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Research Paper

Empowering Education: Harnessing AI for Society 5.0

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Abstract
Era Society 5.0 emphasized the concept of humanized technology due to the necessity of a society that genuinely integrates the physical and virtual worlds. The implication of modern technology in the era of Society 5.0 covers Artificial Intelligence (AI), robots, and the Internet of Things (IoT). The involvement of modern technology has been applied in three primary sectors; economics, industry, and education to support the needs of society. Applying modern technology based on Artificial Intelligence (AI) for educational purposes is interesting yet challenging. This research aims to study and compare the two tools of Artificial Intelligence based on their functions, features, and safety, namely Google Bard (now renamed Gemini) and ChatGPT. Therefore, the method used in this research is a comparative study using practical and literature studies as the primary data. The results highlight ChatGPT's outstanding effectiveness in creating content, generating code, translating languages, and offering clinically accurate answers, despite Bard's notable potential showcased in its unique features. This finding can give a new insight and better understanding of technology literacy for educational practitioners to conduct future research viewing from different perspectives.

Keywords *Artificial Intelligence, ChatGPT, Google Bard, Education, Gemini, Language Model*

INTRODUCTION

Realizing Society 5.0, which focuses on technology-minded people, has become the most crucial concern recently, it aims to be human-centered where people are at the center of all decision-making, and where the economy is designed to serve people that focus on solving social issues, such as poverty, inequality, and climate change while also growing the economy. This society prioritizes human well-being and combines economic progress with effectively tackling societal issues through a closely intertwined network of virtual and tangible domains. Technology is used to integrate cyberspace and physical space in ways that improve people's lives. According to (Suwandi, 2019), the concept of Society 5.0 was first introduced in Japan in 2016 and has subsequently spread worldwide, with its underlying idea continually evolving. Society 5.0 is a term employed by the Council for Science, Technology, and Innovation under the Japanese government's Fifth Science and Technology Basic Plan. It denotes a smart society that seamlessly blends the physical and virtual realms. Although its primary focus is humanity, Society 5.0 envisions a novel societal framework in which science and technology significantly address urgent social problems while promoting economic growth. Subsequently, to embrace Society 5.0, particularly within education, society must confront certain obstacles. This process can commence by shifting the mindset that associates intelligence with the capacity for critical thinking, creativity, and the ability to tackle intricate problems (Puspita Yessi; Astuti, Sri; Novianti, Sri, 2020).

Critical thinking can be defined as the mode of thinking in which an individual enhances the

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quality of their thought process by skillfully taking control of the inherent thinking structures and applying intellectual standards to them. Creativity, on the other hand, refers to the capacity to generate or recognize ideas, options, or potentials that could prove valuable in problem-solving, effective communication, or related endeavors (Franken, 1994). Solving problems involves the ability to comprehend an issue and devise an intelligent solution by combining logical reasoning and imagination. This process aims to create solutions that are beneficial in anticipating future challenges and taking measures to prevent or mitigate their consequences. Previously, several research have been conducted in the field of current Artificial Intelligence (AI)-based applications that focused on certain selected AI-based tools. Singh et al. (2023) in their article reviewed three AI-based applications; Google Bard, which is now known as Gemini, ChatBot, and ChatGPT, while Ahmed et al (2023) investigated Google Bard and ChatGPT in the form of their performance viewing from technical perspectives. Another study in AI-based applications have also been conducted by Doshi et al. (2023); Giannakopoulos et al. (2023); Waisberg et al. (2023), however, mostly discussed about the use of AI applications as the virtual assistance in medical field and only few study focused in the educational field, such as research by da Silva & Ulbricht (2023); Kristianti (2023); and Motlagh et al., (2023).

This research aims to study and compare the roles of Artificial Intelligence (AI)- based applications as supportive tools for educational purposes. The researcher limited the study only to the applications that can afford the needs of today's educational practitioners. ChatGPT and Google Bard, which now is transformed as Gemini, were chosen due to its popularity, adaptability, and suitability. Therefore, this research focused on three aspects to discuss; features, functions, and safety based on the researcher's experiments.

LITERATURE REVIEW

Recent years, the educational practitioners face certain challenges in applying AI-based technology as the virtual assistance, yet they found it is interesting. The primary obstacle relates to the limited familiarity of educational resources (including teachers, students, and parents) with technology, particularly in areas where internet access remains unreliable. Secondly, there is a pressing need to advance Digital Literacy 5.0, as proposed by Suwandi (2019). Digital literacy involves an individual's capacity to discover, analyze, and proficiently communicate information across diverse digital platforms and media channels. Thirdly, fostering lifelong learning is equally imperative. According to Wabisabi Learning (Lee Crockett, 2020), the key to effectively promoting lifelong learning is to embody it oneself. Lifelong learning entails a deliberate and enjoyable pursuit of knowledge throughout life. LLCQ, as referenced in Lee Crockett (2020), outlines four pillars of lifelong learning: learning to know, learning to do, learning to live together and with others, and learning to be. When embraced effectively, this form of learning can unleash student creativity. Achieving such an approach is feasible when educators can select, design, and implement innovative and practical teaching methodologies that cater to the unique needs of their students.

In essence, both Industrial Revolution 4.0 and Society 5.0 share numerous similarities, with Society 5.0 distinguished by its more intentional and conscious utilization of technology. While the fourth industrial revolution focuses on advancing individuals through technology accessibility, Society 5.0 incorporates technology more profoundly into human life. To effectively embrace the Society 5.0 era, particularly in education, it's essential to perceive challenges not as hindrances but as catalysts for thorough preparation. These preparations should equip educators to transition into a new era where technology and humanity collaborate to enhance human experiences, emphasizing human-centric approaches. The application of digital technology in education during the Society 5.0 era plays a pivotal role in enhancing the quality of the education system. Integrating technology in education has become a crucial pathway to achieving educational objectives, particularly during the pandemic. Educators have had to excel in integrating learning materials with technology to

facilitate learning effectively. Various online platforms such as ZOOM or Google Meet have been utilized to support online learning during the pandemic. Google, renowned for its search engine capabilities, offers several features tailored to users' needs, including Google for Education. Google for Education is a service provided by Google, enabling educational institutions to customize various Google products using their own domain names. This service encompasses a variety of web applications that provide functionalities similar to traditional office software suites. Among the included applications are Gmail, Hangouts, Meet, Google Calendar, Drive, Docs, Sheets, Slides, Groups, News, Play, Sites, and Vault. These tools are specifically designed to facilitate communication, collaboration, and document management within educational settings. Google Workspace for Education is offered free of charge and provides the same storage capacity as other Google Workspace accounts, exclusively available to educational institutions. Moreover, Google Workspace for Nonprofits is extended to accredited 501(c)(3) nonprofit organizations at no cost, also offering the same storage capacity (Wikipedia contributors, 2023). In addition to these primary applications, Google presents the Google Workspace Marketplace, an app store catering to Google Workspace users. This marketplace hosts a variety of apps, both free and paid, which users can install to further customize and enhance their Google for Education experience, tailoring it to the specific requirements of educational institutions.

Over the past eight decades, Artificial Intelligence (AI) has been introduced to provide human-like assistance in entertainment and education sectors. AI refers to the simulation of human intelligence processes by machines, particularly computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition, and machine vision. The development of AI relies on specialized hardware and software for creating and training machine learning algorithms. Although there isn't a single programming language exclusively associated with AI, several languages are favored by AI developers for their specific features. These languages include Python, R, Java, C++, and Julia, each offering unique advantages and tools tailored to the needs of AI development (Burns, 2023). According to Burns (2023), AI programming encompasses several cognitive abilities, including the following main components. First, learning involves the acquisition of data and the establishment of algorithms to transform this data into actionable information. These algorithms provide step-by-step instructions for computing devices to effectively execute specific tasks. Second, reasoning entails the selection of the most suitable algorithm to achieve a desired outcome, making logical decisions based on available information and objectives. Third, self-correction incorporates mechanisms for continuous improvement of algorithms over time, ensuring they produce accurate and reliable results and adapt to changing circumstances. This aspect is vital for enhancing performance. Fourth, creativity involves leveraging various techniques such as neural networks, rules-based systems, and statistical methods to generate innovative content like images, text, music, and ideas. This aspect explores machines' ability to produce creative outputs, often pushing the boundaries of creativity in various domains. AI holds significant importance due to its potential to revolutionize lifestyles, work environments, and leisure activities. Its applications in various industries have demonstrated effectiveness in automating tasks previously performed by humans, including customer service, lead generation, fraud detection, and quality control.

In many cases, AI outperforms humans, particularly in handling repetitive, detail-oriented tasks, like the meticulous analysis of extensive legal documents to ensure accurate data entry, often completing these tasks quickly and with minimal errors. One of AI's key advantages is its ability to process vast datasets, providing businesses with valuable insights into their operations that might otherwise remain undiscovered. The ever-expanding realm of generative AI tools is poised to play a pivotal role in diverse fields, spanning from education and marketing to product design. AI's potential to streamline and enhance these areas has the potential to significantly impact its function in the modern world.

As one of the most transformative technologies in the current era, Artificial Intelligence (AI) has potential impact spans a wide range, from aiding doctors in early disease detection to making information accessible to people in their own languages. AI not only benefits individuals but also empowers businesses and communities, unlocking new opportunities that have the capacity to enhance the lives of billions. The word Artificial Intelligence refers to the main idea of how machine, as the brain works, thus, the experts refer to Augmented Intelligence (AI) as the assistance of Artificial Intelligence technology for Education since it is collaborated with human as the main decision maker. Augmented Intelligence is a design pattern for a human-centered partnership model of people and artificial intelligence (AI) working together to enhance cognitive performance, including learning, decision making and new experiences (Information Technology Glossary, 2023).

Since then, Google has consistently poured resources into AI across diverse fields, with both Google AI and DeepMind pushing the boundaries of what's achievable. Currently, the scale of the most extensive AI computations is doubling every six months, surpassing the growth rate forecasted by Moore's Law (Jacob Stoner, 2023). Concurrently, advanced generative AI and large language models have captivated the global imagination. AI holds the promise of transforming various facets of education. It can streamline the grading process, allowing educators to allocate their time to other essential tasks. Moreover, AI can evaluate students' performance and tailor learning experiences to their individual needs, enabling them to progress at their own pace. AI-powered tutors can provide additional support, assisting students in staying focused on their studies. These advancements have the potential not only to reshape where but also how students learn, and in certain instances, they may even substitute for specific teaching roles.

Under the umbrella of Augmented Intelligence, there are two types of educational applications available to support educators in their teaching and learning endeavors: Google Bard (Gemini) and ChatGPT. Google Bard, a complimentary tool within Google Workspace, enables educators to craft and distribute interactive learning materials such as quizzes and flashcards. Integrated with Google Docs and Gmail, it furnishes real-time student feedback and includes images as part of its content. Meanwhile, ChatGPT is a natural language processing tool driven by AI technology, facilitating human-like conversations, and aiding with tasks like composing emails, essays, and code in real-time, also offering image integration.

Moreover, generative AI models like ChatGPT and Bard can aid educators in developing course materials and engaging students in innovative ways, as they have demonstrated. The introduction of such tools also encourages educators to reassess traditional approaches to assigning homework and conducting assessments, prompting revisions to policies regarding plagiarism. The integration of AI in education signifies a significant shift in how educators approach teaching and learning, with the potential to enhance both the efficiency and effectiveness of educational processes.

RESEARCH METHOD

Traditionally, research methodologies are grouped into three primary categories: quantitative, qualitative, and participatory. Each of these approaches encompasses distinct philosophies, tools, and techniques, as outlined by researchers such as Bryman (2001) and Yin (1994). For instance, when conducting case studies, researchers often utilize data triangulation, which involves combining multiple data sources. Despite the common distinction between quantitative and qualitative evidence, Yin (2004) argues that this differentiation doesn't necessarily delineate various research strategies. According to Pikvance (2001), comparative analysis primarily aims to elucidate and deepen understanding of the causal processes behind the emergence of an event, characteristic, or relationship. To achieve this, researchers must scrutinize variations in one or more explanatory variables. While comparative research has a long-standing history, its contemporary resurgence is fueled by factors such as globalization and technological

advancements, which facilitate cross-national investigations (Azarian, 2011). Traditionally, comparative analysis has focused on elucidating both differences and similarities between phenomena. This approach aids in establishing relationships between two or more aspects and provides valid explanations for these differences and similarities. Nowadays, comparative research is conducted at various levels, be it regional, national, or across broader geographical boundaries, contingent on the specific subject or area of interest being examined.

Comparative analysis offers several methodologies, with Tilly (1984) outlining four types of comparative analysis, while May (1993, as cited in Azarian, 2011) presents additional typologies closely aligned with Tilly's categories. First, Individualizing Comparison involves contrasting a small number of cases to comprehend the unique characteristics of each case. Second, Universalizing Comparison aims to demonstrate that every instance of a phenomenon adheres to essentially the same rule. Third, Variation-Finding Comparison endeavors to identify principles of variation in the nature or intensity of a phenomenon by examining systematic differences between instances. Fourth, Encompassing Comparison situates different instances within the same system, ultimately explaining their characteristics based on their diverse relationships with the overarching system.

In this study, the researcher uses Qualitative Comparative Analysis (QCA) as the research method. Qualitative comparative analysis (QCA) is a method that blends qualitative and quantitative approaches to research, aiming to bridge the gap between case-oriented and variable-oriented studies. It offers a practical means to comprehend intricate real-world scenarios (Ragin,1987; Benoît Rihoux & Marx, 2013 in Cragun , 2016.). Dr. Charles Ragin originally created QCA for application in case study research involving small to medium numbers of cases (Ragin,1987). A comparative research method is employed since it's deemed the most suitable approach for measuring the effectiveness of two entities, namely Google Bard (Gemini) and ChatGPT, in supporting educators with their teaching and learning tasks. The comparative method involves analyzing an object of study in relation to another, often across different geographic locations or time periods, and can include both qualitative and quantitative analyses. Comparative research commonly employs two prevalent strategies: the "Most Similar Systems Design" and the "Most Different Systems Design." The former involves comparing very similar cases that differ in the dependent variable, with the assumption that this approach facilitates the identification of independent variables that explain the presence or absence of the dependent variable. Conversely, the latter strategy entails comparing highly diverse cases that share the same dependent variable, allowing any common circumstances among all cases to be considered as the independent variable. These approaches assist researchers in unraveling complex relationships and understanding the underlying factors behind observed outcomes.

Case studies prioritize in-depth contextual examination of a small set of events or circumstances and the connections between them, as described by Yin in 1994. Social research serves various objectives, with the primary ones being to enhance the comprehensibility of established facts, as highlighted by C. Ragin in 1997 and 2000.

Table 1. Contrasts between variable and case-oriented strategies of comparative analysis according to Ragin (1987)

Variable-oriented strategy	Case-oriented strategy
Seeks to achieve generality	Seeks to appreciate complexity
Tests propositions derived from general theories	Unravels the historical conditions that produce different historical outcomes
Seeks ‘probabilistic statements relevant to broadly defined categories’	Seeks ‘invariant statements relevant to more narrowly defined categories of phenomena’
Assumes quantitative causation	Assumes presence/absence causation.

	(see (Lieberson, 1994)

In this study, the researcher employed a case-oriented strategy as it concentrated on two categories of phenomena, namely the distinctions and resemblances between ChatGPT and Google Bard, to ascertain the structure of relationships between the variables. Two forms of comparative analysis were applied based on Pikvance's (2001) perspective: universalizing and differentiating analysis. Universalizing analysis emphasized the points of similarity, whereas differentiating analysis was utilized to delineate the discrepancies between the variables. A detailed description of these comparative analyses based on the starting point of differences and similarities is provided in Table 2.

Table 2. Comparative analysis
(adopted from Pikvance, 2001)

			End point: explanation in terms of	
	Principle of variation		**Principle of universality**	
Starting point:	Observed constructed differences	or	Differentiating comparative analysis	
	Observed constructed similarities	or		Universalizing Comparative analysis

This study concentrates on examining three primary areas—features, functionalities, and data security—between ChatGPT and Google Bard (Gemini) to discern both the differences and similarities.

FINDINGS AND DISCUSSION

As a comprehensive research study, this research elucidated the simultaneous dissemination of specific aspects of social phenomena within a population or sample in the context of technology. It entailed the categorization and distribution of these aspects within the population. The relationship between elements was established based on similarities and differences. The correlation between interdependent variables was elucidated through similarity coefficients, while the independent variables were analyzed based on differing factors, as depicted in Figure.

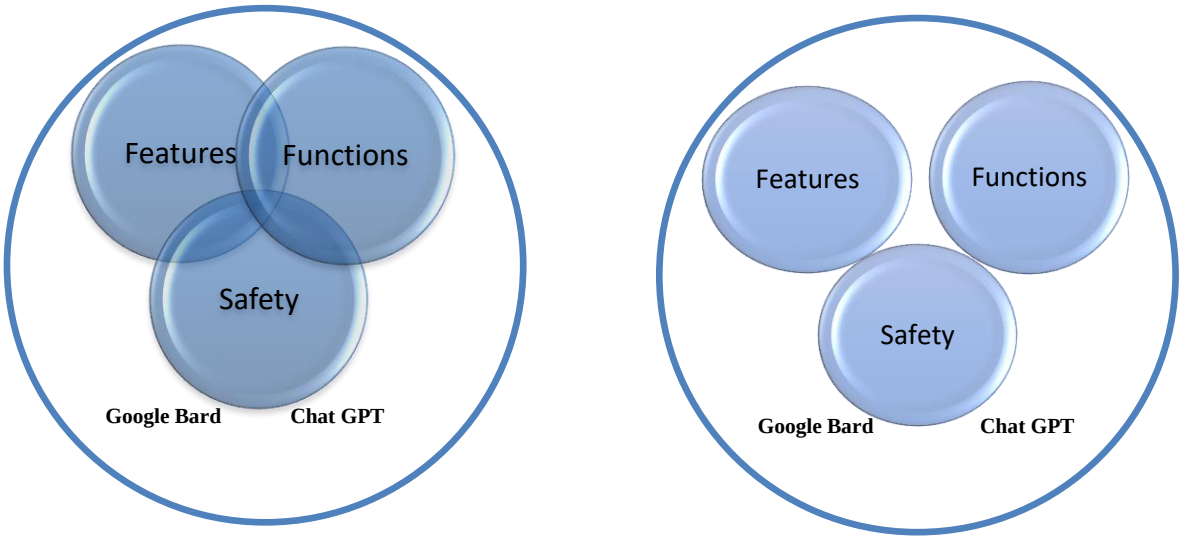

Figure 1. Interdependent and Independent variables analysis

According to Figure above, interdependent variables entail the examination of similarities between ChatGPT and Google Bard. These variables are influenced by factors such as features,

functions, and safety. Although these factors may stand alone, they exhibit correlations in terms of several similarities (refer to Table 3), which mutually support each other, thereby constituting them as interdependent variables. Conversely, independent variables are derived from the differences observed in ChatGPT and Google Bard regarding the same factors: features, functions, and safety. These variables are categorized as independent as they can function autonomously, and each variable may complement the others in specific ways.

For instance, ChatGPT offers a distinct user-friendly feature where users can directly share the link of chat prompt recap, akin to the functionality in the WhatsApp application. In contrast, Google Bard requires users to copy the link from the search engine, paste it, and then send it to the intended recipient. Additionally, Google Bard tends to be time-consuming; based on the researcher's experiment, it took more than one second for Google Bard to respond compared to ChatGPT, which responded more quickly to the same instruction. Despite Google Bard still being under development as a new Augmented Intelligence, it provides polite and natural responses, such as offering further assistance and verifying a question once it has completed the prompts, compared to ChatGPT. The analysis of the differences and similarities between ChatGPT and Google Bard is detailed in Table 3 below.

Table 3. The analysis of ChatGPT and Google Bard

		End point: explanation in terms of	
	Principle of variation	**Principle of universality**	
Starting point:	**Point of analysis**	**ChatGPT**	**Google Bard**
		Differences	
	Features	Natural Language Understanding Text Retrieval Language Translation Text Generation Conversational Interfaces Coding Support Mathematical Computation Educational Support Creative Writing Assistance Task Automation Personality and Tone Generation Multilingual Support	Create diverse text styles. Retrieve and analyse real-world data using Google Search. Maintain coherence in the response.
	Functions	To aid and furnish information via text-based dialogs and support various tasks, including responding to inquiries, explaining concepts, generating text, aiding in coding, and offering suggestions using natural language.	Restricted to utilizing solely the Google data center to access the following functionalities: Data retrieval Text creation Language translation Content summarization Code generation. Creative writing
	Data safety	Privacy and confidentiality safeguards Data storage policies Security protocols User autonomy Users have the option to use any email address. Ability to share chat links with other users through link	No user data is collected or stored. Prompt and responses provided to Bard are logged. Users can only access Bard using their Google ID. There is no option to

	sharing functionality.	share links; users must copy and paste into the search engine.
	Similarities	
Features	It has the capability to produce real-time responses akin to humans, utilizing voice communication and image recognition for user input. Additionally, it offers user feedback through emojis.	It can produce narratives, poems, and stories with a natural tone, drawing from an extensive dataset of code encompassing various styles and genres. Offer user feedback utilizing emojis.
Functions	It provides a regeneration feature tailored to the user's requirements.	It provides a draft feature tailored to the user's requirements.
Data safety	OpenAI utilizes security protocols to safeguard their systems and the data they gather. They employ encryption and access controls to ensure the protection of data.	Securely store all data in Google's Data Center.

https://chat.openai.com/share/19bc9aa1-5d25-4821-8f8e-f842bf8104b4
https://bard.google.com/chat/b38d457ac76a6653

The user interface examples of ChatGPT and Google Bard are depicted in the accompanying figure.

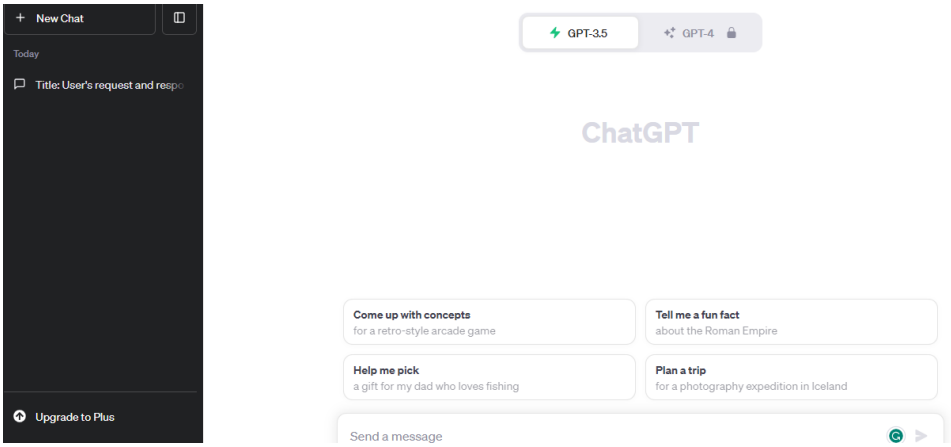

Figure 2. ChatGPT welcoming page

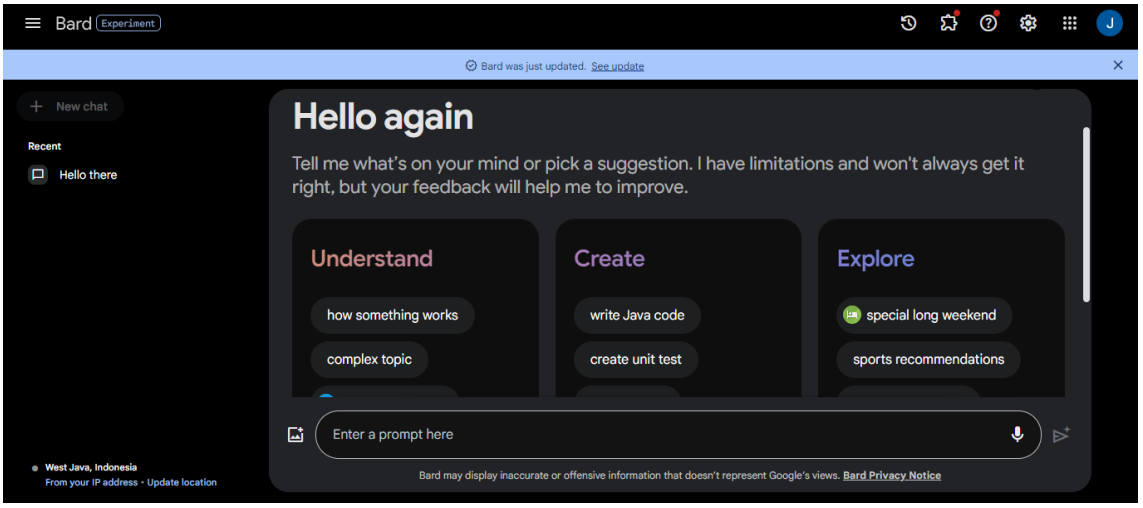

Figure 3. Google Bard (Gemini) welcoming page

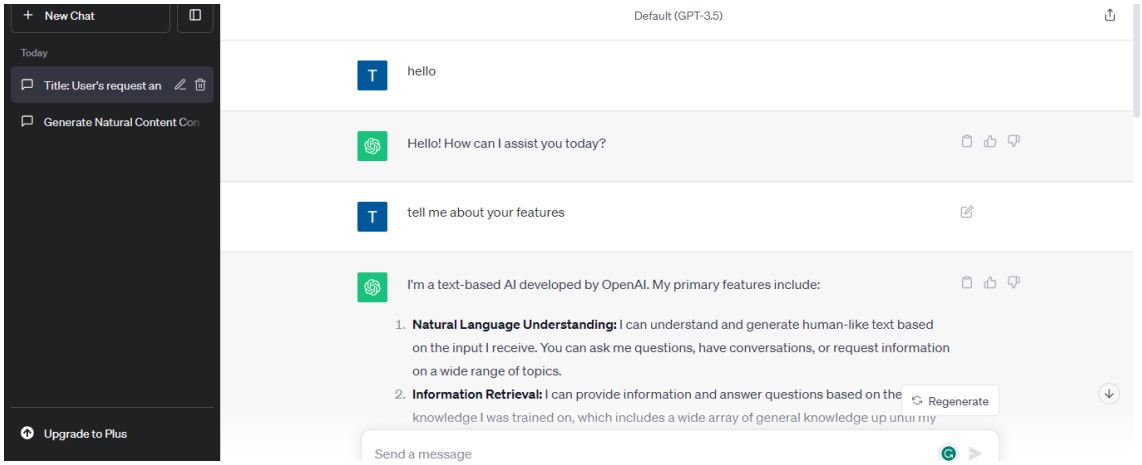

Figure 4. ChatGPT conversational response

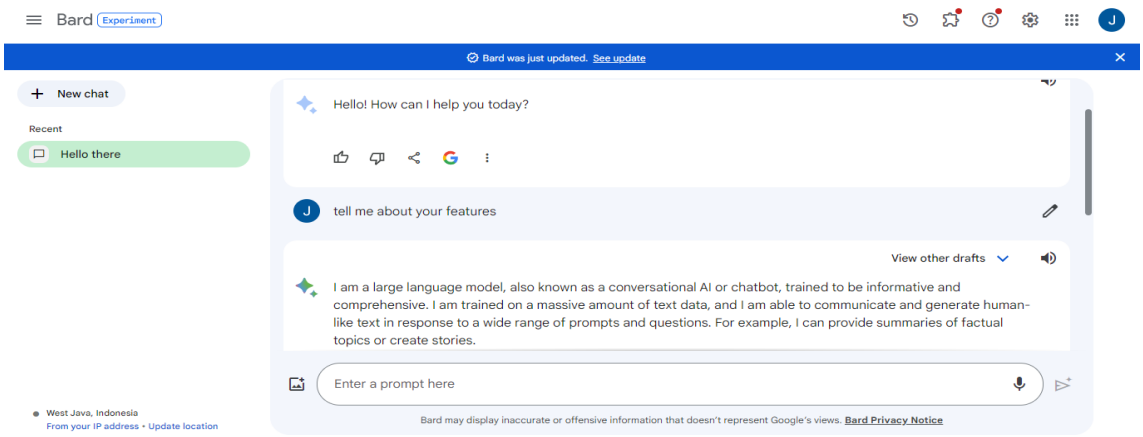

Figure 5. Google Bard (Gemini) conversational response

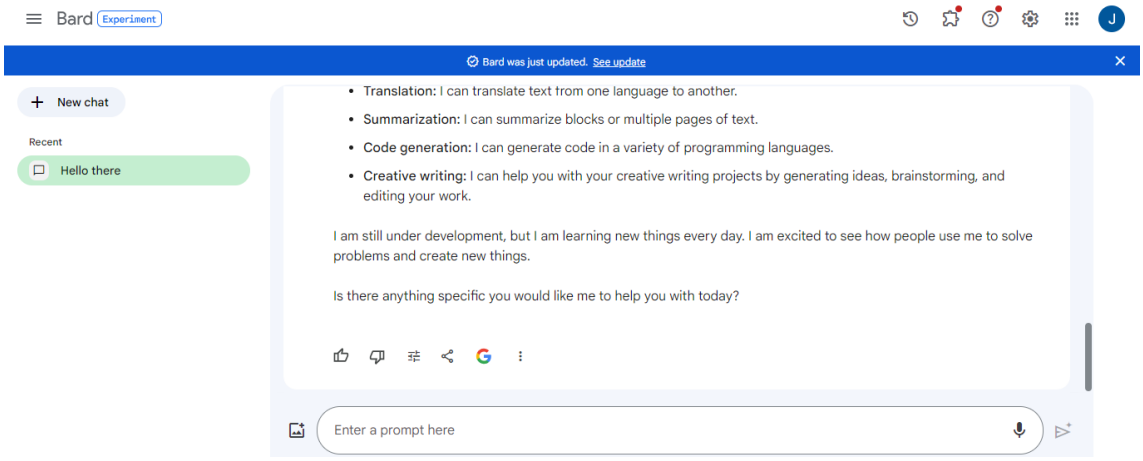

Figure 6. Closing response by Google Bard

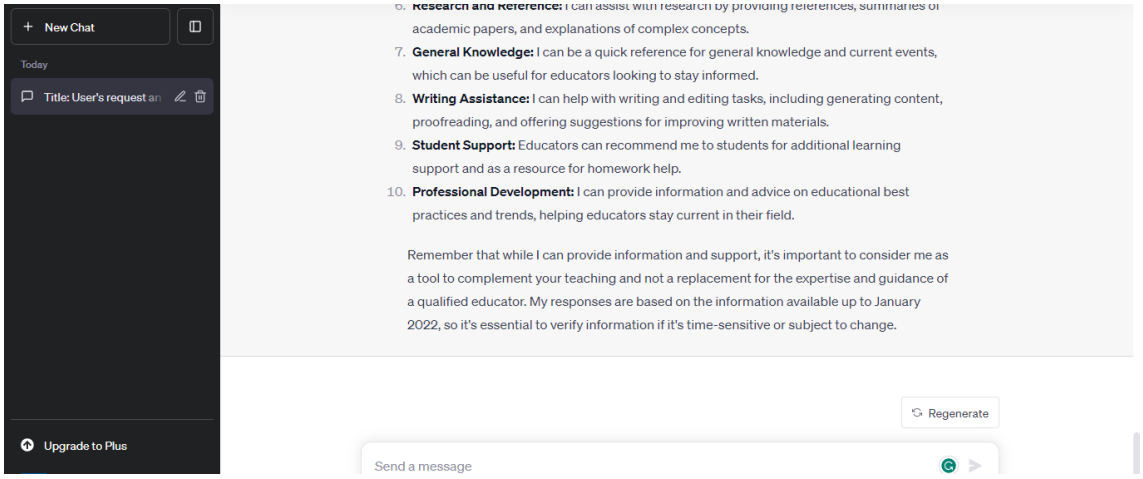

Figure 7. Closing response by ChatGPT

According to technology experts, there are notable differences and similarities between ChatGPT and Google Bard in terms of their functionalities, features, data security, coding responses, and more. Following a performance evaluation conducted by Davis Porter (2023), it is apparent that ChatGPT 4 holds a distinct advantage over Google Bard across various aspects. Although both AI language models have room for improvement, ChatGPT 4 exhibits a more human-like and intelligent approach to text generation. Unlike ChatGPT, which lacks internet access, Bard utilizes a streamlined version of Google's Language Model for Dialogue Applications (LaMDA) and leverages web information for responses, as noted by Sabrina Ortiz (2023). Hope Reese (2023) highlights several unique features of Google Bard. Firstly, it offers "draft" response versions, providing a range of potential responses. Additionally, Bard stays up to date by accessing real-time online information, a capability absents in ChatGPT, which relies solely on data up to September 2021. In terms of readability, Bard outshines as a chatbot. While ChatGPT remains highly legible, its paragraphs tend to be denser compared to Bard's, which offers a wider array of formatting options, as observed by Aaron Drapkin (2023). Despite this factor, Marr (2024) suggested that for users heavily invested in the Google ecosystem, particularly those who rely on Gmail and Google Docs, Bard's seamless integration may be a compelling factor. While Bard demonstrates the potential for coders, Microsoft's Co-Pilot may offer a more specialized solution for programming tasks. However, in terms of content creation, document summarization, image generation, and interactive learning functionalities, ChatGPT currently holds a competitive advantage. This positions it as the preferred choice for users prioritizing these specific capabilities. Feldberg (2024) added a comparative evaluation of ChatGPT Pro and Bard or Gemini Advanced reveals distinct strengths for each platform. While current experimentation favors ChatGPT Pro due to its comprehensive customization functionalities, it is anticipated that Gemini will achieve parity in this domain within

a foreseeable timeframe. Based on the statements of the experts above, the researcher may conclude that both Bard and ChatGPT provide beneficial support in the education field, especially for educational practitioners. The features that both AI applications offer in terms of education are grading assistance, materials collections, and interactive learning functionalities. Additionally, both Bard and ChatGPT support the features for the research as well such as translating, paraphrasing, and generating text and human-like conversations.

CONCLUSIONS

In summary, despite the differences and similarities between ChatGPT and Bard in terms of their features, functions, and safety, both ChatGPT and Google Bard contribute significantly to the advancement of technology, supporting sectors such as economics, healthcare, manufacturing, and education. These Augmented Intelligence platforms offer numerous advantages for educators, including creating learning materials, assisting with grading, translating languages, aiding in research, and referencing, providing writing assistance, facilitating collaborative learning, offering feedback on student work, and fostering the development of new teaching methodologies. Embracing these technologies as virtual assistants can enhance the learning experience for students in the future.

LIMITATION & FURTHER RESEARCH

This study has potential limitations. First, since technology grows fast dan develops rapidly, some data and findings in this research may become obsolete for future study, second, the sample of research may be improved and not limited to its popularity, and third the research method may be discussed in detail and concisely. Future research could, for instance, investigate the advantages and disadvantages of AI-based applications to the students' achievement and educators' digital competencies. It might contribute to identifying specific strategies to tackle the obstacles to the successful digital literacy awareness among educators.

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