Carlos Montenegro · Álvaro Rocha ·
Juan Manuel Cueva Lovelle
Editors

Management, Tourism and Smart Technologies

ICMTT 2023 Volume 1

Springer

Editors
Carlos Montenegro
Universidad Distrital Francisco José de Caldas
Bogota, Colombia

Álvaro Rocha
ISEG
Universidade de Lisboa
Lisbon, Portugal

Juan Manuel Cueva Lovelle
Departamento de Informática
University of Oviedo
Oviedo, Spain

ISSN 2367-3370 ISSN 2367-3389 (electronic)
Lecture Notes in Networks and Systems
ISBN 978-3-031-44130-1 ISBN 978-3-031-44131-8 (eBook)
https://doi.org/10.1007/978-3-031-44131-8

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Paper in this product is recyclable.

Preface

In this edition of the International Conference on Management, Tourism and Technologies—ICMTT 2023, papers were presented in the areas of: Managements, Tourism, Marketing Strategies in Management, Tourism and Technology, and Technology.

We would like to give special thanks to the Universidad Distrital Francisco José de Caldas, Fundación Universitaria Internacional de la Rioja, and Universidad de Cundinamarca, for hosting us, as well as to all the members and collaborators, since without them this dream would not have been possible.

We had more than 200 papers presented, we spent 3 consecutive days in 5 parallel rooms, and more than 400 people passed through the event and generated an academic space that allowed the exchange of experiences to advance in the era of knowledge, where we have so much data that the important thing is to transform it into knowledge. Another of the great experiences that the event left us is that virtuality is definitely a reality, since many of our works were presented in this way.

We still have many challenges, but a very important one and on which we are working is how to get that academic relationship that gives us the presence in these events we can also make up for with virtuality, and this reflection has helped us to understand what a visionary as Mark Zuckerberg CEO of Meta has envisioned in what he called the Metaverse and just put an oculus to understand that virtuality needs these visions to achieve the great challenge we have set ourselves: How will we relate to other people in academic, social, or other contexts through virtual scenarios?

I hope to see you all at the next edition of the International Conference on Management, Tourism and Technologies—ICMTT 2024, in Cusco, Peru, and as we will not stop doing virtual sessions, the challenge is that we all have some oculus to see ourselves in our Metaverse.

May 2023

Carlos Montenegro
Álvaro Rocha

Contents

Artificial intelligence language models: the path to development or regression for education?

Bruno F. Gonçalves[1][0000-0002-7541-3673] and Vitor Gonçalves[2][0000-0002-0645-6776]

[1] CIEB, Polytechnic Institute of Bragança, Portugal
[2] CIEB, Polytechnic Institute of Bragança, Portugal
bruno.goncalves@ipb.pt

Abstract. Artificial intelligence language models have the potential to transform various aspects of the world, for example in the areas of human communication, industry, and science. However, the evolution of these language models also raises concerns about issues related to privacy, security, ethics and responsibility. In this sense, this exploratory research, supported by a literature review, aims to determine the benefits and risks of using these models in an educational context, namely, the ChatGPT (Generative Pre-trained Transformer). The ChatGPT is an artificial language model developed by OpenAI that can be used to generate natural language responses to a wide variety of questions and tasks. This model is trained on a large set of text data and uses deep learning techniques to generate relevant and contextually appropriate answers. Since this technology was launched very recently, in November 2022, in addition to the literature review, the authors make an evaluation of the technology with support in the interaction with it. The results of the research point to the existence of a set of educational potentialities, but also a range of risks in the use of this technology.

Keywords: artificial intelligence, ChatGPT, education, teaching-learning process.

1 Artificial intelligence language models: ChatGPT

The technologies in the field of artificial intelligence are a clear example of this evolution, but also of innovation. Artificial intelligence covers several areas, such as voice recognition, computer vision, machine learning, artificial neural networks, robotics, and natural language processing. All these areas are now very important not only in industry, science, or education, but also in the lives and daily lives of citizens.
Artificial intelligence has more and more examples emerging in the world of true innovations in different areas such as health, gaming industry, agriculture, finance, education and many more. Today we have cars that drive themselves without the need of a driver, such as Tesla's vehicles. We have automatic diagnoses that are sometimes more accurate than diagnoses made by health professionals, such as the robot invented by the company iFlytek that passed the national exam for licensing doctors in China [1]. Facial

recognition is another important technology that helps recognize and interpret human speech, allowing interaction with devices through voice commands [2]. We have facial recognition that allows us to identify people by their facial features [3]. Increasingly fast and accurate machine translators are another example. It should be noted that the area of artificial intelligence that deals with translation and manipulation of text is known as natural language processing [4], [5]. The recommendation system "like Amazon (recommendation of books and products in general), Netflix (recommendation of movies and series) and Spotify (recommendation of music)" [6] is another technology in vogue in the market that is based on the consumption habits and preferences of customers [7]. Sentiment analysis also uses natural language processing techniques to identify the opinion and sentiment expressed in a text [8]. Also in the area of finance we see automation of processes to improve data analysis, such as fraud detection in the financial credit segment that uses machine learning techniques to identify fraudulent transactions in real time [9]. Personalization of content based on users' interests and browsing history is another of the artificial intelligence technologies [10]. Computer network intrusion detection by identifying malicious activities in computer networks to prevent cyber-attacks [11]. Each of these artificial intelligence models has the potential to contribute to the development of the other economic sectors of society either at the level of organizations or at the level of the life of the ordinary citizen. It is of course up to each organization and citizen to use these models in a balanced way taking into consideration the issues related to privacy and security, but also the ethical issues involved.

These models use machine learning techniques to analyze large amounts of text, learn linguistic patterns and rules, and then generate text that is coherent and identical to what a human would produce.

There are several artificial intelligence language models such as, for example, GPT-3 (Generative Pre-trained Transformer 3) created by OpenAI, BERT (Bidirectional Encoder Representations from Transformers) created by Google, ELMO (Embeddings from Language Models) designed by the Allen Institute for AI, Transformer-XL created by the Google Brain team, among many others.

The new chatbot was released by way of research preview "... to get users' feedback and learn about its strengths and weaknesses" [12]. In the following week more than a million users tried out the new chatbot [13]. Following the numbers, it should be noted that GPT-1 was released in 2018 by OpenAI and had 117 million parameters. GPT-2, on the other hand, was released in 2019 and had 1.5 billion parameters, making it one of the largest neural networks in the world at the time. In 2020, OpenAI released GPT-3, which had 175 billion parameters, making it the largest natural language processing model in the world at the time. GPT-3 has been used in a variety of applications, including chatbots, writing assistance, language translation, sentiment analysis, and other tasks related to natural language processing. ChatGPT is a "game changer" with the potential to end some traditional sorts of assignments and assessments such as essay writing [14]. GPT-3 has been used to generate articles [15], stories [16], and other types of written content, with some users reporting that the generated text is difficult to distinguish from text written by humans [17]. The ability to produce articles has generated some concerns about GPT-3 being used to create fake news and through them manipulate public opinion [18]. However, GPT-3 has also been suggested as a tool to help writers and content creators generate ideas and overcome blocking [19], but also as a means to automate the production of repetitive or time-consuming content tasks [20].

ChatGPT is a variant of the GPT-3. The ChatGPT was developed by OpenAI which is an artificial intelligence research company that aims to create artificial intelligence in a safe and beneficial way for humanity. These kinds of technologies use artificial intelligence and natural language to simulate a conversation between a person and a machine, which can have many practical applications and benefits, but also constraints. The ChatGPT was launched on November 30, 2022 and has revolutionized various economic sectors of societies, since it allows greater proximity between humans and machines, namely through a more natural and efficient interaction. ChatGPT represents the effort that computer scientists are making to pursue artificial generalized intelligence - ChatGPT is not only capable of knowledge accumulating, but also coding, and debugging programs [14].

The use of large language models in education has been identified as a potential area of interest due to the diverse range of applications they offer [21]. From the perspective of learning opportunities, these models can enable diverse types of experiences for: elementary school students, middle and high school students, university students, group and distance learning, empowering students with disabilities, and for professional training [21]. These models thus have the potential to provide a wide range of benefits and opportunities for students and professionals in all educational cycles. Can be used to provide support to students and teachers in a variety of educational settings, including face-to-face and distance learning, increasing access to educational information and resources, and improving teaching efficiency and reducing teacher workload. However, the use of these models should be done with caution as they also have limitations such as lack of interpretability and potential for bias, unexpected weakness in relatively simple tasks [22], among others. In this sense, it becomes important to make students aware of good practices in the use of these models, but also regarding emerging dangers. However, awareness is not enough, it is necessary to involve the educational communities and the parents in this matter. Banning doesn't work or make any sense, and this is just the beginning, since the continuous development of artificial intelligence technology is here to stay, so we can expect to see more innovations in education that explore the potential of these models to improve learning and student engagement.

2 Method

This study aims to identify a set of benefits and risks of artificial intelligence language models, constituting the ChatGPT as the technology under study in this research. The research is exploratory in nature, since the theme is still little known, so there is still little information available. It is also descriptive in that it will be very important to describe and analyze a phenomenon, in order to provide a detailed and precise view of the characteristics and properties of the ChatGPT. Both the exploratory and descriptive types are important for the development of the research and are used together to deepen the understanding of this phenomenon that has come to revolutionize the various economic sectors of society.

Systematic literature review will be further adopted as a research methodology to identify and study a set of articles that address the benefits and drawbacks of ChatGPT. The systematic review will be carried out taking into consideration the following set of criteria: (i) Type of documents: scientific articles; (ii) Search languages: Portuguese and

English; (iii) Database: Google Scholar, Scopus, Web of Science, RCAPP. Scielo; Search date: November 2022 to present; (v) Keywords: "Benefits and Constraints of ChatGPT"; "Advantages and Risks of ChatGTP"; "Systematic Reviews on ChatGPT"; "Dangers in ChatGPT".
Qualitative data were recorded in the investigator's diary according to previously defined criteria. Subsequently, they were treated, analyzed and categorized in Microsoft Excel with the aim of identifying the various senses of response.
The following table identifies the selected articles:

Table 1 - Articles selected from the systematic review.

ID	Authors	Year	Title
1	Aljanabi, M., Ghazi, M., Ali, A. H., & Abed, S. A.	2023	ChatGpt: Open Possibilities. Iraqi Journal For Computer Science and Mathematics
2	Alshurafat, H.	2023	he Usefulness and Challenges of Chatbots for Accounting Professionals: Application On ChatGPT.
3	Azaria, A.	2022	ChatGPT Usage and Limitations
4	Baidoo-Anu, D., & Owusu Ansah, L.	2023	Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning
5	Cotton, D. R., Cotton, P. A., & Shipway, J. R.	2023	Chatting and Cheating. Ensuring academic integrity in the era of ChatGPT.
6	Deng, J., & Lin, Y.	2022	The Benefits and Challenges of ChatGPT: An Overview. Frontiers in Computing and Intelligent Systems
7	Gordijn, B., & Have, H. T.	2023	ChatGPT: evolution or revolution?
8	Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., ... & Kasneci, G.	2023	ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education.
9	Lund, B., & Ting, W.	2023	Chatting about ChatGPT: How May AI and GPT Impact Academia and Libraries?
10	Pickell, T. R., & Doak, B. R.	2023	Five Ideas for How Professors Can Deal with GPT-3
11	Zhai, X.	2022	ChatGPT user experience: Implications for education

As can be seen in the previous table, of the total 18 articles identified, 11 were selected and, therefore, 7 were excluded for not meeting the requirements defined for conducting the systematic literature review.

4. Benefits and risks in education: ChatGPT

The GPT chat has 5 benefits that we think are crucial for the development of the teaching-learning process [23]:
Text generators like ChatGPT can boost our collective familiarity with AI and how to use it, a critical competency for our students and their futures; (Assist educators in preparing and reviewing sessions by providing them with additional resources or helping them create engaging educational content. The addition of tech like ChatGPT has the potential to develop written materials previously validated; Can save educators time by

automatically grading students' assignments or doing educators' repetitive work (preparing announcements and instructions for assignments or exams or providing feedback to students); Can be used for training purposes (students can use ChatGPT to emulate conversations and develop their language skills and abilities through conversational interactions with the chatbot); ChatGPT could be used to improve engagement in online learning by increasing students' motivation in asynchronous sessions or activities.
In addition to the benefits listed by [23], there are others that seem to complement the above [24]: Academic writing: ability to assist in research (generate abstracts of papers, extract key points, and even provide citations). It should be noted here that, based on the authors' experience with the GPT Chat, many of the references, especially those from the last 3-5 years, are false or simply do not exist. Another advantage is its ability to help with writing and also provide feedback on grammar, style, and coherence, helping writers improve their work. It should be used as a tool to help with academic writing, not to replace it. In addition, the output generated by ChatGPT should be checked and reviewed by the user, as it is not always 100% accurate [25], as noted above; ChatGPT as a search engine: one of the main advantages of using ChatGPT as a search engine is its ability to understand and respond to queries in natural format and the ability to provide contextually relevant information. In addition, ChatGPT can also generate new text, making it a powerful tool for content creation. However, one of the main limitations is its cost and accessibility - it is only available to a select group of developers and the cost of using ChatGPT can be prohibitive for some users. A limitation is that it does not fully understand human language, so it does not always provide the most accurate or useful information. It is also unable to handle certain types of queries, such as mathematical calculations [26]; Coding: ability to understand natural language inputs; ability to provide contextually relevant information; generate new code, making it a powerful tool for code generation. However, one of the main limitations is that ChatGPT is not yet able to fully understand the nuances of programming languages and therefore may not always provide the most accurate or useful information. It must also be taken into consideration here that these aspects still need a lot of improvement, which again is vital to always corroborate the information provided; Detect security vulnerabilities: ability to help detect security vulnerabilities, making it a valuable tool for security professionals; it can understand the intent behind a query and provide information directly related to the vulnerability being sought; it can also generate new code fragments, making it a powerful tool for exploit generation. One of the main limitations is that it is not yet ready to understand the nuances of security vulnerabilities and therefore may not always provide the most accurate or useful information. It is also unable to handle certain types of queries, such as reverse engineering or malware analysis [27]; Media: ability to help with media tasks; ability to understand natural language input (this can make the content creation process more intuitive and user-friendly for many people); ability to provide contextually relevant information; generate new text, making it a powerful tool for creating engaging and informative media publications. However, a major limitation is that it is not yet ready to understand the nuances of human language and media communication, and therefore may not always provide the most accurate or useful information. It is also not able to deal with certain types of issues, such as creating hashtag strategies or identifying trending topics [28].
Other advantages of ChatGPT in an educational context are, for example [29]: Personalized tutoring (ChatGPT can be used to provide personalized tutoring and feedback to

students based on their individual learning needs and progress); Automated Essay Grading (ChatGPT can be trained to grade students' essays, giving teachers more time to focus on other aspects of teaching); Language Translation (ChatGPT can be used to translate educational materials into different languages, making them more accessible to a wider audience); Interactive Learning (ChatGPT can be used to create interactive learning experiences where students can interact with a virtual tutor in a conversational manner); Adaptive Learning (ChatGPT can be used to create adaptive learning systems that adjust their teaching methods based on a student's progress and performance).

Obviously, as with everything, there are limitations and constraints associated with the use (or misuse) of ChatGPT [29], so these are also addressed below. Lack of Human Interaction: ChatGPT is not capable of providing the same level of human interaction as a real teacher whether in face-to-face or online teaching). The interaction between teachers and students is one of the most significant factors for school success, especially when the feedback given by the teacher is effective and encouraging and, therefore, fundamental in the teaching-learning process [30]–[33]; 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; 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; 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; 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. Lack of Contextual Understanding: Generative models lack the ability to understand context and situation, which can lead to inappropriate or irrelevant responses; Limited ability to personalize instruction: 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.

Other benefits of ChatGPT are related to the fact that the platform has asynchronous communication [34]; Increase student engagement and collaboration, as it allows students to post questions and discuss topics without having to be present at the same time [35]; Can be used to create student groups, allowing students to work together on projects and assignments [36]; It allows remote teaching, which is useful for students who are unable to attend classes due to physical or mental health issues [37]; GPT-3 could be used to generate customized exams or quizzes for each student based on their individual needs and abilities [37], [38]; Creation of interactive, game-based assessments [34]; Provide educational resources, such as study guides and lecture notes, to help students better understand the material [39]; Grade assignments and provide feedback to students in real-time, allowing for a more efficient and personalized learning experience [38], [40], [41].

Other authors largue that ChatGPT can [42]: Help increase efficiency by automating conversations; Generate responses quickly, allowing for faster conversations; Cost reduction for organizations; Ability to respond in real time; ChatGCP can learn and improve its capabilities. These authors consider that, in parallel, there are also some limitations, such as: It is only able to generate text based on the input provided to it. This means that it is unable to provide accurate or up-to-date information on a wide

range of topics; Is trained on a large dataset of human language, and as a result it may produce responses that contain biased or offensive language.
Also [21] in a study about the opportunities and challenges of the great language models for education, some more benefits related to learning opportunities are pointed out, namely: personalized learning, lesson planning, language learning, research and writing, professional development, assessment and evaluation, and also acquaintance of students with AI challenges. The challenges that artificial intelligence creates are indeed very interesting from an educational point of view, namely, the ability to reason and reflect, so it is essential that students learn and become involved in artificial intelligence models.
Other limitations associated with the use of artificial intelligence in education have to do with [14]: Complexity: since the systems require resources and expertise to be developed and maintained, and many schools do not have them. Integration with existing systems: aI systems often need to be integrated with existing systems and processes, which can be a challenge for schools and educators. This can be a challenge for schools in terms of ethical, privacy and security issues; Internet connectivity: many AI systems depend on Internet connectivity to function properly. This can be a challenge in areas where Internet access is limited or unreliable; Initial costs: the initial costs of implementing AI systems can be significant.
Obviously, besides the benefits and risks presented by the integration of models like ChatGPP in education, there are others that we will only realize over time, based on the experience of the various educational actors. However, it becomes more important to reflect on how ChatGP (and other similar models) can be integrated into education: In the first, second and third cycles? In secondary and vocational education? In higher education? In all study cycles? For all ages? In which courses, disciplines or learning contexts might it be useful to integrate? In all or only some? There is no point in marginalizing these kinds of models, quite the contrary. We have to find appropriate ways to integrate them into teaching-learning processes to improve the quality of education and to train young people with diverse and truly useful digital skills for the market.

3 Conclusions

The development of this research allowed us to study more specifically the language models of artificial intelligence and, through this, to contribute to literacy in the area, but also to reflection and debate on the subject in the educational and scientific communities. A number of benefits, but also risks in using ChatGPT in education (face-to-face or online) were identified. When crossing these two dimensions, it was understood that the benefits are indeed immense, and many of them we still can not visualize clearly, because the ChatGPT is very recent and has not yet been officially integrated as a tool to support the teaching-learning process. However, the main benefits are related to innovation, accessibility, democratization of information and teaching, availability, self-learning, speed of response, scalability and multilingualism. The main risks identified refer to ethical issues related to security, reliability and privacy, manipulation through the spread of misinformation, prejudice and social discrimination, and the absence of personalized feedback.

So, are artificial intelligence language models the path to development or regression for education? The answer is: they are an integral and important part of the path to development for education as long as they are used with ethical principles in mind. It is, therefore, fundamental to train teachers, students and parents in this type of tools, so that they are equipped with the skills to operate within ethical and responsible standards, and also to make them aware of the importance of this technology as a tool to support the teaching-learning process and not as a mere substitute. Beyond training, it is necessary to go much further, and for this reason, this may be the perfect opportunity to rethink and reflect on the civil community. The covid-19 pandemic has boosted the adoption of online learning in educational institutions and is here to stay, and now the artificial language models have certainly come and are not going away, quite the contrary! Given that the contextual conditions have changed in education and that there have been a number of changes in the last three years in the way education is offered to students and in the way it is developed, we believe it is important to rethink whether the education models currently in force are useful and appropriate to the new educational reality. Isn't it time to change course, taking the opportunity to modernize, innovate, and re-invent education? Shouldn't we really seize this opportunity? We believe so!

Acknowledgment

This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the Project Scope: UIDB/05777/2020.

References

[1] R. C. X. SARACCO, “You are now a medical doctor,” *IEEE Futur. Dir.*, 2017.

[2] G. Hinton *et al.*, “Deep neural networks for acoustic modeling in speech recognition: The shared views of four research groups,” *IEEE Signal Process. Mag.*, vol. 29, no. 6, pp. 82–97, 2012.

[3] Y. Taigman, M. Yang, M. Ranzato, and L. Wolf, “Deepface: Closing the gap to human-level performance in face verification,” in *Proceedings of the IEEE conference on computer vision and pattern recognition*, 2014, pp. 1701–1708.

[4] A. Torfi, R. A. Shirvani, Y. Keneshloo, N. Tavaf, and E. A. Fox, “Natural language processing advancements by deep learning: A survey,” *arXiv Prepr. arXiv2003.01200*, 2020.

[5] D. W. Otter, J. R. Medina, and J. K. Kalita, “A survey of the usages of deep learning for natural language processing,” *IEEE Trans. neural networks Learn. Syst.*, vol. 32, no. 2, pp. 604–624, 2020.

[6] T. B. Ludermir, “Inteligência Artificial e Aprendizado de Máquina: estado atual e tendências,” *Estud. Avançados*, vol. 35, pp. 85–94, 2021.

[7] G. Linden, B. Smith, and J. York, “Amazon. com recommendations: Item-to-item collaborative filtering,” *IEEE Internet Comput.*, vol. 7, no. 1, pp. 76–80, 2003.

[8] B. Pang and L. Lee, “Opinion mining and sentiment analysis,” *Found. Trends® Inf. Retr.*, vol. 2, no. 1–2, pp. 1–135, 2008.

[9] E. Martins and N. V. Galegale, “Detecção de fraudes no segmento de crédito financeiro utilizando aprendizado de máquina: uma revisão da literatura,” *Rev. e-TECH Tecnol. para Compet. Ind.*, vol. 15, no. 3, 2022.

[10] G. Adomavicius and A. Tuzhilin, “Toward the next generation of recommender systems: A survey of the state-of-the-art and possible extensions,” *IEEE Trans. Knowl. Data Eng.*, vol. 17, no. 6, pp. 734–749, 2005.

[11] A. Patcha and J.-M. Park, “An overview of anomaly detection techniques: Existing solutions and latest technological trends,” *Comput. networks*, vol. 51, no. 12, pp. 3448–3470, 2007.

[12] O. Team, “ChatGPT: Optimizing language models for dialogue.” 2022.

[13] C. Vallance, “ChatGPT: New AI chatbot has everyone talking to it,” 2022, [Online]. Available: https://www.bbc.com/news/technology-63861322.

[14] X. Zhai, “ChatGPT user experience: Implications for education,” *Available SSRN 4312418*, 2022.

[15] G. G. P. Transformer, A. O. Thunström, and S. Steingrimsson, “Can GPT-3 write an academic paper on itself, with minimal human input?,” 2022.

[16] L. Lucy and D. Bamman, “Gender and representation bias in GPT-3 generated stories,” in *Proceedings of the Third Workshop on Narrative Understanding*, 2021, pp. 48–55.

[17] K. Elkins and J. Chun, “Can GPT-3 pass a Writer’s turing test?,” *J. Cult. Anal.*, vol. 5, no. 2, 2020.

[18] L. Floridi and M. Chiriatti, “GPT-3: Its nature, scope, limits, and consequences,” *Minds Mach.*, vol. 30, pp. 681–694, 2020.

[19] A. Duval, T. Lamson, G. de L. de Kérouara, and M. Gallé, “Breaking Writer’s Block: Low-cost Fine-tuning of Natural Language Generation Models,” *arXiv Prepr. arXiv2101.03216*, 2020.

[20] G. Jaimovitch-López, C. Ferri, J. Hernández-Orallo, F. Martínez-Plumed, and M. J. Ramírez-Quintana, “Can language models automate data wrangling?,” *Mach. Learn.*, pp. 1–30, 2022.

[21] E. Kasneci *et al.*, “ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education,” 2023.

[22] T. Ansari, “Freaky ChatGPT fails that caught our eyes,” *Anal. India Mag. December*, vol. 7, p. 2022, 2022.

[23] Y. Mucharraz, F. V. Cano, and R. H. Martinez, “ChatGPT and AI Text Generators: Should Academia Adapt or Resist?,” *Harvard Bus. Publ. Educ.*, 2023, [Online]. Available: https://hbsp.harvard.edu/inspiring-minds/chatgpt-and-ai-text-generators-should-academia-adapt-or-resist.

[24] M. Aljanabi, M. Ghazi, A. H. Ali, and S. A. Abed, “ChatGpt: Open Possibilities,” *Iraqi J. Comput. Sci. Math.*, vol. 4, no. 1, pp. 62–64, 2023.

[25] M.-H. Nguyen, “Academic writing and AI: Day-1 experiment,” *Cent. Open Sci.*, 2023.

[26] S. O’Connor, “Open artificial intelligence platforms in nursing education: Tools for academic progress or abuse?,” *Nurse Educ. Pract.*, vol. 66, p. 103537, 2022.

[27] M. R. King, “The future of AI in medicine: a perspective from a Chatbot,” *Ann. Biomed. Eng.*, pp. 1–5, 2022.

[28] M. Hammad, “The Impact of Artificial Intelligence (AI) Programs on Writing Scientific Research,” *Ann. Biomed. Eng.*, pp. 1–2, 2023.
[29] D. Baidoo-Anu and L. Owusu Ansah, “Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning,” *Available SSRN 4337484*, 2023.
[30] K. Solheim, P. Roland, and S. K. Ertesvåg, “Teachers’ perceptions of their collective and individual learning regarding classroom interaction,” *Educ. Res.*, vol. 60, no. 4, pp. 459–477, 2018.
[31] M. C. Borba, A. S. de S. Chiari, and H. R. F. L. de Almeida, “Interactions in virtual learning environments: new roles for digital technology,” *Educ. Stud. Math.*, vol. 98, pp. 269–286, 2018.
[32] Y. Wang, Y. Cao, S. Gong, Z. Wang, N. Li, and L. Ai, “Interaction and learning engagement in online learning: The mediating roles of online learning self-efficacy and academic emotions,” *Learn. Individ. Differ.*, vol. 94, p. 102128, 2022.
[33] H. Shang and C. B. Sivaparthipan, “Interactive teaching using human-machine interaction for higher education systems,” *Comput. Electr. Eng.*, vol. 100, p. 107811, 2022.
[34] D. R. E. Cotton, P. A. Cotton, and J. R. Shipway, “Chatting and Cheating. Ensuring academic integrity in the era of ChatGPT,” 2023.
[35] C. Li and W. Xing, “Natural language generation using deep learning to support MOOC learners,” *Int. J. Artif. Intell. Educ.*, vol. 31, pp. 186–214, 2021.
[36] A. Lewis, “Multimodal large language models for inclusive collaboration learning tasks,” in *Proceedings of the 2022 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies: Student Research Workshop*, 2022, pp. 202–210.
[37] M. Barber, “Gravity Assist: Propelling Higher Education Towards a Brighter Future. London: Office for Students.” 2021.
[38] O. Zawacki-Richter, V. I. Marín, M. Bond, and F. Gouverneur, “Systematic review of research on artificial intelligence applications in higher education–where are the educators?,” *Int. J. Educ. Technol. High. Educ.*, vol. 16, no. 1, pp. 1–27, 2019.
[39] S. Perez *et al.*, “Identifying productive inquiry in virtual labs using sequence mining,” in *Artificial Intelligence in Education: 18th International Conference, AIED 2017, Wuhan, China, June 28–July 1, 2017, Proceedings 18*, 2017, pp. 287–298.
[40] J. Gao, “Exploring the feedback quality of an automated writing evaluation system pigai,” *Int. J. Emerg. Technol. Learn.*, vol. 16, no. 11, pp. 322–330, 2021.
[41] R. D. Roscoe, J. Wilson, A. C. Johnson, and C. R. Mayra, “Presentation, expectations, and experience: Sources of student perceptions of automated writing evaluation,” *Comput. Human Behav.*, vol. 70, pp. 207–221, 2017.
[42] J. Deng and Y. Lin, “The Benefits and Challenges of ChatGPT: An Overview,” *Front. Comput. Intell. Syst.*, vol. 2, no. 2, pp. 81–83, 2022.