Álvaro Rocha · Carlos Ferrás ·
Jorge Hochstetter Diez ·
Mauricio Diéguez Rebolledo
Editors

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Editors
Álvaro Rocha
ISEG, Universidade de Lisboa
Lisbon, Portugal

Carlos Ferrás
Facultade de Geografía e Historia
University of Santiago de Compostela
Santiago de Compostela, Spain

Jorge Hochstetter Diez
Departamento de Computación e Informática
University of La Frontera
Temuco, Chile

Mauricio Diéguez Rebolledo
Departamento de Computación e Informática
University of La Frontera
Temuco, Chile

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Preface

This book is composed of the papers written in English and accepted for presentation and discussion at The 2024 International Conference on Information Technology & Systems (ICITS'24). This Conference had the support of Universidad de La Frontera, Information and Technology Management Association (ITMA), IEEE Systems, Man, and Cybernetics Society, and AISTI (Iberian Association for Information Systems and Technologies). It took place in Temuco, Chile, January 24–26, 2024.

The 2024 International Conference on Information Technology & Systems (ICITS'24) is an international forum for researchers and practitioners to present and discuss the most recent innovations, trends, results, experiences, and concerns in the several perspectives of Information Technology & Systems.

The Program Committee of ICITS'24 was composed of a multidisciplinary group of 264 experts and those who are intimately concerned with Information Systems and Technologies. They have had the responsibility for evaluating, in a 'double-blind review' process, the papers received for each of the main themes proposed for the Conference: A) Information and Knowledge Management; B) Organizational Models and Information Systems; C) Software and Systems Modeling; D) Software Systems, Architectures, Applications, and Tools; E) Multimedia Systems and Applications; F) Computer Networks, Mobility, and Pervasive Systems; G) Intelligent and Decision Support Systems; H) Big Data Analytics and Applications; I) Human-Computer Interaction; J) Ethics, Computers & Security; K) Health Informatics; L) Information Technologies in Education; and M) Media, Applied Technology and Communication.

ICITS'24 received 389 contributions from 34 countries around the world. The papers accepted for presentation and discussion at the Conference are published by Springer (this book) and by RISTI and will be submitted for indexing by WoS, SCOPUS, EI-Compendex, and/or Google Scholar, among others.

We acknowledge all of those who contributed to the staging of ICITS'24 (authors, committees, workshop organizers, and sponsors). We deeply appreciate their involvement and support which was crucial for the success of ICITS'24.

Álvaro Rocha
Carlos Ferrás
Jorge Hochstetter Diez
Mauricio Diéguez Rebolledo

Contents

Information Technologies in Education

ChatGPT: Systematic Review of Potentials and Limitations in Education

Maria Raquel Patrício(✉) and Bruno F. Gonçalves

Research Centre in Basic Education (CIEB), Instituto Politécnico de Bragança, , Bragança, Portugal
{raquel,bruno.goncalves}@ipb.pt

Abstract. The growth in the supply of artificial intelligence technologies in recent months has been drawing the attention of governments and public and private organizations in all economic sectors of society. In this sense, also the education sector has been showing interest in this type of emerging technologies in the market. Thus, through the present research we seek to make a systematic review of the literature on the potentialities and limitations of ChatGPT in education. The systematic review of the literature will be carried out with the support of a pre-defined set of criteria that will be essential for the serration of information on the topic addressed. The results of the research point to the existence of a set of potentialities, but also limitations of ChatGPT for education, namely for teaching-learning processes. However, like all technologies, there are always potentialities and limitations, and it is up to educational agents, especially institution directors and teachers, to adopt the most appropriate AI technologies for each learning moment. Digital and pedagogical innovation in education will always be important for student motivation, streamlining teaching-learning processes and improving the quality of education.

Keywords: Artificial intelligence · ChatGPT · Digital technologies · Education

1 Introduction

Considering the importance that technologies 4.0 have for innovation and improvement of the quality of teaching-learning processes and for the acquisition of skills by both students and teachers, it is essential to conduct research involving artificial intelligence language models in the educational context. 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 [1].

Studying artificial intelligence in education constitutes an indispensable contribution to the development and innovation of other educational processes. It is important to reflect that this genre of r(evolution) by itself does not serve to teach and contribute to the development of our students, but rather as one of the complements to support the teaching-learning process. It should be noted that over the years there have been different innovations in education, in the most varied dimensions, pedagogical, contextual, technological, social, among many others. Artificial intelligence is yet another

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contribution to essentially rethinking education, taking the opportunity to innovate and improve teaching processes that are sometimes already obsolete. Likewise, it is also important to understand the limitations that all technologies have, which can eventually be of different types.

Thus, this research seeks, through a systematic review of the literature, to identify the main potentialities and limitations of ChatGPT in education with a view to contributing to the discussion and reflection of the theme in the educational and scientific communities.

It is important to note that ChatGPT is a specific type of chatbot known as a "language model", which uses artificial intelligence and machine learning to generate responses based on context and previous conversation history. This model has been trained on a massive amount of data, allowing it to understand and generate human-like text with remarkable accuracy [2].

The importance of identifying both the potentialities and limitations of the ChatGPT has to do with the need to clarify the educational agents (teachers, directors of institutions, students, guardians (parents), employees and other educational actors) of the positive role that artificial intelligence has in education, but also the limitations that are also important to mention. Knowing that it is no longer possible to send artificial intelligence away from schools, institutions, organizations, in short, from our lives, it is up to us to help in the digital literacy of communities, through a balance between the two components: potentialities and limitations. In the end, after reading this article and after experimenting with this type of technology, the reader will certainly draw his conclusions.

2 Methodology

Through this research we seek to make a systematic review of the literature identifying the main potentialities and limitations of ChatGPT for education. For this, the systematic literature review is adopted as the investigative methodology to support the study. The systematic review of the literature will be carried out with the support of a pre-defined set of criteria that will be essential for the serration of information on the theme addressed, namely: (i) Time interval: 2022–2023; (ii) Keywords: chatgpt, education, potential, limitations; (iii) Documents: reference articles and doctoral theses; (iv) Search language: English and Portuguese; (v) Bibliometric databases: Scopus.

Based on the criteria previously established, the general framework of the documents found is presented (Table 1):

Three documents were excluded because they were outside the lines of the research and, in this sense, seventeen documents were considered for the purposes of this research.

The data collected from the documents that emerged from the search were categorized and treated in Microsoft Excel. Two main categories were created: potentialities and limitations. For each of these categories, all the corresponding data were associated. The following section discusses the main results, identifying the main potentialities and limitations of ChatGPT for education.

Table 1. General table of documents found.

Year	Article Title	Authors	Journal	Language
2023	The Benefits, Risks and Regulation of Using ChatGPT in Chinese Academia: A Content Analysis	Hung, J.; Chen, J	Social Sciences	English
2023	ChatGPT: An ever-increasing encroachment of artificial intelligence in online assessment in distance education	Naidu, K., Sevnarayan, K	Online Journal of Communication and Media Technologies	English
2023	How to harness the potential of ChatGPT in education?	Zhu, C.; Sun, M.; Luo, J.; Li, T.; Wang, M	Knowledge Management and E-Learning	English
2023	Chatbots in Education and Research: A Critical Examination of Ethical Implications and Solutions	Kooli, C	Sustainability - Multidisciplinary Digital Publishing Institute (MDPI)	English
2023	Can ChatGPT improve communication in hospitals?	Santandreu-Calonge, D.; Medina-Aguerrebere, P.; Hultberg, P.; Shah, M.-A	Profesional de la Informacion	English
2023	The use of ChatGPT in the digital era: Perspectives on chatbot implementation	Limna, P.; Kraiwanit, T.; Jangjarat, K.; Klayklung, P.; Chocksathaporn, P	Journal of Applied Learning and Teaching	English
2023	The role of ChatGPT in higher education: Benefits, challenges, and future research directions	Rasul, T.; Nair, S.; Kalendra, D. Robin, M.; Santini, F.; Ladeira, W. J.; Sun, M.; Day, I.; Rather, R.A.; Heathcote, L	Journal of Applied Learning and Teaching	English
2023	ChatGPT in higher education: Considerations for academic integrity and student learning	Sullivan, M.; Kelly, A.; McLaughlan, P	Journal of Applied Learning and Teaching	English
2023	ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?	Rudolph, J.; Tan, S.; Tan, S	Journal of Applied Learning and Teaching	English

(*continued*)

Table 1. (*continued*)

Year	Article Title	Authors	Journal	Language
2023	ChatGPT—A double-edged sword for healthcare education? Implications for assessments of dental students	Ali, K.; Barhom, N.; Tamimi, F.; Duggal, M	European Journal of Dental Education	English
2023	Exploring the Potential of ChatGPT as an Educational Technology: An Emerging Technology Report	Glaser, N	Technology, Knowledge and Learning	English
2023	Large Language Models in Medical Education: Opportunities, Challenges, and Future Directions	Abd-Alrazaq, A.; AlSaad, R.; Alhuwail, D.; Ahmed, A.; Healy, P. M.; Latifi, S.; Aziz, S.; Damseh, R.; Alrazak, S.A.; Sheikh, J	JMIR Medical Education	English
2023	Performance of GPT-3.5 and GPT-4 on the Japanese Medical Licensing Examination: Comparison Study	Takagi, S.; Watari, T.; Erabi, A.; Sakaguchi, K	JMIR Medical Education	English
2023	Enhancing STEM learning with ChatGPT and Bing Chat as objects to think with: A case study	Vasconcelos, M.A.R.; dos Santos, R.P	Eurasia Journal of Mathematics, Science and Technology Education	English
2023	Examining the Impacts of ChatGPT on Student Motivation and Engagement	Muñoz S.A.S.; Gayoso G.G.; Huambo A.C.; Tapia R.D.C.; Incaluque J.L.; Aguila O.E.P.; Cajamarca J.C.R.; Acevedo J.E.R.; Huaranga Rivera H.V.; Arias-Gonzáles J.L	Przestrzen Spoleczna	English

(*continued*)

Table 1. (*continued*)

Year	Article Title	Authors	Journal	Language
2023	Personalized tutoring: ChatGPT as a virtual tutor for personalized learning experiences	Limo F.A.F.; Tiza D.R.H.; Roque M.M.; Herrera E.E.; Murillo J.P.M.; Huallpa J.J.; Flores V.A.A.; Castillo A.G.R.; Peña P.F.P.; Carranza C.P.M.; Gonzáles J.L.A	Przestrzen Spoleczna	English
2023	Generative Artificial Intelligence in Education, Part One: the Dynamic Frontier	Hsu, Y.-C., Ching, Y.-H	TechTrends	English
2023	Surfing the technology wave: An international perspective on enhancing teaching and learning in accounting	Al Ghatrifi, M.O.M., Al Amairi, J.S.S., Thottoli, M.M	Computers and Education: Artificial Intelligence	English
2023	Performance of ChatGPT on UK Standardized Admission Tests: Insights from the BMAT, TMUA, LNAT, and TSA Examinations	Giannos, P., Delardas, O	JMIR Medical Education	English
2023	A SWOT analysis of ChatGPT: Implications for educational practice and research	Farrokhnia, M., Banihashem, S.K., Noroozi, O., Wals, A	Innovations in Education and Teaching International	English

3 Potential and Limitations of ChatGPT in Education

Several documents were found that address some of the potentialities and limitations of ChatGPT for education, so below we discuss the main results obtained through two main categories: potentialities and limitations.

3.1 Potentialities of ChatGPT in Education

The literature analysis revealed that ChatGPT offers various potentialities for education, both for students and teachers, if used appropriately and responsibly. ChatGPT is an accessible, easy-to-use software that minimizes the time and effort spent by students and teachers in learning or academic instructions, with the potential to assist in the development of linguistic and cultural skills [3]. The time and effort reduction are also highlighted by [4], as ChatGPT has the potential to automate tasks and processes,

particularly in assessment correction and, consequently, based on the analysis of each student's responses, personalize learning experiences to meet the needs of each student. This ChatGPT feature of personalizing students' learning, as well as providing immediate feedback and support, enriches their experience, participation, and engagement in learning, which is a consensus across most analyzed documents.

Similar to other technologies, the use of ChatGPT has an impact on student motivation [4–7]. [7] even state that "… Incorporating ChatGPT into educational programs can increase students' motivation to study independently and under teacher supervision" (p. 20).

In this regard, we find relevant the study by [8] in which it is mentioned that students, when using ChatGPT as a virtual tutor, take responsibility for their learning by asking questions and making decisions, allowing them to learn autonomously, quickly, and effectively.

The potential of ChatGPT in education in general, and in specific areas such as medicine, health, STEM, accounting, or distance education, is also addressed in the analyzed literature. In this sense, ChatGPT represents a disruption in traditional approaches to teaching and evaluating distance education, in addition to assisting in the creation of different types of content and preparing students for exams [4]. In the field of medicine and health, the use of ChatGPT can enable more interactive, dynamic, and collaborative learning by applying theoretical knowledge to real-world situations, such as practicing diagnostic skills or treatment plans for virtual patients, clinical communication skills with virtual patients, and discussion with colleagues and experts [9, 10]. In the study conducted by [11], the "ChatGPT's capacity to transform STEM education by fostering critical thinking, problem-solving, and engagement in inclusive and accessible learning environments is highlighted" (p. 2). This study also emphasizes its potential in promoting creativity, collaboration, exploration, critical thinking, problem-solving, and a deeper understanding of complex concepts. Regarding the teaching and learning of accounting courses, ChatGPT can be a valuable interactive tool to help students quickly understand complex accounting concepts compared to traditional educational resources such as textbooks and manuals [12].

Furthermore, the literature refers to the importance of ChatGPT in supporting teachers, both in reducing time and workload, and in creating lesson plans, relevant teaching materials, more challenging and meaningful learning experiences for students, and innovative assessment activities that promote creativity, critical thinking, and cooperative learning [5, 13]. Therefore, teachers have more time to focus on higher-order tasks such as additional and personalized support for students or academic research [6].

Ethical and academic integrity implications are similarly discussed. Teachers should promote ethical awareness in students and provide guidelines on how to verify and critically evaluate the information generated by ChatGPT [3, 14–16].

In summary, we highlight the potential of ChatGPT in education, mentioning the work of [17] who propose a set of strategies through the use of ChatGPT as: a virtual tutor to answer students' questions; an assistant for creating learning materials; specialized support for complex tasks; a virtual learning companion; a tool for reflective learning; a stimulus for critical thinking (p. 149).

3.2 Limitations of ChatGPT in Education

The main limitations of ChatGPT in education as mentioned in the literature are related to the quality, accuracy, and timeliness of information [4, 10]. Furthermore, "The main limitation observed for ChatGPT performance on these items was that is only able to answer text-based questions and did not allow processing of questions based on images" (p. 3) [9].

The literature highlights that ChatGPT can potentially facilitate plagiarism, fraud, and academic dishonesty among students, particularly in assessment practices [13, 16–18]. Therefore, "At present, a very important limitation of ChatGPT is that it does not provide sources and quotations. Whilst it is able to provide book recommendations and provide reasons for its recommendations, it does not provide in-text referencing and a reference list in its responses. This is a major shortcoming in writing academic assignments (that usually require a certain number of references)" (p. 355) [19].

In terms of assessment, ChatGPT may not be able to replicate and adapt effective assessment strategies [13].

Furthermore, aspects such as data protection [16], privacy and security [12], or even discrimination [5] are among the mentioned concerns that hinder or limit the use of ChatGPT in education. Additionally, the potential misuse of ChatGPT for malicious purposes, such as generating fake and biased news and propaganda, is also a concern [16].

Another shared concern among some authors [7, 9, 13, 17, 18] is related to equity, accessibility, and digital inequality, which can be exacerbated if students do not have access to these digital technologies and need to pay for a subscription, further deepening exclusion and social inequalities.

However, despite the aforementioned limitations and concerns about ChatGPT, it appears that the significant limitation lies in social, interpersonal, relational, and emotional skills and competencies, which are uniquely human. Therefore, the lack of human interaction, empathy, the ability to understand context and nuances in the same way humans do, such as cultural, ethnic, gender, and identity differences [4, 5, 10, 14, 16, 18]. In this regard, "By taking over routine tasks, ChatGPT enables teachers to focus more on cultivating students' critical thinking, creativity, and interpersonal skills—areas where AI still cannot compete" (p. 17) [18]. And [19] add "AI is less competent with content that requires higher-order thinking (critical, analytical thinking)" (p. 349).

4 Conclusions

The research allowed to contribute to the discussion of artificial intelligence in education, especially its role in the motivation of students and the innovation and dynamization of teaching-learning processes. Two main categories were created, by which the main results obtained during this research were grouped.

The main features of ChatGPT are constant and immediate support and feedback; specialized support for complex tasks; increased motivation, participation, and involvement in learning; interactive and meaningful learning; stimulating creativity, critical and reflective thinking; helping teachers to create materials, activities and learning assessments.

The principal limitations essentially indicate concerns related to academic integrity, privacy, and security; the possible lack of quality, accuracy and timeliness of information; the absence of specific human skills, such as interpersonal and emotional skills, sensitivity and discernment; the possible increase in digital and social inequalities.

Although ChatGPT has potential as an additional educational tool, its potential and limitations must be carefully considered in the context of specific teaching levels, subject areas, and assessment formats. We stress the importance of integrating ChatGPT into a comprehensive learning strategy, without ignoring its limitations. To this end, educators and researchers should continue to explore ChatGPT to enhance its educational use, enriching teaching, and learning. But also address the ethical concerns and risks associated with its misuse, establishing preventive measures and guidelines. In conclusion, we believe that ChatGPT could have enormous potential to help transform education if it is used ethically and responsibly.

This research is in fact an important study that contributes to the technical-pedagogical literacy of all educational agents, but especially teachers, as they are the ones who define which technologies to integrate into the teaching-learning process. Giving teachers access to a systematic literature review that summarizes both the potential and the limitations of AI in Education, in particular ChatGPT, contributes to faster decision-making, with all the data available.

It should also be noted that AI is experiencing exponential growth in all economic sectors of society and education is obviously one of the most affected by this AI boom. However, it is important to note that the integration of AI tools obviously depends on the context in which the teaching-learning process takes place, but also on the pedagogy adopted to boost the educational process.

Finally, it is important to mention that this research contributed to the broad discussion on the subject both in the educational communities and in the scientific community, hoping that it will contribute equally to the literature in the area and to the reflections of educational agents [20].

5 Limitations and Future Research

There are some limitations underlying this research. Initially, this research is solely based on Scopus and does not consider other significant academic databases such as Web of Science. Furthermore, the review is not comprehensive or representative of all research evaluation criteria in education, as it was limited to these keywords. Finally, the authors only examined more recent data via Scopus, focusing on data from 2022 to 2023 (August), to analyze the potentialities and limitations of ChatGPT in education.

Despite these limitations, our study provides valuable insights into the potentialities and limitations of ChatGPT in education.

Future work could consider these limitations and involve using other databases like the Web of Science e additional keywords. Another important focus that could be relevant is exploring the impact of ChatGPT or other AI technologies on teaching and learning in higher education would be valuable.

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