ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

ChatGPT Versus Gemini: A Comparative Analysis of the Factors Influencing Academic Performance among Bangladeshi University Students

[1]Faisal Al Islam; [2]Ameera Binty Nazmul

[1]Research Officer
Bangladesh Institute of Development Studies
Dhaka, Bangladesh

[2]BSS Student
Department of Economics, Bangladesh University of Professionals
Dhaka, Bangladesh

Publication Date: 2025/01/27

Abstract: The global expansion of accessible Gen AI tools, specifically Large Language Models (LLMs) such as ChatGPT and Gemini is transforming the paradigm of higher education. Bangladesh is not exempt from this as the favorability of ChatGPT and Gemini is increasing substantially among Bangladeshi university students given its availability and ability to generate exclusive content, and comprehensive responses within seconds. However, the core differences between ChatGPT and Gemini in accessing and processing information lead them to provide exclusive experience and expertise influencing students' productivity and interest. By analyzing the factors influencing Bangladeshi students' use of ChatGPT and Gemini, this research intends to provide critical insights and contribute to developing policies for incorporating AI ethically in the national curriculum addressing students' needs. This study adopted quantitative methods with a questionnaire survey. The paper identified the key factors that differentiate the use of ChatGPT and Gemini for academic purposes among university students in Bangladesh which will contributes to transformative changes in Bangladesh's education development.

Keywords:- *ChatGPT, Gemini, LLMs, Education, Bangladesh.*

How to Cite: Faisal Al Islam; Ameera Binty Nazmul (2025). ChatGPT Versus Gemini: A Comparative Analysis of the Factors Influencing Academic Performance among Bangladeshi University Student. *International Journal of Innovative Science and Research Technology*, 10(1), 951-958. https://doi.org/10.5281/zenodo.14744536

I. INTRODUCTION

With the recent development of Artificial Intelligence, specifically Large Language Models (LLMs), the trajectory of many aspects of lives has shifted revolutionarily, including a major shift in the paradigm of higher education. Technology has always shaped education with every innovation such as expanding the conventional classroom model into a global model with the Internet, Personal Computers (Bebell and O'Dwyer, 2020; Zucker and Light, 2009), Smartphones (Sung et al., 2015), etc. The recent advancement of LLMs, specifically Gemini and ChatGPT possess the capability to provide tailored learning experiences by analyzing learners' patterns. This addition ignites a transformative change in how education is perceived and assessed, breaking the traditional classroom system and affecting the teacher's role (Jeon and Lee, 2023).

A unique feature of LLMs that differentiates it from previous technologies is that it can generate human-like personalized content after analyzing the context on any topic and utilizing the vast dataset available. For their well-structured conversational skills, grammatically correct and analyzed information, exclusive texts, language support, availability, personalized learning support, original content creation, and efficiency - these tools are gaining huge popularity among university students in research and writing tasks as well as outlining study plans. Though ChatGPT and Gemini share similar core functionalities, they provide some differentiated assistance to the users. Gemini generates elaborative answers with the view of the nature of science while strictly following AI principles to minimize harmful content (Nyaaba, 2023). Integrated with Google's eco-system, it may sometimes include the source of the information allowing users to double-check whereas ChatGPT generates human-like creative text-based answers

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

to a wide range of questions and prompts asked by the users. ChatGPT is trained on large-scale publicly available and free data on the internet and fine-tuned to produce conversational responses which may allow biases and toxicity in its responses. (OpenAI; Zhuo, 2023). Gemini's advanced multimodal features such as pictures, videos, audio, etc. enable student accessibility while ChatGPT primarily focuses on text-based interactions in its free version (Team et al., 2023). OpenAI has started to introduce experimental multimodal features in the paid, upgraded versions.

Despite offering benefits, integration of LLMs in higher education presents unique challenges and potential threats such as unethical usage, inefficiency of current assessment, information bias, high risk of plagiarism, misinformation, and overdependence on these tools. With the growing popularity of LLMs and a lack of study in the comparative use of Gemini and ChatGPT in Bangladesh, there remains a risk of ineffectiveness of the existing traditional assessments, with the possibility of discrimination among students and a high risk of plagiarized content. This will harm the overall effectiveness of the education system in Bangladesh hindering its development. Thus, incorporating AI into higher education needs proper policy implementation in Bangladesh to ensure ethical usage, minimal threats to academic integrity, and overall efficiency of the education system.

Technology has consistently changed the trajectory of perceiving education at an accelerating pace: making any information accessible globally with the Internet, expanding the boundaries of a classroom with YouTube, facilitating access to knowledge and resources at one's fingertip with smartphones, and now personalizing one-to-one learning with the latest addition of AI chatbots (Kassab et al., 2019; Shoufan and Mohamed, 2022, Haleem et al., 2022; Yilmaz et al., 2023).

Integrating technology into higher education can create an engaging, accessible, and cost-effective learning experience. Following the recent global pandemic, COVID-19, educators, and learners have become aware of the pedagogical value of technology to shift from the traditional classroom model to a more efficient and hybrid model of the digitized classroom (Holden et al., 2021).

The framework of Contemporary technology is prevalently dominated by Artificial Intelligence (AI) and machine learning for its human-like creative processing and ability to produce real outcomes. After Discriminative AI, which could sort and organize data, the innovation of GenAI tapped into the unopened door of autonomous content creation. GenAi or 'Generative Artificial Intelligence' (GAI) is a subfield of AI that functions by 'using an ML model to learn the patterns and relationships in a dataset of human-created content' and training using a 'supervised model' to create original, human-like 'text, images, music, audio, and videos. GenAI synthesizes output from the natural language prompt received as inputs and extensive training through a conversational interface. (Cao et al., 2023)

Large Language Models (LLMs) are a specific subsection of GenAI. They are a system program that uses extensive datasets to generate content, translate, and categorize text. Text GenAI uses an LLM called GPT or generative pre-trained transformer, which was first invented in 2018. Natural Language Processing (NLP) is the foundation that enables LLMs to analyze, understand, interpret, and generate human language and sentiment to engage in interactive conversation with humans. LLMs are a huge milestone in GenAI transformative technology with vast potential in many sectors including IT, education, health, journalism, engineering, finance and economics, medicine, and law. Within this cutting-edge technology, the most impactful and used innovations till now are AI-powered chatbots and models, specifically OpenAI's ChatGPT and Google's Gemini AI.

Launched in November 2022, OpenAI's ChatGPT is a widely used mainstream chatbot and auto-regressive large language model with human-like text-generating capabilities, creative content, and brainstorming ideas. Based on the third iteration of the Generative Pre-trained Transformer (GPT-3) model, ChatGPT feeds into massive data that are available online, it can correctly understand and analyze the input context and produce a personalized high-quality output, which is almost identical to human text. (He et al., 2022; Aydin & Karaarslan, 2023) ChatGPT is easily distinguished from other chatbots as it can respond conversationally while giving out information, analyzes the conversation with each user, and generates more tailored, well-structured texts with multilingual support (Javaid et al., 2023). It can also assist with brainstorming, translating, writing on all topics, and providing timely responses to queries.

Google's largest and most capable multi-modal foundation model DeepMind Gemini AI model was launched as a competitor of OpenAI's ChatGPT on December 6th, 2023. It incorporates 3 versions - Gemini Ultra, Gemini Pro, and Gemini Nano with different capabilities and processing power for a wide range of users (Coles, 2023). One of the significant characteristics of Gemini AI is that it can understand and process different types of data along with normal text such as images, videos, audio, and codes leveraging Google's vast knowledge base. It will also be integrated into various Google services such as Google Search and Google Workspace. (Reid, 2024)

As Gen AI models, both ChatGPT and Gemini AI possess characteristics that can revolutionize academics promoting self-learning and personalized growth. Integrating them into higher education can bring major shifts in every aspect after assessing the opportunities and challenges needed for policy implementation at the national and global levels.

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

II. LITERATURE REVIEW

Integrating GenAI such as ChatGPT or Gemini in education will bring positive influence as learning can be more personalized, effective, and tailored according to each student's growth. The multimodal features of the AI tools such as text-to-text and image-to-text or voice-to-text will allow education and information to be accessible and inclusive (Chan et al., 2023). With their ability to instantly generate, analyze, synthesize, and summarize a vast amount of data, GenAI can be a great help for researchers in assisting with rigorous work (Berg, 2023). While incorporating AI in learning has the possibility to bring challenges and shifts in the traditional assessment of students' performances, it can develop a curriculum to prepare students for real-world problems and assist them in structuring practical, plausible solutions with critical thinking and creativity (Zhai, 2022). A survey including 399 HE students in Hong Kong indicates that young students and academics prefer the integration of GenAI in the education sector provided appropriate precautions are taken (Chan, 2023). Given their characteristics as GenAI and unique specialties, ChatGPT and Gemini can bring immense transition through efficient contributions in the field of education. However, it is crucial to introduce proper and effective policies to control and mitigate the challenges and threats that may arise with the transition.

Leveraging ChatGPT's grammatical and structural feedback can enhance the foundational writing skills of the students (Yan, 2023). The differentiated and adaptive suggestions effectively elevate students' quality of writing by finding grammatical and structural mistakes as well as providing real-time feedback (Neumann et al., 2023). Studies found that ChatGPT provides visual, step-by-step instruction and breakdown which enables students to understand a problem and its solution in-depth (Rahman and Watanobe, 2023). It allows non-native English learners to practice listening and speaking language in a safe and supportive environment (Kovačević, 2023). Utilizing ChatGPT's analytical accuracy, educators can make personalized lesson plans and course outlines, encompassing each student's strengths, weaknesses, and learning pace. Optimizing its ability to create original human-toned texts, ChatGPT can help shorten the generational gap between the students and the instructor (Javaid, 2023). A recent study in Indonesia, (Firania, 2023) found that ChatGPT provides a clear concept explanation, helps to find information, form ideas, and translates foreign language articles, to make higher education resources more accessible for learners. Though there are some misuses and threats, incorporating ChatGPT has the potential to create a more engaging and efficient learning environment. There is evidence of ChatGPT increasing productivity in academic work in a shorter amount of time indicating efficiency found by (Dwivedi et al., 2023). It instigates transformative reforms in the education sector while allowing humans more spare time to engage in creative and non-repetitive works. A study by (Niloy et al., 2024) found that the intention to use ChatGPT in higher education among students is significantly affected by the time efficiency and ease of access it provides. The study also revealed that peer pressure is another variable causing students to be more prone to use GPT. Additionally, ChatGPT can be an effective learning partner for non-English speaking students as it can edit, translate, and generate human-like information and content in multi-language along with elaborative explanations making learning interesting (Lim et al., 2023; Lee, 2023).

Using ChatGPT in academics is beneficial to instructors as it facilitates them to make course outlines and study plans according to the weaknesses and learning pace of each student for more inclusive growth and reduced workload (Baidoo-Anu et al., 2023). A survey of dental educators revealed that most of the participants share a positive outlook on taking AI chatbot assistance for in-depth brainstorming, personalized one-to-one learning, and critical thinking in dental education while addressing the risk of over-dependence on AI (Uribe et al., 2024).

Gemini can respond with multiple suggestions along with a comprehensive and elaborative analysis of each option, which ensures students' deep understanding. It can also provide relatable context and rationale for similar problems along with assisting in reference searching for research. One of the main features differentiating Gemini from other AI tools is that it enables users to find the reference of the information provided, ensuring transparency, mitigating confusion, and promoting reliability (Tu et al., 2024). Observing Gemini's role in retrieving, organizing, and referencing research articles given specific instructions, (Supriyadi, 2024) found efficient results recommending further study to test and incorporate Gemini AI in research. Furthermore, Gemini's advanced technology provides tailored and relevant suggestions and feedback to its users on any topic by analyzing every information provided to it (Saeidnia, 2023). A study by (Nyaaba, 2023) shed light on Gemini's competitiveness against ChatGPT and any other GPT-4 model. Each model provides accurate and informative responses with examples given a question on a specific topic. Gemini focuses on a comprehensive elaboration of its understanding of a particular topic. Whereas, in contrast, ChatGPT generally presents summarized data. Both ChatGPT and Gemini, being a large language model (LLM) can increase efficiency by providing concise and short outlines or summaries, assisting students with the core points of any topic or passage (Kasneci et al., 2023).

Given its multimodal approach, using Gemini as a study assistant can be immensely helpful for both educators and learners. Leveraging its capability, educators may organize engaging materials to keep students' attention and interest, instantly assess and give feedback on academic works, and generate many types of learning tools and assessments like quizzes, puzzles, and flashcards, each different according to each student's needs. Moreover, to grasp the context from an alternative viewpoint, students can use Gemini's ability to produce an array of visuals such as chats, diagrams, infographics, simulations, and even original narratives. This feature is particularly beneficial to visually inclined students (Imran & Almusharraf, 2024).

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

With this massive shift in education, there remain some threats to integrating GenAI into the education system which needs thorough analysis and solutions. (Susnjak, 2022) raised a concern about the critical thinking capabilities of ChatGPT which may get misused by some students in online exams and shared his recommendation on taking proper measurements to prevent it. (Farrokhnia et al., 2023) performed a SWOT analysis on ChatGPT which revealed its strength in real, plausible, and accessible responses, there are also threats of misinformation, biases, possibilities of plagiarism and cheating, and discrimination. (Geerling et al., 2023) concluded that even though economics must be taught by providing hands-on experiments and real-life case studies, ChatGPT exhibits functionality in answering basic economics questions. As ChatGPT generates answers based on the information it's being fed, there remains a probability of unreliability. A study by (Tanvir et al., 2023) on Bangladeshi students demonstrated the negative correlation between the overuse of ChatGPT and students' creativity. As the students became more dependent on ChatGPT, their ability to produce creative content was disturbed. According to (Urban et al., 2024), to prevent overdependency on AI, Hybrid-Human-AI-Regulation (HHAIR) should be implemented, and students should focus on improving their valid metacognitive cues and critical thinking. While ChatGPT has high reliability and accuracy in the information provided, it is defined as a 'black box' by (Zhai, 2023), as the source of the information cannot be tracked. Along with it, ChatGPT gathers information by 'feeding' into huge online resources, thus it can be biased in certain topics. Instructors and students should acquire critical skills to assess the response preventing themselves from misusing this vast technology.

With their limitations, the conversational ability, summarization, and authenticity of ChatGPT through natural language interaction and accurate knowledge and reliable information along with the accessibility of Gemini have a significant impact on acknowledging the challenges in every sector. (Rane et al., 2024) Additionally, (Zhai, 2022) has mentioned changing the current student assessments such as essay writing because of GenAI's ability to generate human-like comprehensive essays that are likely to be undetectable. However, he concluded that by maintaining proper caution, a hybrid curriculum involving AI will eventually increase the quality of education received. Another concern, which might be an issue in all developing and underdeveloped nations is the skill and age gap between teachers and students in the context of using technology in teaching, which was highlighted by (Alotaibi & Alshehri, 2023). In Saudi Arabia, apart from the threat of cheating and plagiarism, the instructors and educators not being able to utilize GenAI pedagogically might be a concern. Thus, the government should provide intensive training on the understanding and usage of AI along with proper budget planning to cut the infrastructure and technological gap. (Perera & Lankathilaka, 2023) have recommended several policies for a smooth transition from the traditional classroom to AI integrated hybrid education model. The government and teachers hold a crucial position in introducing the ethical use of AI in education. The government must implement policies on the national level to address the multimodal aspect of AI and educate and train educators and students for a better understanding of opportunities and threats. The curricular inclusion of AI must be accepted to reduce unethical and misuse rather than banning it. Consequently, students must be provided with proper knowledge and taught critical literacy skills to use AI as their study partner and not as a replacement for teachers.

III. RESEARCH OBJECTIVE

The broad objective of this research is to assess and compare various factors of ChatGPT and Gemini that influence the academic performance among university-level students in Bangladesh. The specific objective of this research is to determine the purpose of using both tools for academic purposes.

IV. RESEARCH GAP

A dearth of exhaustive research exists that thoroughly analyses the various factors that have led to the high usage of Gemini and ChatGPT among university students in Bangladesh. Most recent research examining the use of AI in education needs to adequately analyze the comparative factors associated with the utilization of ChatGPT and Gemini from a Bangladesh perspective. Furthermore, there needs to be more empirical data regarding the impact of these platforms on students' academic objectives, long-term retention of knowledge, and development of skills. This research aims to address these deficiencies by conducting a comprehensive evaluation and comparison of the factors that influence the usage of Gemini and ChatGPT. Therefore, this research will provide significant insights for Policymakers, Educators, Stakeholders, and various technology companies to strengthen the efficiency of ChatGPT and Gemini as well as other AI-driven technologies in Bangladesh.

V. DATA METHODOLOGY

This study employed a quantitative research approach. The data were collected from 12 public and private universities of Bangladesh. Using simple random sampling technique, 404 data was collected. The questionnaire segmented into 2 different parts: Chatgpt and Gemini. The questionnaire was designed in likert scale-based containing close ended questions. The data analysis was conducted using the software STATA and Microsoft Excel. This research maintained all ethical considerations during the survey. The personal information of the survey respondents remained confidential. The study followed ethical protocols to safeguard the rights and well-being of the participants.

VI. RESULTS & DISCUSSION

To analyze the factors such as accessibility, user-friendliness, familiarity, information quality, relevance to academic context, effectiveness in native context, context retention, and multimodal capabilities of both ChatGPT and Gemini on the students' academic performance, paper used ordered logistic regression model.

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

Ordinal logistic regression model for both ChatGPT (Pseudo R^2=0.5567,LR $chi^2(8)$ = 376.06, p<0.001) Gemini (Pseudo R^2=0.6652, LR $chi^2(8)$=412.14,p<0.001) showed significant explanatory results.

Table 1: Comparative Outputs of ChatGPT and Gemini (Ordered Logistic Regression)

Factors	Tool	Coefficient	Std. Error	z- value	p-value
Accessibility	ChatGPT	1.64	0.212	7.73	<0.001
	Gemini	0.23	0.130	1.79	0.074
User-friendliness	ChatGPT	0.31	0.121	2.56	0.011
	Gemini	-0.11	0.145	-0.81	0.417
Familiarity	ChatGPT	1.91	0.211	8.74	<0.001
	Gemini	0.07	0.136	0.57	0.568
Information Quality	ChatGPT	0.08	0.108	0.81	0.417
	Gemini	1.33	0.264	5.05	<0.001
Relevance to Academics	ChatGPT	0.25	0.117	2.13	0.033
	Gemini	-0.02	0.133	0.65	0.514
Effectiveness in Native language	ChatGPT	0.10	0.109	1.00	0.317
	Gemini	-0.02	0.134	-0.21	0.834
Context Retention	ChatGPT	-0.08	0.109	-0.79	0.430
	Gemini	1.99	0.272	7.34	<0.001
Multimodal Capabilities	ChatGPT	-0.09	0.115	-0.79	0.427
	Gemini	2.05	0.285	7.21	<0.001

The findings highlight a comparative difference in the factors between ChatGPT and Gemini concerning their influence on the academic performance of university students. For ChatGPT, accessibility, familiarity, and user-friendliness showed the strongest predictors of academic performance at a 5% significance level. On the other hand, Gemini is influenced by information quality, context retention, and multimodal capabilities, emphasizing its advanced features as critical for academic performance. ChatGPT is superior in user-centered design and accessibility; Gemini users appreciate its capacity to incorporate multimodal inputs and maintain continuity.

The efficacy of native context and the relevance of academic content were insignificant for both cases. ChatGPT is prioritized for its simplicity of use, while their complementary characteristics are also indicated. Gemini users appreciate ChatGPT's ability to integrate multimodal inputs and maintain continuity, while ChatGPT is particularly adept at user-centered design and ease of access.

Table 2: Purpose for using ChatGPT and Gemini

Type of the Purpose	ChatGPT (out of 210)	Gemini (out of 195)
Assignment	148	113
Academic Papers & Projects	122	132
Exam preparation	145	105
Information Exploration	110	124
Study Reference	141	120

The results underscore the comparative purpose of using Gemini and ChatGPT among university students. It showed that Gemini is extensively used and popular for academic papers and projects. Gemini has also been more accepted in the case of information exploration. On the other hand, ChatGPT is more used in assignments, exam preparation, and study reference.

VII. CONCLUSION

The comparative paper highlighted the different use factors of ChatGPT and Gemini among university students in Bangladesh. Factors such as accessibility, familiarity, and user friendliness- ChatGPT exceeds Gemini's acceptability. On the other hand, Gemini is known for having higher information quality and for supporting multiple modalities. Gemini has been developed with advanced features made remarkably simple and has been contextually enhanced for more effective educational purposes. The research underlines the importance of adapting AI systems and tools to meet the diverse academic needs of students by analyzing the different factors that influence the usage of ChatGPT and Gemini.The paper highlighted that the implementation of such systems and tools in higher learning should consider ethical use, policy, and embrace diversity. Policy makers have the responsibility of coming up with encouraging guidelines on how best the AI can be used to enhance the educational sector while at the same time discouraging other uses that are considered unethical such as over reliance on AI generated content, plagiarism and biassed information. Ultimately, both ChatGPT and Gemini have the potential to influence the future of the academic domain significantly.

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

REFERENCES

[1]. Alotaibi, N. S., & Alshehri, A. H. (2023). Prospers and Obstacles in Using Artificial Intelligence in Saudi Arabia Higher Education Institutions—The Potential of AI-Based Learning Outcomes. Sustainability, 15(13), 10723. https://doi.org/10.3390/su151310723

[2]. Aydin, Ö., & Karaarslan, E. (2023). Is ChatGPT Leading Generative AI? What is Beyond Expectations? Academic Platform Journal of Engineering and Smart Systems, 11(3), 118–134. https://doi.org/10.21541/apjess.1293702

[3]. Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the Era of Generative Artificial Intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. Journal of AI, 7(1), 52–62. https://doi.org/10.61969/jai.1337500

[4]. Bebell, D., & O'Dwyer, L. (2010, January 3). Educational Outcomes and Research from 1:1 Computing Settings. https://ejournals.bc.edu/index.php/jtla/article/view/1606

[5]. Berg, C. (2023). The case for Generative AI in Scholarly practice. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4407587

[6]. Cao, Y., Li, S., Liu, Y., Yan, Z., Dai, Y., Yu, P. S., & Sun, L. (2023). A Comprehensive Survey of AI-Generated Content (AIGC): A History of Generative AI from GAN to ChatGPT. arXiv (Cornell University). https://doi.org/10.48550/arxiv.2303.04226

[7]. Chan, C. K. Y., & Hu, W. (2023). Students' voices on generative AI: perceptions, benefits, and challenges in higher education. International Journal of Educational Technology in Higher Education, 20(1). https://doi.org/10.1186/s41239-023-00411-8

[8]. Chan, C. K. Y., & Lee, K. K. W. (2023b). The AI generation gap: Are Gen Z students more interested in adopting generative AI such as ChatGPT in teaching and learning than their Gen X and millennial generation teachers? Smart Learning Environments, 10(1). https://doi.org/10.1186/s40561-023-00269-3

[9]. Coles, G. (2023, December 28). Google DeepMind Gemini AI release date. PC Guide. https://www.pcguide.com/apps/google-deepmind-gemini-release-date/

[10]. D. Kovačević, "Use of ChatGPT in ESP Teaching Process," 2023 22nd International Symposium INFOTEH-JAHORINA (INFOTEH), East Sarajevo, Bosnia and Herzegovina, 2023, pp. 1-5 10.1109/INFOTEH57020.2023.10094133

[11]. Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., . . . Wright, R. (2023). Opinion Paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. International Journal of Information Management, 71, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

[12]. Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. (2023). A SWOT analysis of ChatGPT: Implications for educational practice and research. Innovations in Education and Teaching International, 61(3), 460–474. https://doi.org/10.1080/14703297.2023.2195846

[13]. Firaina, R., & Sulisworo, D. (2023). Exploring the Usage of ChATGPT in Higher Education: Frequency and Impact on Productivity. Buletin Edukasi Indonesia, 2(01), 39–46. https://doi.org/10.56741/bei.v2i01.310

[14]. Geerling, W., Mateer, G. D., Wooten, J., & Damodaran, N. (2023). ChatGPT has Aced the Test of Understanding in College Economics: Now What? The American Economist, 68(2), 233-245. https://doi.org/10.1177/05694345231169654

[15]. Gemini. (2024, October 9). Google DeepMind. https://deepmind.google/technologies/gemini/

[16]. Generative AI examples. (n.d.). Google Cloud. https://cloud.google.com/use-cases/generative-ai

[17]. Google (2024). Gemini Apps FAQ. https://gemini.google.com/faq

[18]. Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. Sustainable Operations and Computers, 3, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

[19]. He, W., Dai, Y., Zheng, Y., Wu, Y., Cao, Z., Liu, D., Jiang, P., Yang, M., Huang, F., Si, L., Sun, J., & Li, Y. (2022). GALAXY: A Generative Pre-trained Model for Task-Oriented Dialog with Semi-supervised Learning and Explicit Policy Injection. Proceedings of the AAAI Conference on Artificial Intelligence, 36(10), 10749–10757. https://doi.org/10.1609/aaai.v36i10.21320

[20]. Holden, O. L., Norris, M. E., & Kuhlmeier, V. A. (2021). Academic Integrity in Online Assessment: A Research review. Frontiers in Education, 6. https://doi.org/10.3389/feduc.2021.639814

[21]. How technology is shaping learning in higher education. (2022, June 15). McKinsey & Company. https://www.mckinsey.com/industries/education/our-insights/how-technology-is-shaping-learning-in-higher-education

[22]. Imran, M., & Almusharraf, N. (2024). Google Gemini as a next-generation AI educational tool: a review of emerging educational technology. Smart Learning Environments, 11(1). https://doi.org/10.1186/s40561-024-00310-z

[23]. Interaction Design Foundation - IxDF. (2024, March 20). What is The Fourth Industrial Revolution? Interaction Design Foundation - IxDF. https://www.interaction-design.org/literature/topics/the-fourth-industrial-revolution

[24]. Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023). Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. BenchCouncil Transactions on Benchmarks Standards and Evaluations, 3(2), 100115. https://doi.org/10.1016/j.tbench.2023.100115

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

[25]. Jeon, J., & Lee, S. (2023). Large language models in education: A focus on the complementary relationship between human teachers and ChatGPT. Education and Information Technologies, 28(12), 15873–15892. https://doi.org/10.1007/s10639-023-11834-1

[26]. Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., . . . Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, 102274. https://doi.org/10.1016/j.lindif.2023.102274

[27]. Kassab, M., DeFranco, J., & Laplante, P. (2019). A systematic literature review on Internet of things in education: Benefits and challenges. Journal of Computer Assisted Learning, 36(2), 115–127. https://doi.org/10.1111/jcal.12383

[28]. Learn more about Deep Learning and Natural Language Processing. (n.d.). Kili-website. https://kili-technology.com/data-labeling/nlp/nlp-deep-learning Staff, C. (2024, April 18).

[29]. Lee, J. H., Shin, D., & Noh, W. (2023). Artificial Intelligence-Based Content Generator technology for young English-as-a-Foreign-Language learners' reading enjoyment. RELC Journal, 54(2), 508–516. https://doi.org/10.1177/00336882231165060

[30]. Lim, W. M., Gunasekara, A., Pallant, J. L., Pallant, J. I., & Pechenkina, E. (2023). Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators. The International Journal of Management Education, 21(2), 100790. https://doi.org/10.1016/j.ijme.2023.100790

[31]. Neumann, M., Rauschenberger, M. and Schön, E.-M. (2023), "'We need to talk about ChatGPT': the future of AI and higher education", in 2023 IEEE/ACM 5th International Workshop on Software Engineering Education for the Next Generation (SEENG), IEEE, pp. 29-32.

[32]. Niloy, A. C., Bari, M. A., Sultana, J., Chowdhury, R., Raisa, F. M., Islam, A., Mahmud, S., Jahan, I., Sarkar, M., Akter, S., Nishat, N., Afroz, M., Sen, A., Islam, T., Tareq, M. H., & Hossen, M. A. (2024). Why do students use ChatGPT? Answering through a triangulation approach. Computers and Education Artificial Intelligence, 6, 100208. https://doi.org/10.1016/j.caeai.2024.100208

[33]. Nyaaba, M. (2023). Comparing human and AI's (GPT-4 and Gemini) understanding of the nature of science. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4661602

[34]. OpenAI. (2023, September 25). ChatGPT can now see, hear, and speak. Retrieved October 17, 2024, from https://openai.com/index/chatgpt-can-now-see-hear-and-speak/

[35]. OpenAI. (2024, September). How ChatGPT and our language models are developed. OpenAI Help Center. Retrieved October 16, 2024, from https://help.openai.com/en/articles/7842364-how-chatgpt-and-our-language-models-are-developed

[36]. Perera, P., & Lankathilaka, M. (2023). Preparing to revolutionize education with the multi-model GenAI tool Google Gemini? A journey towards effective policy making. J Adv Educ Philos, 7(8): 7(8): 246-253 https://dx.doi.org/10.47772/IJRISS.2023.7623

[37]. Rahman, M. M., & Watanobe, Y. (2023). ChatGPT for Education and Research: Opportunities, Threats, and Strategies. Applied Sciences, 13(9), 5783. https://doi.org/10.3390/app13095783

[38]. Rane, Nitin and Choudhary, Saurabh and Rane, Jayesh, Gemini or ChatGPT? Efficiency, Performance, and Adaptability of Cutting-Edge Generative Artificial Intelligence (AI) in Finance and Accounting (February 19, 2024). Available at SSRN: https://ssrn.com/abstract=4731283 or http://dx.doi.org/10.2139/ssrn.4731283

[39]. Reid, L. (2024, May 15). Generative AI in Search: Let Google do the searching for you. Google. https://blog.google/products/search/generative-ai-google-search-may-2024/

[40]. Ross, P., & Maynard, K. (2021). Towards a 4th industrial revolution. Intelligent Buildings International, 13(3), 159–161. https://doi.org/10.1080/17508975.2021.1873625

[41]. Saeidnia, H. R. (2023). Welcome to the Gemini era: Google DeepMind and the information industry. Library Hi Tech News. https://doi.org/10.1108/LHTN-12-2023-0214

[42]. Shoufan, A., & Mohamed, F. (2022). YouTube and Education: A scoping review. IEEE Access, 10, 125576–125599. https://doi.org/10.1109/access.2022.3225419

[43]. Sullivan, M., Kelly, A., & McLaughlan, P. (2023). ChatGPT in higher education: Considerations for academic integrity and student learning. Journal of Applied Learning & Teaching, 6(1). https://doi.org/10.37074/jalt.2023.6.1.17

[44]. Sung, Y., Chang, K., & Liu, T. (2015). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. Computers & Education, 94, 252–275. https://doi.org/10.1016/j.compedu.2015.11.008

[45]. Supriyadi, edi. (2024). Exploring Google Bard's (Gemini) Role in Enhancing Research Articles in Computational Thinking and Mathematics Education. Papanda Journal of Mathematics and Science Research, 3(1), 28–37. https://ejournal.papanda.org/index.php/pjmsr/article/view/707

[46]. Susnjak, T. (2022). ChatGPT: The end of online exam integrity? arXiv (Cornell University). https://doi.org/10.48550/arxiv.2212.09292

[47]. Tanvir, K., Islam, M. S., Sezan, S. B. K., Sanad, Z. A., & Ataur, A. I. (2023). Impact of ChatGPT on Academic Performance among Bangladeshi Undergraduate Students. Deleted Journal, 35, 18–28. https://doi.org/10.55529/ijrise.35.18.28

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14744536

[48]. Team, G., Anil, R., Borgeaud, S., Alayrac, J., Yu, J., Soricut, R., Schalkwyk, J., Dai, A. M., Hauth, A., Millican, K., Silver, D., Johnson, M., Antonoglou, I., Schrittwieser, J., Glaese, A., Chen, J., Pitler, E., Lillicrap, T., Lazaridou, A., . . . Vinyals, O. (2023). Gemini: a family of highly capable multimodal models. arXiv (Cornell University). https://doi.org/10.48550/arxiv.2312.11805

[49]. Tu, J., Hadan, H., Wang, D. M., Sgandurra, S. A., Mogavi, R. H., & Nacke, L. E. (2024). Augmenting the Author: Exploring the Potential of AI Collaboration in Academic Writing. https://doi.org/10.48550/arXiv.2404.16071

[50]. Urban, M., Děchtěrenko, F., Lukavský, J., Hrabalová, V., Svacha, F., Brom, C., & Urban, K. (2024). ChatGPT improves creative problem-solving performance in university students: An experimental study. Computers and Education/Computers & Education, 215, 105031. https://doi.org/10.1016/j.compedu.2024.105031

[51]. Uribe, S. E., Maldupa, I., Kavadella, A., Tantawi, M. E., Chaurasia, A., Fontana, M., Marino, R., Innes, N., & Schwendicke, F. (2024). Artificial intelligence chatbots and large language models in dental education: Worldwide survey of educators. European Journal of Dental Education. https://doi.org/10.1111/eje.13009

[52]. Yan, D. (2023). Impact of ChatGPT on learners in a L2 writing practicum: An exploratory investigation. Education and Information Technologies, 28(11), 13943–13967. https://doi.org/10.1007/s10639-023-11742-4

[53]. Yilmaz, F. G. K., Yilmaz, R., & Ceylan, M. (2023). Generative Artificial Intelligence Acceptance Scale: A Validity and Reliability study. International Journal of Human-Computer Interaction, 1–13. https://doi.org/10.1080/10447318.2023.2288730

[54]. Zhai, X. (2023). ChatGPT for next-generation Science Learning. Crossroads, 29(3), 42–46. https://doi.org/10.1145/3589649

[55]. Zhai, X. (2022b). ChatGPT User Experience: Implications for Education. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4312418