations. One of the main limitations is that GPT models are based on statistical approaches that learn patterns from large text datasets, which can retain biases and stereotypes present in the data [18]. This means that the model might produce offensive or harmful output.

B. Example of Artificial Intelligence Application

1. Khanmigo

Khanmigo is an artificial intelligence (AI)-based guide developed by Khan Academy, a non-profit educational organization. Khanmigo aims to replicate the one-on-one tutoring experience by providing customized support, encouraging critical thinking, and suggesting relevant resources. Khanmigo can also help teachers with lesson planning and providing feedback to students. Khanmigo is still in the experimental stage and can only be accessed by a limited number of users who meet certain requirements. Khanmigo can be used to help students as a virtual tutor and

as a debate partner. Teachers can also access it to generate lesson plans and help with other administrative tasks. Part of the purpose of the pilot launch is to determine what the demand is for the tutor and how educators and students are using it.

2. Duolingo

Duolingo Max is a new subscription service from Duolingo, a popular language learning app. Duolingo Max offers two new features powered by artificial intelligence (AI), namely Explain My Answer and Roleplay. These features use OpenAI's GPT-4 technology, which is the latest and most powerful generative technology.

Explain My Answer provides feedback and explanations on the user's answers in the lesson, whether they are correct or incorrect. Users can tap the button after certain types of exercises to enter a chat with Duo, the Duolingo mascot, and get a simple explanation of why their answer was right or wrong, as well as ask for further examples or clarification.

Roleplaying allows users to practice real-world conversation skills with in-app characters. These challenges, which award XP (experience points), will live alongside the path as one of the "Side Quests" that users can access by tapping on the character. Users might discuss future vacation plans with Lin, order coffee at a cafe in Paris, shop for furniture with Eddy, or ask a friend to go on a hike. While users aren't actually talking to a live human, the AI behind the feature is responsive and interactive, meaning no two conversations are exactly the same. After the interaction, users get AI-based feedback from Duo about the accuracy and complexity of their response, as well as tips for future conversations.

C. Education Policy in Indonesia

In the era of Society 5.0, people are faced with various challenges and social problems that are increasingly complex and require a holistic approach. Therefore, education has a central role in becoming an agent of change and creating a learning community that uses various learning resources through technology and information platforms and follows global curriculum developments by utilizing digital innovation. Education policy is the foundation for providing direction and clarity and becomes the legal basis for all education providers to participate in educating the nation's life [19], as stated in the Preamble of the 1945 Constitution:

1. Pursue the expansion and equalization of opportunities to obtain high-quality education for all Indonesian people towards the creation of high-quality Indonesian human beings with a significant increase in the education budget.

2. Improve academic and professional abilities and improve the welfare of education personnel so that educators are able to function optimally, especially in improving character and character education, in order to restore the authority of institutions and education personnel;

3. Improve the quality of educational institutions organized by both the community and the government to establish an effective and efficient education system in the face of developments in science, technology, and the arts;

4. Improving the mastery, development, and utilization of science and technology, including the nation's own

technology, in the business world, especially small, medium, and cooperative enterprises

Education policy in Indonesia has an important role in facing the era of society 5.0 by creating high-quality human resources, developing science and technology, and maintaining cultural values and character. Therefore, there is a need for synergy between the government, society, and all stakeholders in realizing quality, equitable, and inclusive education for the nation's next generation.

D. Generation Z

1. Definition of Generation Z

Generation Z or commonly called Gen Z, iGen or centennials refers to the generation born in 1996-2010 [20], which is the phase after the millennial generation or Generation Y [21]. Generation Z is the largest generation today and will play an important role in human resource development in the future. Also known as the Net Generation or Internet Generation, they are highly connected to technology and have unique characteristics that set them apart from previous generations [22]. The 2020 Census shows that the composition of Indonesia's population mostly comes from Generation Z / Gen Z (the generation born between 1997 and 2012) as much as 27.94% or 74.93 million. Meanwhile, the generation that has traditionally been the main mover of social movements in Indonesia, represents only a small portion of the Indonesian population, which is around 25.87% or around 69.38 million people. Gen Z has an important role to play in influencing the current and future development of Indonesia. Thus, nurturing their potential from now on through understanding Gen Z and its character, preparing a supportive education system and model, and opening up space for their opportunities in the professional world and industry [23].

2. Characteristics of Generation Z

In an article entitled 7 Unique Characteristics of Generation Z, several characteristics of Generation Z are mentioned:

a) Digital natives, Generation Z, are significantly different from previous generations in terms of technological

advancement. They grew up with digital technology and consider it a normal part of their daily lives. Therefore, Generation Z can more easily adapt to technological changes compared to previous generations.

b) Generation Z faces greater uncertainty than previous generations, such as the events of 9/11, international terrorism, and the impact of the 2007 financial crisis. They are aware of the realities of living with terrorism and are steeped in economic experiences that make them frugal and cautious. One of the characteristics of Generation Z is good financial knowledge; they have a clear financial orientation from an early age. They understand the importance of saving, investing, and being prudent in their financial management to avoid getting into debt.

c) Generation Z is known to be a highly creative and innovative generation. A survey shows that around 63% of them are interested in doing creative activities every day. This is influenced by their engagement in communities and social media, which is also a result of the rapid development

of technology. Generation Z was born in the era of smartphones and computer technology, so they are very familiar with digital technology. The survey also showed that about 33% of Generation Z spends more than 6 hours a day on their mobile phones, and they use social media more frequently than previous generations. In Indonesia, Generation Z even ranks the highest in cell phone usage, at around 8.5 hours every day [24].

III. RESEARCH METHODS

A. Research Approach and Type

Research methods are a series of structured or systematic ways used by researchers with the aim of getting the right answers to the question at the center of the research. Or, simply put, the meaning of research methods is an attempt to find out something with a systematic series. In this study, the author conducted research by applying three relevant research methods, namely:

1. Qualitative Research

Qualitative research is a research method that focuses on analyzing text and unstructured data. In this research, a series of data processing trials in the form of structured and unstructured text analysis were conducted on GPT-4.

2. Literature Study Method

Literature study research is a research method that focuses on collecting literature or scientific works that are relevant to the research topic. In the context of this research, literature collection is carried out on journals that contain the application of GPT-4 in education.

3. Quantitative Research

Quantitative research is a systematic research method that uses mathematical models. In this study, a series of trials were conducted for GPT-4. These trials included: 1) Working on SBMPTN general reasoning questions 2) Working on CPNS general reasoning questions 3) Working on mathematical reasoning questions for SBMPTN

4) Working on CPNS mathematical reasoning questions From the results of a series of trials, researchers compared the accuracy of GPT-4, GPT-3.5, and human answers

B. Data Type and Source

The types of data referenced in this study include primary and secondary data. Primary data is data obtained from sources such as observations, interviews, or surveys. Secondary data is data collected by others and reviewed to produce answers to the objectives of this research.

1. Type of Primary Data

The primary data in this study are the results of the compiler's observations about the use of GPT-4 in working on general and mathematical reasoning questions.

2. Secondary Data Type

Secondary data in this study were obtained from sources such as journals, articles, scientific publications, government reports, educational institutions, and related organizations related to educational technology, especially ChatGPT, as well as the role of Generation Z in the context of education. Information from the internet was also utilized

to support this research. Secondary data collection aims to provide a broader context of the problem under study and help researchers understand and evaluate the potential and challenges of utilizing ChatGPT as a learning tool for Generation Z in Indonesia.

C. Data Collection Techniques

In this research, the data collection techniques used include trials and literature studies.

1. Trial

The trial was conducted by testing the ability of GPT-4 in working on general and mathematical reasoning questions from SBMPTN and CPNS, and analyzing the comparison of GPT-4 answers to answers from teaching staff. This aims to assess the effectiveness and accuracy of GPT-4 in an educational context.

2. Literature Review

The literature review was conducted by collecting and analyzing literature relevant to the theme of this research, including journals, scientific publications and press releases. This activity is important to understand the broader context and support the researcher's analysis of the potential and challenges in implementing ChatGPT as a learning tool for Generation Z in Indonesia.

D. Validity and Reliability

In order to ensure the reliability and correctness of the premises and statements in this study, the researcher will take the following steps:

1. Triangulasi

Using multiple data sources and data collection methods, including English journals as well as official journals from OpenAI, to gain a broader perspective and ensure the validity of the research findings.

2. Peer review

Provide findings, analysis, and hypotheses to experts in related fields to ensure the truth and get constructive criticism, so that the research results are more accurate and accountable.

IV. RESEARCH RESULT AND DISCUSSION

A. Research Results

Based on the literature analysis method, researchers found several important findings on the application of ChatGPT-4 as a learning support tool in Indonesia: 1. ChatGPT-4's abilities in various fields such as literature, medicine, law, physics, and programming almost match human abilities. However, ChatGPT-4 has not yet reached expert level and does not have the capacity to conduct scientific research in these fields [25].

2. ChatGPT-4 shows an increase in expertise and understanding that is far superior to its predecessor [26]. 3. ChatGPT-4 hallucinates less than its predecessor model (ChatGPT-3.5)

4. ChatGPT-4 can answer difficult high school math questions and engage in conversations around advanced math topics [25].

5. ChatGPT-4 has passed a software developer-level programming exam and achieved a "job-ready" designation.

6. ChatGPT-4 produces top 10% top scores on SAT, UniformBar, AP .

7. Microsoft scientists tested GPT-4 in the legal field and gave a questionnaire to prosecutors or judges regarding GPT-4 answers without telling them that they were GPT-4 answers. As a result, most prosecutors or judges liked GPT

4's answers because they were factual, even though they sometimes had some errors.

8. The GPT-4 model has multimodal capabilities [27] (cross-system understanding); it can read the context of an image; it can find strange or funny things in an image; and it can analyze a graphic image [28].

9. ChatGPT-4 can make trivial mistakes, such as arithmetic calculations.

10. The ChatGPT-4 model is not immune to population biases, so the output may also be inaccurate and offensive. To reduce this possibility, technology developers should pay attention and minimize the biases in the model from the beginning. In addition, regular evaluation and further testing should be conducted to ensure the accuracy and safe use of ChatGPT-4 technology.

11. ChatGPT-4, especially in math, can mention formulas and methods in detail. However, in the calculation process, it is

often incoherent and inconsistent with the supposed numbers and formulas. Therefore, there is a need for continuous evaluation and improvement to increase the accuracy of the model and reduce the possibility of errors in its use.

Based on the quantitative analysis method that the researcher tested himself, the researcher found several interesting things, such as:

1. The GPT-4 model excels in mathematical reasoning and general reasoning. However, it is weak in quantitative problems, the usual mistakes made by GPT-4 are trivial errors in the form of arithmetic calculations (multiplication, division, addition), but the GPT-4 model has done the problem in the correct way.

2. After being tested with various SBMPTN questions, researchers found that the GPT-4 model has an accuracy on general reasoning questions of 80%, mathematical reasoning of 80%, and quantitative reasoning of 50%. This is much better than the GPT-3.5 model, which only has an average accuracy of 43%.

3. The GPT-4 model will show less accurate performance when answering questions in Indonesian compared to English. This is due to the much more limited amount of training data in Indonesian.

Based on the qualitative analysis method that researchers tested and some literature as a reference, researchers found several things that can greatly help the learning process: 1. The GPT-4 model is able to summarize complex and non-complex journals very well.

2. The questionnaire conducted by the researcher showed that people preferred the explanation made by GPT-4 to the teacher's explanation.

3. The GPT-4 model can make analogies or explanations that are easily understood by most people and can provide countless analogies.

4. The short memory of GPT-4 can make the model incoherent if there are too many inputs.

B. Discussion

In the context of education in Indonesia, the implementation of ChatGPT as a learning support tool offers various potentials and challenges that Generation Z needs to face. In terms of potential, ChatGPT can assist educators in providing subject matter, assignment assistance, and even serving as a virtual assistant for students [29]. In addition, AI technologies such as ChatGPT can improve the effectiveness and efficiency of education by enabling the use of customized learning strategies, improving accuracy, and generating more reliable predictions about student achievement [30]. Examples of apps such as Duolingo Max and Khanmigo show how AI can be used to provide learning that is tailored to students' individual needs and abilities.

However, the implementation of ChatGPT also poses some challenges. One of them is the difference in social, economic, and infrastructure situations in different parts of Indonesia. To overcome these challenges, policymakers need

to design policies on procedures for using ChatGPT that suit local conditions and develop Human Resources (educators) to understand the conditions of science and technology development. In addition, it is necessary to socialize how educators respond to the use of ChatGPT wisely so that they are not complacent and fall into unethical and immoral use [31].

In improving the effectiveness of the learning process, the application of technology such as ChatGPT can help learners and educators receive learning that adapts to their individual abilities. AI-based learning systems such as Khanmigo and Duolingo Max offer customized support, encourage critical thinking, and suggest relevant resources, thus assisting students in developing the knowledge and skills sought by employers [32].

One of the advantages of AI in education is its ability to identify students' weaknesses and strengths and provide timely and relevant feedback. In addition, according to Loeck, AI can also help reduce teachers' workload by automating administrative and evaluation tasks. However, it is important to remember that AI cannot replace the important role of the teacher in the learning process but should serve as a complementary and supportive tool.

The use of ChatGPT in an educational context also raises questions about data privacy and security. Therefore, it is important for the parties involved to ensure that student and teacher data is properly protected and used ethically.

In addition, it needs to be recognized that AI technologies such as ChatGPT still have limitations, such as difficulties in understanding the context and nuances of language, as well as potential biases that may exist in the data used to train AI models. Therefore, it is important for educators and students to be aware of these limitations and use ChatGPT as one source of information, not as a sole source.

V. CONCLUSION

A. Conclusion

Based on the above discussion, it can be concluded as follows:

1. The implementation of ChatGPT as a learning support tool in Indonesia can be adjusted to accommodate the needs and challenges of Generation Z by designing policies on ChatGPT usage procedures that are in accordance with local conditions, developing Human Resources (educators) who understand the conditions of science and technology development, and utilizing AI-based applications tailored to the needs and abilities of individual students such as Duolingo Max and Khanmigo.

2. The potential of utilizing ChatGPT as a learning tool for Generation Z in Indonesia includes increasing the effectiveness and efficiency of the learning process, the ability to provide materials tailored to the individual needs of students, and support in various fields such as mathematics, literature, medicine, law, physics, and programming. Meanwhile, limitations include trivial errors in arithmetic calculations, biases in the model, and limitations in quantitative reasoning and understanding of the Indonesian language.

3. The application of technology such as ChatGPT can improve the effectiveness of the learning process by understanding learners' individual strengths and weaknesses, and providing timely and relevant feedback. Through identifying students' specific needs, ChatGPT can suggest appropriate learning strategies, encourage critical thinking and suggest relevant resources. This allows learners and educators to receive personalized learning, making the learning process more efficient and effective. In addition, ChatGPT can also reduce teachers' workload by automating administrative and evaluation tasks, allowing them to focus on other important aspects of the learning process. However, it should be kept in mind that this technology should serve as a supportive tool that complements and supports the role of teachers, not replace their role in the learning process.

B. Suggestions

1. ChatGPT-4 can be used as a learning support tool, especially in the areas of mathematical reasoning and general reasoning. However, it should be noted that while ChatGPT-4's capabilities are almost equal to those of a human, it cannot replace the role of a teacher or lecturer entirely.

2. ChatGPT-4 still has weaknesses, such as trivial errors in arithmetic calculations and a tendency towards population bias. Therefore, the results provided by ChatGPT-4 need to be constantly corrected and checked for correctness.

3. ChatGPT-4 is superior in English to Indonesian because the amount of training data available in Indonesian is still limited. Therefore, further research and development of the model in Indonesian are needed.

4. The ChatGPT-4 model can help the learning process by summarizing journals and works and making analogies that are easy to understand. However, its use needs to be tailored to students' needs and skills.

5. Although ChatGPT-4 has not yet reached the expert level, its capabilities are quite impressive. Therefore, further development is needed to improve the capabilities and quality of ChatGPT-4.

6. As a user, it is necessary to have the skills to select the information obtained from ChatGPT-4 and check its veracity carefully. In this case, the role of the teacher or lecturer is still needed as a leader and supervisor in the learning process.

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