

ChatGPT's Possibilities in Advancing Education in the Age of Generative Artificial Intelligence: A Review and Analysis

¹Alka Rani , ¹Deepam Sharma, ¹Priyanka, ¹Savita , ²Suryakant Singh and ²Sikander Hans

¹Department of Computer Science, KC group of Research & professional institute, Pandoga, Una

²Department of Electrical Engineering, KC group of Research & professional institute, Pandoga, Una

Abstract: Generative artificial intelligence tool ChatGPT stunned the globe with its extraordinary versatility. Teachers are divided about how they feel about the revolutionary effects of ChatGPT, an artificial intelligence system with amazing capabilities that can do complicated jobs in the field of education. The purpose of this study was to investigate the possible advantages and disadvantages of ChatGPT for enhancing education by analysing the most recent literature on the topic. ChatGPT's advantages include, but are not limited to, the facilitation of student-centered and collaborative learning, the generation of suggestions for formative assessment activities that deliver continuous feedback to guide instruction, and so on. The research goes on to detail the ChatGPT's built-in restrictions, such as the possibility of false positives, the existence of data-training biases that might amplify pre-existing biases, privacy concerns, etc. The research provides suggestions about how to best use ChatGPT to advance education. It would be beneficial for policymakers, academics, teachers, and tech experts to begin discussions on how these nascent generative AI technologies might be utilised in a responsible manner to boost student learning.

Keywords: *ChatGPT, Education, Generative AI, Teaching and Learning*

1. INTRODUCTION

The contemporary era is marked by the rapid proliferation of Artificial Intelligence (AI), a technological revolution that has transcended the boundaries of various industries and permeated nearly every facet of human life. Within this transformative landscape, the field of education has emerged as a prominent arena where the synergistic interaction between human intellect and machine capabilities is altering the very essence of pedagogy and learning. As we navigate the intricate dynamics of education in the Era of Generative Artificial Intelligence (AI), it is imperative to explore how AI-driven technologies, exemplified by ChatGPT, have the potential to reshape and amplify the teaching and learning experience[1].

The advent of ChatGPT, a state-of-the-art generative AI language model, represents a pivotal milestone in the evolution of AI technologies[2]. With its remarkable ability to understand and generate human-like text, ChatGPT has become a versatile tool with diverse applications. Within the realm of education, its potential is particularly intriguing. ChatGPT stands at the intersection of machine intelligence and pedagogical innovation, offering educators, learners, and educational institutions an unprecedented array of opportunities to enhance the teaching and learning process shown in Figure 1.

This research paper embarks on an illuminating exploration of the "Potential Benefits of ChatGPT in Promoting Teaching and Learning in the Era of Generative Artificial Intelligence (AI)." It endeavours to shed light on the multifaceted advantages that ChatGPT and similar generative AI models can offer in the educational context. From personalized tutoring to content creation, ChatGPT possesses the capacity to tailor educational experiences to individual needs, streamline administrative tasks, and foster a more engaging and interactive learning environment[3].

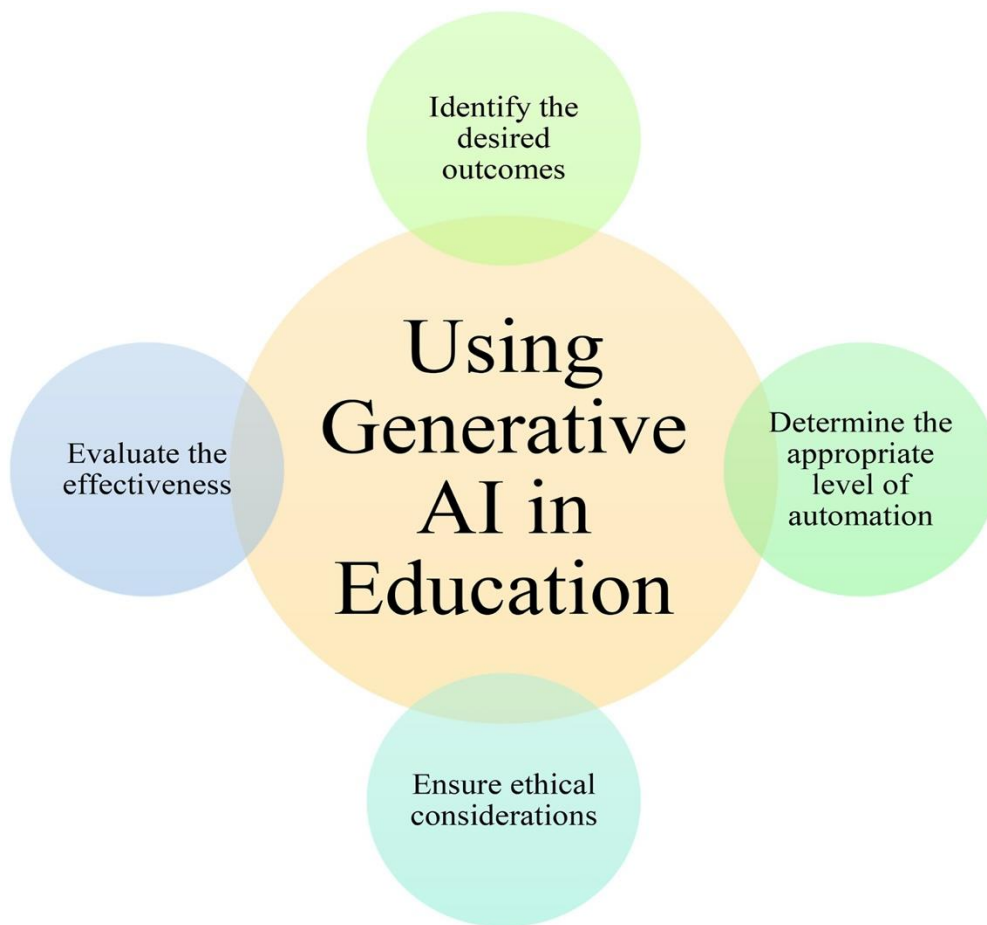


Figure 1: ChatGPT as ‘Educative artificial intelligence’

while the potential benefits are compelling, they are accompanied by complex considerations. This includes questions related to the ethical use of AI in education, the need for robust safeguards against bias, and the preservation of human pedagogical expertise[4]. Consequently, as we navigate the integration of ChatGPT and similar AI technologies into education, it is crucial to strike a balance between harnessing their potential and addressing the ethical and practical challenges they pose.

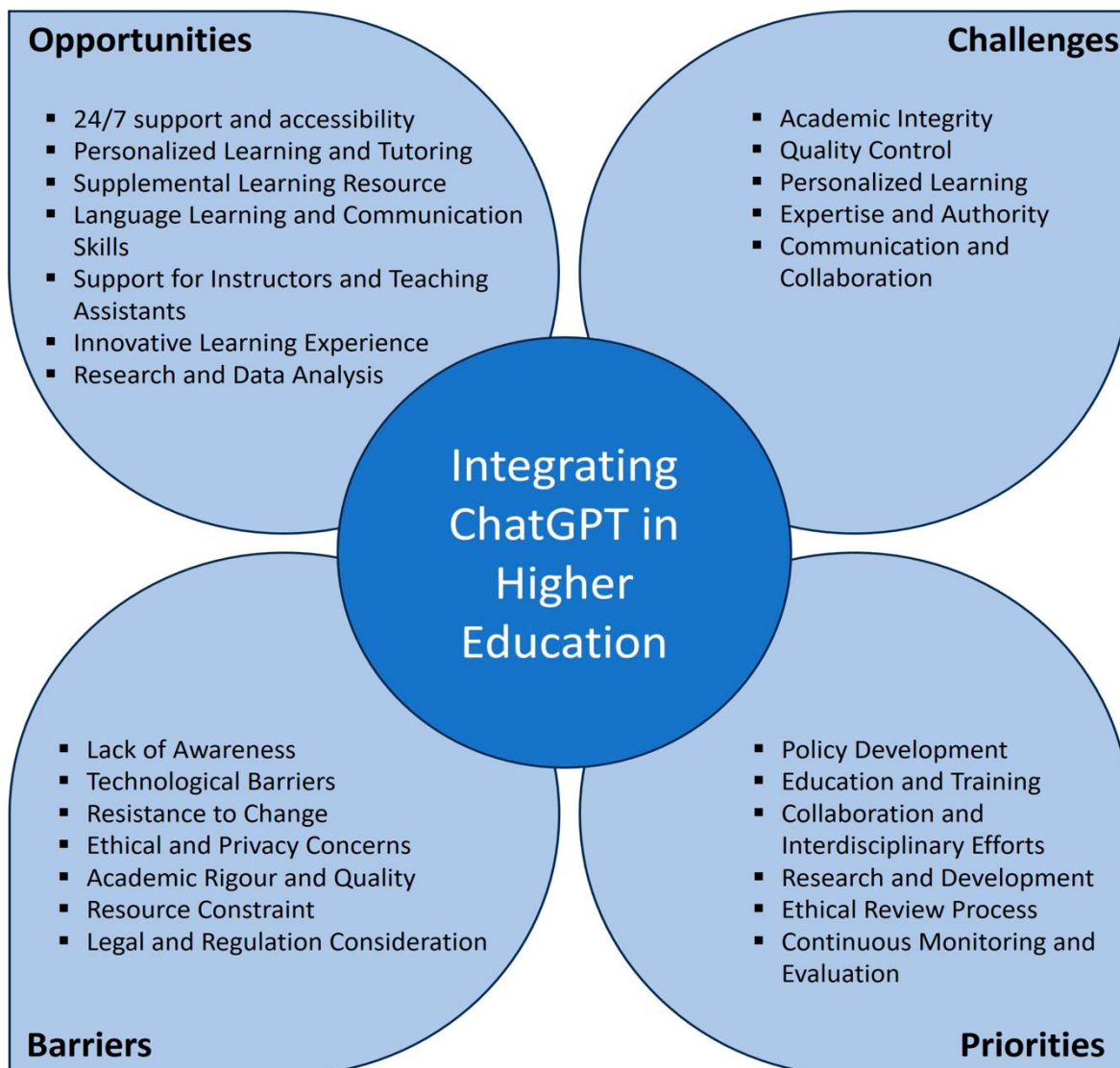


Figure 2: Themes emerging from the interview (own elaboration).

In essence, this research paper aims to provide a comprehensive exploration of the potential benefits of ChatGPT in education, offering insights into how this generative AI model can elevate teaching and learning practices[5]. Through a rigorous analysis of its applications, impacts, and ethical dimensions, we seek to contribute to the ongoing discourse surrounding the role of AI in education. Ultimately, this paper aspires to foster a deeper understanding of how ChatGPT can be leveraged to transform and enrich the educational landscape in this transformative era of Generative Artificial Intelligence (AI)[6-8].

The Present Study

The research question of the present study is “What are the current opinions and evidence about the opportunities and the challenges represented by the development and implementation of AI systems in educational settings?” The stated research question is challenged with a narrative review article that analyzes the current research, opinions, and published literature on AI and ChatGPT (and, by extension, AI and LLMs)

and the impact of these technologies in the educational sector. The existing literature was screened non systematically, searching for the keywords “ChatGPT AND education” and “AI AND education” in Google Scholar and Scopus for articles published after December 2022 until august 2023. Further articles were added using the snowball method, selecting articles perceived as particularly relevant starting points. The present article aims to build on recently published scientific works, explicitly targeting the discussion on how these advanced AI models can be used in education and especially in university settings.

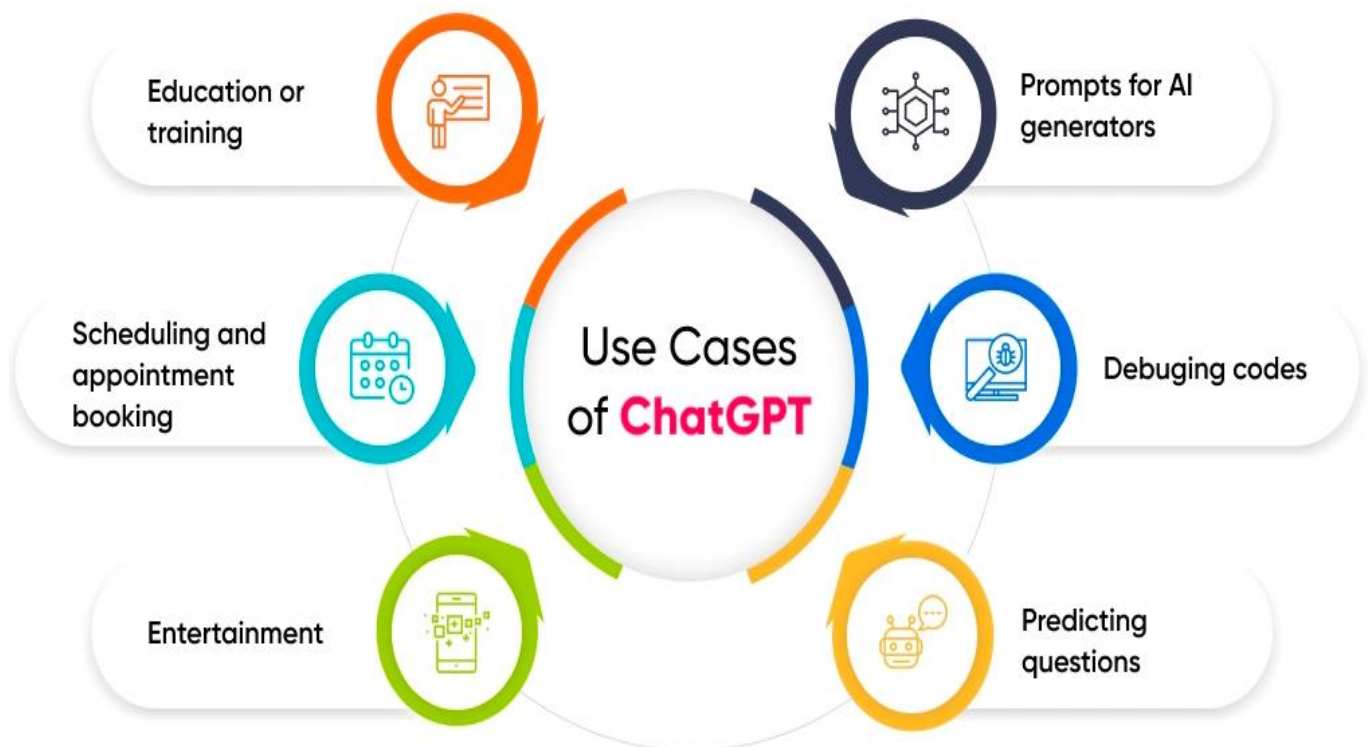


Fig: Uses of ChatGP

2. Method: Thing Ethnography Applied to ChatGPT

Ethnography refers to a form of social research that emphasizes the importance of studying first-hand what people do and say in particular contexts [9]. It involves an in-depth understanding of the world based on social relations and everyday practices. Traditionally, the focus of ethnography has been on human perspectives via qualitative methods such as observation and interviews. However, it is argued that as humans, “we have complex and intertwined relationships with the objects around us. We shape objects; and objects shape and transform our practices and us in return” [10]. Recognizing this continual interplay between humans and objects necessitates research methodologies that grant both parties an equal role.

Recently, there has been a growing interest in moving away from a human-centered ethnographic approach to that of seeking nonhuman perspectives in a context where human perspectives are felt to be partial to fully understanding the interdependent relations between humans and nonhumans [11]. By studying things as incorporated into practices, we learn about both people and objects at the same time. This approach

provides the opportunity to reflect on us by reflecting on things [12]. Relatively consolidated methods for exploring the distinct viewpoints, development paths, and possible worldviews of nonhuman entities incorporate ‘thing ethnography’ [13]. Thing ethnography is an approach that allows access to and interpretation of things’ perspectives, enabling the acquisition of novel insights into their socio-material networks. Thing ethnography emerges at the intersection of data that things give access to and the analysis and interpretation that human researchers contribute [14]. Giaccardi et al. contend that adopting a thing perspective can offer distinct revelations regarding the interplay between objects and human practices, leading to novel approaches for collectively framing and resolving problems alongside these entities.



Figure 3: Principles for acceptable and responsible use of AI in higher education

In this shift towards thing ethnography, artificial intelligence (AI) plays a significant role as its unique capacities provide unprecedented access to nonhuman perspectives of the world [15]. The unique perspectives of mundane things such as kettles, cups, and scooters can now be accessed via the use of software and sensors [16-17]. For instance, by attaching autographers to kettles, fridges, and cups, a study collected more than 3000 photographs that helped to uncover use patterns and home practices around these objects. Another study looking into the design of thoughtful forms of smart mobility used cameras and sensors to collect data from scooters in Taipei, generating a better understanding of the socio-material networks among scooters and scooterists in Taiwan [18]. Moreover, the development of chatbots opens the possibility of directly interacting and accessing AI systems’ views via text exchange.

It has already been recognized that AI “has the potential to impact our lives and our world as no other technology has done before” [19], both positively and negatively. This knowledge is raising many questions concerning its ethical, legal, and socio-economic effects, and even calls for a pause in the development of more advanced AI systems [20]. With the increasing intelligence of things, it becomes crucial to adopt suitable perspectives to access, observe and understand the diverse social consequences and emerging possibilities that arise from this advancement [21]. So far, the relationship between humans and things in research has been unidirectional. So, what happens if we change the focus to ‘things’, especially ‘things’ with human-like intelligence with the potential to become fully self-aware within the next few decades or even achieve Artificial General Intelligence (AGI) [22-23]? What happens if we try to understand the world from the perspective of a ‘thing’, such as AI, which is increasingly impacting many aspects of life? Applying

3. AI and ChatGPT for Advancing Teaching and Learning Activities

The published scientific literature broadly suggests that AI technology possesses the potential to serve as a significant asset in education, occupying various roles that enrich both learning and pedagogical experiences. Authors have suggested that AI technology is an instrumental tool in essay grading [24-25], although the value and the efficacy of these AI-based grading tools remain largely unclear within the confines of the existing scientific literature. The literature has reported that ChatGPT exhibits the potential to automatize and improve the grading system and has suggested that ChatGPT could be utilized to semi automate the grading process for students’ work by discerning both the strengths and weaknesses within a given task in a broad spectrum of assignments, including research articles, academic essays, and other forms of written coursework [26]. In this context, educators can adapt the reports generated by such a model to deliver beneficial feedback to students, whether in formative or summative assessment scenarios. Furthermore, with the assistance of ChatGPT, a more precise evaluation of a student’s learning challenges, and progression can be ascertained. This can aid teachers in pinpointing the areas where learners encounter difficulties, allowing them to target interventions more effectively [27].

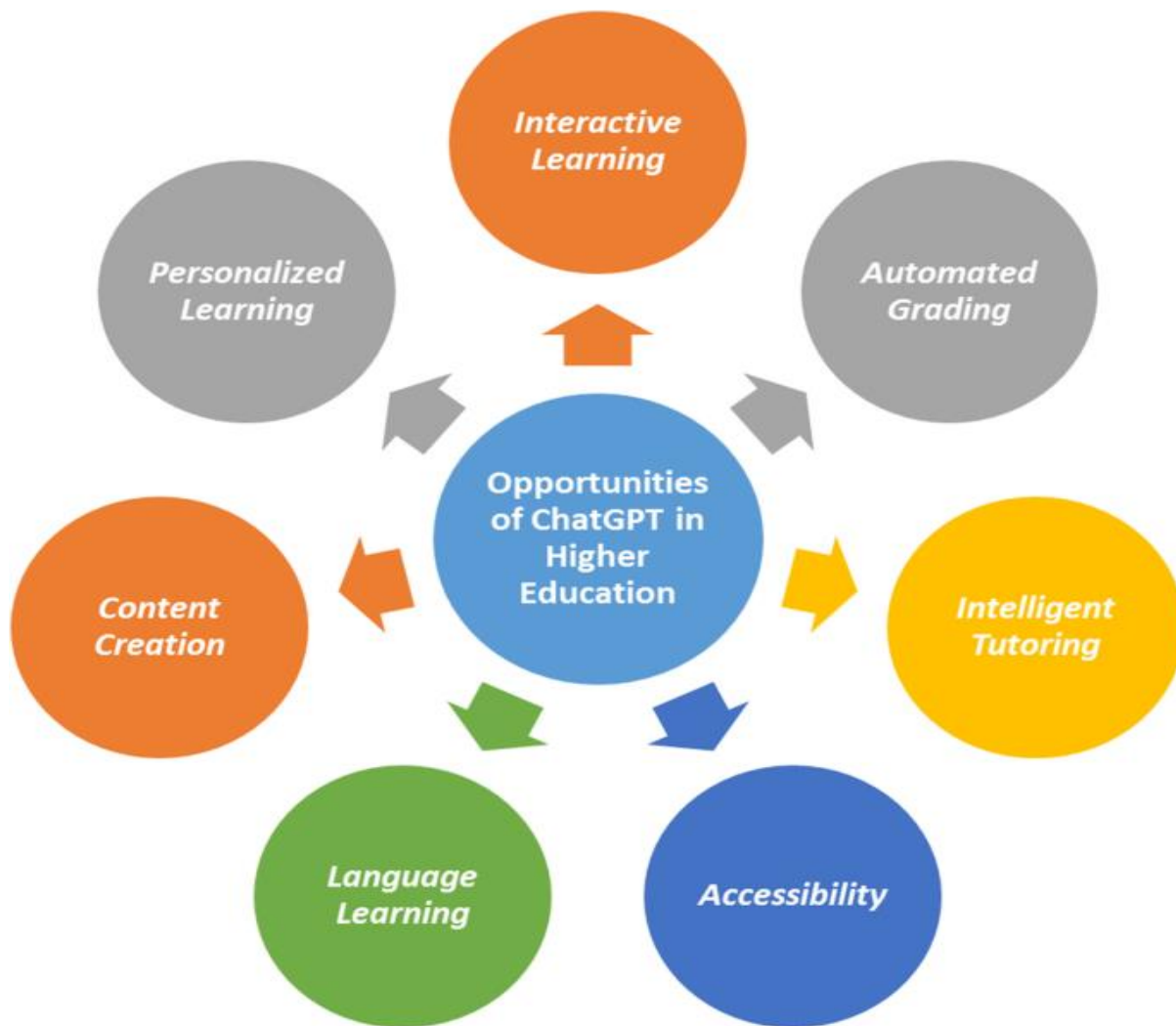


Fig: ChatGPT in Higher Educaion

The deployment of AI for grading short answer responses in an online learning environment has been evidenced successfully in past studies [28-29]. Furthermore, it has been argued that an AI-powered automatic grader (to be used to prepare an exam preparation) could potentially serve as a teaching aid for the students and help them achieve higher exam scores. Furthermore, AI graders may contribute to a more impartial grading process [30-31]. However, it is worth considering that it is essential to study the importance of the grading explanation and transparency of the grading process that these systems are reporting to the students, which may be a pivotal aspect considering both ethical concerns related to the technology and its acceptability [32].

Additionally, since AI systems rely on existing data from prior evaluations for training, they may be suited explicitly for assessing standardized tests, such as nationwide professional education examinations, where data from past tests are abundant and standardized assessment is a priority. However, these systems may be less competent when assessing individual university exams that often undergo annual format alterations and where past evaluation data might be limited.

Moreover, deploying AI for evaluating complex assignments might prove insufficient, necessitating that AI grades be calibrated or weighted by considering various variables unique to each assignment. These variables could include the student's independent work and contribution, their comprehension and representation of the existing literature on a given topic, and scenarios with limited training data. A balanced evaluation procedure that synergizes both a transparent or explainable AI system (for perspectives and definitions of explainable AI, see, for example, [33,34]) and human involvement is likely to yield the most favourable results in terms of the quality of assessments and the acceptability of using AI for evaluating student work, at least in the foreseeable future.

Because of future AI support, teachers could potentially lessen their workloads, redirecting their primary focus towards crafting innovative lesson plans, engaging in professional development, and offering personalized coaching and mentorship to each student. All these activities are instrumental in enhancing students' learning performance for the skills and challenges of the future.

The potential of AI tools extends beyond grading and assessment; they can also be deployed for translating educational materials and fostering interactive and adaptive learning environments. Notably, generative models, such as GPT-4, exhibit substantial promise in these domains. GPT-4 has demonstrated high proficiency in translation tasks, surpassing previous solutions in terms of quality [35-36]. However, the novelty of this application is partially tempered due to the pre-existing success of machine translation technologies, which have delivered satisfactory results in document translation already for several years [37-38]. Although this is not an entirely new development, it underscores the continuous advancements and improvements in the AI field, specifically in the sphere of machine translation. Envisioning learning materials translated quickly and automatically into several different languages is nowadays a potential perspective in the short term. These improvements hold the potential to further enhance and revolutionize learning experiences by providing precise and efficient translations of educational content. This not only expands the accessibility of materials to a more diverse student population but also contributes to creating more responsive and adaptable learning environments.

4. Challenges and Threats Posed by ChatGPT in Education

While ChatGPT's potential is vast, some concerns regarding the accuracy of its generated content must be addressed. Topsakal and Topsakal (2022) [39] proposed using ChatGPT to generate raw dialogue materials for training course-specific chatbots. Upon verification of the content's accuracy, these materials could then be translated by ChatGPT into a format compatible with AI chatbots such as Google Dialog flow, thus providing students with a personalized and interactive learning environment.

While, as discussed earlier, AI tools may help lecturers to decrease their current workload and therefore promote more research and lifelong learning activities (e.g., to improve the overall quality of the teaching and to implement new teaching methods in the classroom), they could also lead to job cuts [40] or outsourcing to the machines of a large portion of paid employment [41].

The use of ChatGPT in education poses challenges related to its accuracy and reliability [42]. Because ChatGPT is trained on a large corpus of unpolished, raw data, it may not be objective and critical inaccuracies

have been reported. The efficacy of generative models hinges on the quality and diversity of the data used in their training. If these training datasets encompass biases, these biases invariably seep into the model. Consider an illustrative scenario where a model is trained using a dataset predominantly composed of essays from students belonging to a specific demographic. This lack of diverse representation may compromise the model's ability to evaluate essays written by students outside of that demographic. The origin of these biases can be traced back to factors such as overreliance on research data sourced from affluent nations or the use of textbooks that fail to address a global perspective [43]. As evidenced by the work of Pavlik (2023) [44], ChatGPT is not familiar with crucial information relevant to evaluating media sources' quality and eventual biases. It has also been found that, in some cases, the information delivered by ChatGPT may be biased politically [45-46]; as well on religion, race, gender, and fairness (for a review see [47]). However, these biases seem to have decreased in the latest version of the AI tool [48]. In addition, ChatGPT's knowledge is by now limited to data before 2021 [49-50]. Taking into consideration the time required for AI systems to collect data and be updated, some level of delay between when the information is created (e.g., over the internet) and included in the model is also to be expected in the future (although this can be mitigated, e.g., by allowing the model to access information live on the internet, as in the implementation of ChatGPT into Bing or the recently released ChatGPT browsing beta). Therefore, its responses may not always be accurate or reliable, particularly for specialized subjects and recent events. Furthermore, ChatGPT may generate incorrect or even fabricated information, as often reported by both users and the scientific literature [51-52], and such issue can be problematic for students who rely on ChatGPT to inform their learning. However, the problems regarding the false information provided by AI models (often referred to as "AI Hallucinations," see [53]) are probably going to be mitigated in the future, and GPT4 already shows fewer of these hallucinations compared to the previous version of ChatGPT [54].

The complex issue of student plagiarism has become a significant worry within educational institutions due to the widespread use of AI writing tools. The rampant misuse of intellectual property without appropriate citation raises ethical concerns and undermines the academic integrity of the educational process. To combat this, plagiarism-detection applications routinely uncover plagiarized content in student submissions. These software solutions use various methods, from similarity checking to advanced linguistic pattern analysis, to identify plagiarized material (for an in-depth analysis of these tools and their application, refer to [55]).

Despite these precautionary measures, recent studies have highlighted an alarming trend where sophisticated AI models like ChatGPT can successfully circumvent these plagiarism detectors. It appears that ChatGPT, due to its ability to generate seemingly original text, can produce content that appears to be genuinely novel, thereby evading detection by traditional plagiarism software [56]. Exacerbating this issue are findings that even plagiarism detectors designed to flag text generated by AI models might not be entirely trustworthy. Although these specific detectors have shown some promise, they are not infallible and occasionally cannot identify AI-generated content. This inconsistency undermines the efficacy of these tools, contributing to the increasing complexity of plagiarism detection.

5. POSSIBLE DRAWBACK OF USING CHATGPT AND RELATED GENERATIVE AI IN EDUCATION

To have an overview of the possible drawback incorporating ChatGPT and related generative AI in education, ChatGPT was asked to discuss with references the possible drawback of using ChatGPT and related generative AI in education. Below is the outcome of my query.

While there are many potential benefits of using ChatGPT and other generative AI models in education, there are also some drawbacks to consider. These drawbacks are supported by research studies:

Lack of Human Interaction: ChatGPT and other generative models are not capable of providing the same level of human interaction as a real teacher or tutor. This lack of human interaction can be a disadvantage for students who may benefit more from a personal connection with a teacher. A study by D'Mello and colleagues (2014) found that students who interacted with a virtual tutor that mimicked human-like affective behaviour had a better learning outcome than those who interacted with a virtual tutor that lacked this behaviour.

Limited Understanding: Generative models are based on statistical patterns in the data they are trained on, and they do not have a true understanding of the concepts they are helping students learn. This can be a disadvantage when it comes to providing explanations or feedback that are tailored to a student's individual needs and misconceptions. A study by Wang and colleagues (2020) showed that a generative model-based tutoring system lacked the ability to provide explanations that were tailored to students' misconceptions.

Bias in Training Data: Generative models are only as good as the data they are trained on, and if the training data contains biases, the model will also be biased. For example, if a model is trained on a dataset of essays that are primarily written by students from a certain demographic, it may not be able to accurately grade essays written by students from other demographics. A study by Bolukbasi and colleagues (2016) showed that a generative model trained on a large corpus of text from the internet exhibited gender bias in its language generation.

Lack of Creativity: Generative models can only generate responses based on the patterns in the data they have seen during training, which can limit the creativity and originality of the responses. A study by Ziegler and colleagues (2019) found that a generative model-based music composition system had a limited ability to generate original and diverse melodies.

Dependency on Data: Generative models are trained on a large amount of data, and the quality of the model is highly dependent on the quality and quantity of the data. If the data is not sufficient or not relevant, the model will not be able to perform as well. A study by Kocaguneli and colleagues (2019) showed that a generative model-based question answering system performed poorly when the training data was not relevant to the task at hand.

Lack of Contextual Understanding: Generative models lack the ability to understand context and situation, which can lead to inappropriate or irrelevant responses. A study by Gao and colleagues (2019) showed that

a generative model-based dialogue system had a limited ability to understand and generate contextually appropriate responses in a conversation.

Limited ability to personalize instruction: ChatGPT and other generative AI models can provide general information and assistance, but they may not be able to personalize instruction to meet the individual needs of a particular student.

Privacy: There are also concerns about privacy and data security when using ChatGPT and other generative AI models in education.

It is important to keep in mind that ChatGPT and other generative AI models are powerful tools, but they are not a replacement for human teachers and tutors. It is important to use these tools responsibly and in conjunction with human instruction and support.

Overall, while generative AI models such as ChatGPT can be powerful tools for enhancing teaching and learning, it is important to be aware of their limitations and to use them in conjunction with other teaching methods that emphasize human interaction and understanding.

6. Conclusions

The findings of this study highlighted the transformative potential of ChatGPT in education, consistent with previous studies, while also revealing additional insights. It also highlighted significant challenges that must be addressed. The paper presents key themes identified during the interview, including opportunities, challenges, barriers, and mitigation strategies. Given the novelty of ChatGPT, existing literature about its use within higher education is limited and largely hypothetical or speculative. Our hope is that the findings presented here can serve as a research agenda for researchers and the wider academic community to identify research priorities, gaps in knowledge, and emerging trends. A key takeaway point is the urgent need for empirical research that delves into best practices and strategies for maximizing the benefits of GenAI, as well as user experiences, to understand students' and academics' perceptions, concerns, and interactions with ChatGPT. Another priority is the development of policies, guidelines, and frameworks for the responsible integration of ChatGPT in higher education. Based on the conversation with ChatGPT, this paper also presents some principles for the acceptable and responsible use of AI in higher education. These principles can be useful for Higher Education Institutions working towards internal AI policies. However, empirical studies are needed to explore the transferability of findings presented here to varied contexts with specific features, for instance, distance or online learning.

This study employed a thing ethnography approach to explore ChatGPT's perspective on the opportunities and challenges it presents for higher education. This is an innovative approach that has been implemented in design research but could become a powerful tool for researchers from other disciplines wanting to engage with "intelligent things". In this study, thing ethnography provided a methodological framework to collect the viewpoints of ChatGPT. This helped us to test its potential biases and accuracy, as well as uncover

insights that have not been extensively documented in the existing literature. As an interviewee, ChatGPT provided very relevant and interesting insights, showing some level of critique towards itself when questioned about potential risks and challenges, which indicates some level of transparency regarding its own shortcomings. A benefit of this approach is that ChatGPT enables interviewers to request further information and clarify responses, which can enhance data collection. Additionally, the chatbot displays a very good level of recollection during a conversation. Its memory seems to be limited; however, this did not represent an issue for the length of our interview. Despite the absence of non-verbal cues and expressions, the answers obtained seemed balanced and clearly conveyed meaning. Therefore, it is argued that interviews with ChatGPT have the potential to collect relevant data.

Author Contributions

Conceptualization, **Alka Rani**; methodology, **Deepam Sharma.**; validation, **Alka, Deepam, Priyanka Savita, Suryakant singh.** formal analysis, **Alka, Deepam , Priyanka, Savita, Suryakant singh and Sikander Hans:** writing—original draft preparation, **Sikander Hans, Suryankant singh** ; writing—review and editing, **Alka., Deepam , Priyanka, Savita, Suryakant singh and Sikander Hans;** . All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

REFERENCES

- [1] Makridakis, S. The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms. *Futures* **2017**, *90*, 46–60.
- [2] Bozkurt, A.; Xiao, J.; Lambert, S.; Pazurek, A.; Crompton, H.; Koseoglu, S.; Farrow, R.; Bond, M.; Nerantzi, C.; Honeychurch, S. Speculative Futures on ChatGPT and Generative Artificial Intelligence (AI): A collective reflection from the educational landscape. *Asian J. Distance Educ* **2023**, *18*, 50–130.
- [3] Bozkurt, A. Generative artificial intelligence (AI) powered conversational educational agents: The inevitable paradigm shift. *Asian J. Distance Educ.* **2023**, *18*. Available online: <http://www.asianjde.com/ojs/index.php/AsianJDE/article/view/718> (accessed on 15 April 2023).
- [4] Mondal, S.; Das, S.; Vrana, V.G. How to bell the cat? A theoretical review of generative artificial intelligence towards digital disruption in all walks of life. *Technologies* **2023**, *11*, 44.
- [5] Zhang, C.; Zhang, C.; Li, C.; Qiao, Y.; Zheng, S.; Dam, S.K.; Zhang, M.; Kim, J.U.; Kim, S.T.; Choi, J. One small step for generative ai, one giant leap for agi: A complete survey on chatgpt in aigc era. *arXiv* **2023**, arXiv:2304.06488.
- [6] Jovanovic, M.; Campbell, M. Generative Artificial Intelligence: Trends and Prospects. *Computer* **2022**, *55*, 107–112.

- [7] Mathew, A. Is Artificial Intelligence a World Changer? A Case Study of OpenAI's Chat GPT. *Recent Prog. Sci. Technol.* **2023**, 5, 35–42.
- [8] Rivas, P.; Zhao, L. Marketing with chatgpt: Navigating the ethical terrain of gpt-based chatbot technology. *AI* **2023**, 4, 375–384.
- [9] Hammersley, M. Ethnography: Problems and prospects. *Ethnogr. Educ.* **2006**, 1, 3–14.
- [10] Giaccardi, E.; Speed, C.; Cila, N.; Caldwell, M.L. Things as co-ethnographers: Implications of a thing perspective for design and anthropology. In *Design Anthropological Futures*; Smith, R.C., Vangkilde, K.T., Otto, T., Kjaersgaard, M.G., Halse, J., Binder, T., Eds.; Routledge: London, UK, 2020; pp. 235–248.
- [11] Hans, S. and Ghosh, S.(2020), "Position analysis of brushless direct current motor using robust fixed order H-infinity controller", *Assembly Automation*, Vol. 40 No. 2, pp. 211-218.
- [12] S. Hans and S. Ghosh, "H-infinity controller based disturbance rejection in continuous stirred-tank reactor," *Intelligent Automation & Soft Computing*, vol. 31, no.1, pp. 29–41, 2022.
- [13] S. Hans, S. Ghosh, S. Bhullar, A. Kataria, V. Karar et al., "Hybrid energy storage to control and optimize electric propulsion systems," *Computers, Materials & Continua*, vol. 71, no.3, pp. 6183–6200, 2022
- [14] S. Hans, S. Ghosh, A. Kataria, V. Karar and S. Sharma, "Controller placement in software defined internet of things using optimization algorithm," *Computers, Materials & Continua*, vol. 70, no.3, pp. 5073–5089, 2022
- [15] Dignum, V. Responsible Artificial Intelligence: Recommendations and Lessons Learned. In *Responsible AI in Africa: Challenges and Opportunities*; Eke, D.O., Wakunuma, K., Akintoye, S., Eds.; Springer Nature: Cham, Switzerland, 2023; pp. 195–214.
- [16] Future of Life Institute. Pause Giant AI Experiments: An Open Letter. Available online: <https://futureoflife.org/open-letter/pause-giant-ai-experiments/> (accessed on 22 April 2023).
- [17] Gonzalez-Jimenez, H. Taking the fiction out of science fiction:(Self-aware) robots and what they mean for society, retailers and marketers. *Futures* **2018**, 98, 49–56.
- [18] OpenAI (2023) Planning for AGI and Beyond. Available online: <https://openai.com/blog/planning-for-agi-and-beyond> (accessed on 30 April 2023).
- [19] Babitha, M.M.; Sushma, C. Trends of Artificial Intelligence for online exams in education. *Int. J. Early Child. Spec. Educ.* **2022**, 14, 2457–2463.
- [20] AlAfnan, M.A.; Dishari, S.; Jovic, M.; Lomidze, K. Chatgpt as an educational tool: Opportunities, challenges, and recommendations for communication, business writing, and composition courses. *J. Artif. Intell. Technol.* **2023**, 3, 60–68.
- [21] Kasneci, E.; Seßler, K.; Küchemann, S.; Bannert, M.; Dementieva, D.; Fischer, F.; Gasser, U.; Groh, G.; Günnemann, S.; Hüllermeier, E. ChatGPT for good? On opportunities and challenges of large language models for education. *Learn. Individ. Differ.* **2023**, 103, 102274.

- [22] Schlippe, T.; Stierstorfer, Q.; Koppel, M.T.; Libbrecht, P. Explainability in Automatic Short Answer Grading. In *Artificial Intelligence in Education Technologies: New Development and Innovative Practices: Proceedings of 2022 3rd International Conference on Artificial Intelligence in Education Technology*; Springer: Berlin, Germany, 2023; pp. 69–87.
- [23] Schlippe, T.; Sawatzki, J. *Cross-lingual automatic short answer grading. Artificial Intelligence in Education: Emerging Technologies, Models and Applications: Proceedings of 2021 2nd International Conference on Artificial Intelligence in Education Technology*; Springer: Berlin, Germany, 2021; pp. 117–129.
- [23] Conijn, R.; Kahr, P.; Snijders, C. The Effects of Explanations in Automated Essay Scoring Systems on Student Trust and Motivation. *J. Learn. Anal.* **2023**, *10*, 37–53.
- [25] Hagra, H. Toward human-understandable, explainable AI. *Computer* **2018**, *51*, 28–36.
- [26] Langer, M.; Oster, D.; Speith, T.; Hermanns, H.; Kästner, L.; Schmidt, E.; Sesing, A.; Baum, K. What do we want from Explainable Artificial Intelligence (XAI)?—A stakeholder perspective on XAI and a conceptual model guiding interdisciplinary XAI research. *Artif. Intell.* **2021**, *296*, 103473.
- [27] Jiao, W.X.; Wang, W.X.; Huang, J.T.; Wang, X.; Tu, Z.P. Is ChatGPT a good translator? Yes with GPT-4 as the engine. *arXiv* **2023**, arXiv:2301.08745.
- [28] Wang, L.; Lyu, C.; Ji, T.; Zhang, Z.; Yu, D.; Shi, S.; Tu, Z. Document-level machine translation with large language models. *arXiv* **2023**, arXiv:2304.02210.
- [29] Deng, X.; Yu, Z. A systematic review of machine-translation-assisted language learning for sustainable education. *Sustainability* **2022**, *14*, 7598.
- [30] Tsai, S.C. Using google translate in EFL drafts: A preliminary investigation. *Comput. Assist. Lang. Learn.* **2019**, *32*, 510–526.
- [31] Lim, W.M.; Gunasekara, A.; Pallant, J.L.; Pallant, J.I.; Pechenkina, E. Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators. *Int. J. Manag. Educ.* **2023**, *21*, 100790.
- [32] Dwivedi, Y.K.; Kshetri, N.; Hughes, L.; Slade, E.L.; Jeyaraj, A.; Kar, A.K.; Baabdullah, A.M.; Koohang, A.; Raghavan, V.; Ahuja, M.; et al. “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *Int. J. Inf. Manag.* **2023**, *71*, 102642.
- [33] Kasneci, E.; Seßler, K.; Küchemann, S.; Bannert, M.; Dementieva, D.; Fischer, F.; Gasser, U.; Groh, G.; Günnemann, S.; Hüllermeier, E.; et al. ChatGPT for good? On opportunities and challenges of large language models for education. *Learn. Individ. Differ.* **2023**, *103*, 102274.
- [34] Baidoo-Anu, D.; Owusu Ansah, L. Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *SSRN* **2023**.
- [35] Zhai, X. ChatGPT user experience: Implications for education. *SSRN* **2022**.
- [36] Reuters. Top French University Bans Use of ChatGPT to Prevent Plagiarism. Available online: <https://www.reuters.com/technology/top-french-university-bans-use-chatgpt-prevent-plagiarism-2023-01-27/> (accessed on 28 April 2023).

- [37] TheTab. These Are the Russell Group Unis that Have Banned Students from Using ChatGPT. Available online: <https://thetab.com/uk/2023/03/03/these-are-the-russell-group-unis-that-have-banned-students-from-using-chatgpt-297148> (accessed on 28 April 2023).
- [38]. UCL. Engaging with AI in Your Education and Assessment. Available online: <https://www.ucl.ac.uk/students/exams-and-assessments/assessment-success-guide/engaging-ai-your-education-and-assessment> (accessed on 28 April 2023).
- [39] Topsakal, O.; Topsakal, E. Framework for a Foreign Language Teaching Software for Children Utilizing AR, Voicebots and ChatGPT (Large Language Models. *J. Cogn. Syst.* 2022, 7, 33–38.
- [40] Howard, J. Artificial intelligence: Implications for the future of work. *Am. J. Ind. Med.* 2019, 62, 917–926.
- [41] De Cremer, D.; Kasparov, G. AI should augment human intelligence, not replace it. *Harv. Bus. Rev.* 2021, 18.
- [42] Mbakwe, A.B.; Lourentzou, I.; Celi, L.A.; Mechanic, O.J.; Dagan, A. ChatGPT Passing USMLE Shines a Spotlight on the Flaws of Medical Education. *PLoS Digit. Health* 2023, 2, 0000205.
- [43] Pavlik, J.V. Collaborating with ChatGPT: Considering the Implications of Generative Artificial Intelligence for Journalism and Media Education. *J. Mass Commun. Educ.* 2023, 78, 10776958221149577.
- [44] McGee, R.W. Is chat gpt biased against conservatives? an empirical study. *SSRN Electron. J.* 2023, 2023.
- [45] Rozado, D. The political biases of chatgpt. *Soc. Sci.* 2023, 12, 148.
- [46] Singh, S. Is ChatGPT Biased? A Rev. 2023. Available online: <http://osf.io/9xkbu/download> (accessed on 15 April 2023).
- [47] Abramski, K.; Citraro, S.; Lombardi, L.; Rossetti, G.; Stella, M. Cognitive network science reveals bias in GPT-3, ChatGPT, and GPT-4 mirroring math anxiety in high-school students. *arXiv* 2023, arXiv:2305.18320.
- [48] Gilson, A.; Safranek, C.W.; Huang, T.; Socrates, V.; Chi, L.; Taylor, R.A.; Chartash, D. How does CHATGPT perform on the United States Medical Licensing Examination? the implications of large language models for medical education and knowledge assessment. *JMIR Med. Educ.* 2023, 9, 45312.
- [49] Grünebaum, A.; Chervenak, J.; Pollet, S.L.; Katz, A.; Chervenak, F.A. The exciting potential for ChatGPT in obstetrics and gynecology. *Am. J. Obstet. Gynecol.* 2023, 228, 696–705.
- [50] Gravel, J.; D'Amours-Gravel, M.; Osmanliu, E. Learning to fake it: Limited responses and fabricated references provided by ChatGPT for medical questions. *Mayo Clin. Proc. Digit. Health* 2023, 1, 226–234.
- [51] Wen, J.; Wang, W. The future of ChatGPT in academic research and publishing: A commentary for clinical and translational medicine. *Clin. Transl. Med.* 2023, 13, 1207.
- [52] Alkaissi, H.; McFarlane, S.I. Artificial hallucinations in ChatGPT: Implications in scientific writing. *Cureus* 2023, 15, e35179.
- [53] Ali, R.; Tang, O.Y.; Connolly, I.D.; Fridley, J.S.; Shin, J.H.; Sullivan, P.L.Z.; Cielo, D.; Oyelese, A.A.; Doberstein, C.E.; Telfeian, A.E.; et al. Performance of ChatGPT, GPT-4, and Google Bard on a Neurosurgery Oral Boards Preparation Question Bank. *Neurosurgery* 2023.

- [54] Naik, R.R.; Landge, M.B.; Mahender, C.N. A review on plagiarism detection tools. *Int. J. Comput. Appl.* 2015, 125, 16–22.
- [55] Khalil, M.; Er, E. Will ChatGPT get you caught? Rethinking of plagiarism detection. *arXiv* 2023, arXiv:2302.04335.
- [56] Bašić, Ž.; Banovac, A.; Kružić, I.; Jerković, I. Better by you, better than me, chatgpt3 as writing assistance in students essays. *arXiv* 2023, arXiv:2302.04536.