doi.org/10.51891/rease.v11i2.18224

CHATGPT NAS SALAS DE AULAS DAS UNIVERSIDADES: POR QUE ADOTÁ-LO E NÃO TEMÊ-LO?

CHATGPT IN UNIVERSITY CLASSROOMS: WHY ADOPT IT AND NOT FEAR IT?

CHATGPT EN LAS AULAS DE LAS UNIVERSIDADES: ¿POR QUÉ ADOPTARLO Y NO TEMERLO?

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RESUMO: A última década tem sido marcada por profundos avanços tecnológicos. Segmentos produtivos de diferentes matizes experimentaram, em vários níveis, eventuais benefícios trazidos por essas tecnologias. O desenvolvimento de materiais poliméricos "inteligentes", de supercondutores e de algumas ligas metálicas especiais são alguns exemplos direcionados à fabricação propriamente dita. Porém, houve um avanço quase que siliencioso e igualmente impactante: a Inteligência Artificial. Essa tecnologia, baseada muito na programação, foi capaz de se disseminar rapidamente e, em poucos anos, promover verdadeira mudança no gerenciamento de organizações, empresas e instituições mundo afora. Com o lançamento do ChatGPT, as universidades tornaram-se aparentemente vulneráveis a essa ferramenta e a qualquer outra que possa produzir conteúdos. O presente trabalho objetivou mostrar o potencial dessa ferramenta para o corpo discente do Curso de Engenharia Mecânica. Para tanto, foram confeccionados estudos dirigidos personalizados que estimularam o uso de IA para resolução de questionários. Baseado em rodadas de perguntas, os estudos diferenciaram-se entre aqueles que tinham perguntas mais genéricas e os que tinham perguntas específicas, baseadas em literatura previamente selecionada. Ao final, os estudantes foram convidados a responder questionário sobre suas percepções quanto ao nível de detalhamento e precisão das respostas dadas tanto pela IA quanto pelos próprios alunos, sem consulta ao ChatGPT.

Palavras-chave: Educação. Universidade. Engenharia. Polímeros. Inteligência Artificial.

ABSTRACT: **Background** The last decade has been marked by profound technological advancements. Productive sectors of various kinds have experienced, at different levels, the eventual benefits brought by these technologies. The development of "smart" polymeric materials, superconductors, and some special metallic alloys are some examples directed towards manufacturing itself. However, there was an almost silent and equally impactful advancement: Artificial Intelligence. This technology, based largely on programming, was able to spread rapidly and, in a few years, promote a real change in the management of organizations, companies, and institutions worldwide. With the launch of ChatGPT, universities became seemingly vulnerable to this tool and any other that could produce content. **Purpose** This work aimed to show the potential of this tool for the student body of the Mechanical Engineering Course. **Method** To this end, personalized directed studies were created that encouraged the use of AI to solve questionnaires. Based on rounds of questions, the studies differed between those that had more generic questions and those that had specific questions, based on previously selected literature. At the end, the students were invited to answer a questionnaire about their perceptions regarding the level of detail and accuracy of the answers given by both the AI and the students themselves, without consulting ChatGPT. **Conclusions** Although newer generations of students are already familiar with technology and use generative language tools in their studies, the majority still believe that it, on its own, is insufficient.

Keywords: Education. University. Engineer. Polymers. Artificial Intelligence.

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RESUMEN: La última década ha estado marcada por profundos avances tecnológicos. Segmentos productivos de diferentes matices han experimentado, en varios niveles, eventuales beneficios traídos por estas tecnologías. El desarrollo de materiales poliméricos "inteligentes", de superconductores y de algunas aleaciones metálicas especiales son algunos ejemplos dirigidos a la fabricación propiamente dicha. Sin embargo, hubo un avance casi que silencioso e igualmente impactante: la Inteligencia Artificial. Esa tecnología, basada mucho en la programación, fue capaz de diseminarse rápidamente y, en pocos años, promover verdadera mudanza en la gestión de organizaciones, empresas e instituciones mundo afora. Con el lanzamiento del ChatGPT, las universidades se volvieron aparentemente vulnerables a esa herramienta y a cualquier otra que pueda producir contenidos. El presente trabajo objetivó mostrar el potencial de esa herramienta para el cuerpo discente del Curso de Ingeniería Mecánica. Para tanto, fueron confeccionados estudios dirigidos personalizados que estimularon el uso de IA para resolución de cuestionarios. Basado en rondas de preguntas, los estudios se diferenciaron entre aquellos que tenían preguntas más genéricas y los que tenían preguntas específicas, basadas en literatura previamente seleccionada. Al final, los estudiantes fueron invitados a responder cuestionario sobre sus percepciones cuanto al nivel de detalle y precisión de las respuestas dadas tanto por la IA cuanto por los propios alumnos, sin consulta al ChatGPT.

Palabras clave: Educación. Universidad. Ingeniería. Polímeros. Inteligencia Artificial.

INTRODUCTION

Technology has been promoting significant changes in society. Although we associate these transformations with production methods and the development of new materials, with significant investments in research and development, they have also become impactful in the field of education. The advent of the internet and more agile telecommunication systems, coupled with the emergence of various applications for creating digital content, have transformed the way we teach and learn. A classroom, in today's world, needs to be dynamic and connected to the world. Teachers accustomed to being the central and only figure in the learning process are destined to fail in transmitting their knowledge. New generations, born and raised in a digital environment, need to find in classrooms an atmosphere that reflects the dynamism of the world around them.

Undoubtedly, a technology that has arrived to stay (and be improved) and be increasingly incorporated into teaching is generative language (Lim et al, 2023). The most well-known, ChatGPT (GPT is acronym for Generative Pre-trained Transformer) (Short and Short, 2023), caused a real stir due to its immense potential (Ali, 2023; Dibble, 2023; Hu, 2023; Mollick and Mollick, 2023), even while still in its development stages. However, it was enough to generate a movement in academia to better understand it and how it could impact teaching (Stokel-Walker, 2022; Fasenmaier and Wöber, 2023; Gasevic et al, 2023; Pavlik, 2023). Even in universities, almost always accustomed to dealing with technologies (Fasenmaier and Wöber, 2023), there is a fear and some apprehension about adopting AI tools (Lund et al, 2023; Yan et

al, 2023). It is believed that they will either compete with teachers or hinder the learning process, making the level of discussion superficial.

Engineering courses, traditionally more closely aligned with technologies, are significant hubs for development and research in these fields. However, while programming tools and languages are established and taught in these courses, there is a resistance to using AI as a teaching aid. This is because many engineering disciplines, considered 'hard sciences,' are grounded in concepts of numerical calculus, physics, and chemistry, whose approach often relies on equations and mathematical expressions that are challenging for generative language tools to construct. Despite this general perception, there are enthusiasts who believe in the responsible use of AI tools with a focus on teaching (Caccavale et al, 2024; Knoth et al, 2024; Padovano et al, 2024; Vazquez, 2024) and, without losing ethics (Daniel and Xuan, 2024). Even so, recent studies have demonstrated interest on the part of the academic community in adopting generative language tools. In their studies focused on chemical engineering students, Brown et al (2020) and Kong et al (2023) highlighted the importance of students developing critical thinking as well as knowing and interacting with tools similar to ChatGPT.

In this sense, this work aims to analyze, from the perspective of students in polymer materials courses, the potential of generative language tools to complement learning in a night course of Mechanical Engineering at the Federal University of Paraná.

METHODOLOGY

The research was based on the implementation of targeted activities, through guided studies, on the specific topic of each discipline. A total of 4 disciplines were covered, namely: Introduction to Materials, Polymer Processing, Processing of Polymer Composites, and Non-Metallic Materials. All offered in the night undergraduate program in Mechanical Engineering at the Federal University of Paraná and with the participation of 110 students. The guided studies were structured to include 3 rounds of questions. The first round consisted of a questionnaire with more general approaches, and the second round had a questionnaire whose statements referred to some document made available online, in the form of academic articles and/or books. Understanding the limitations imposed by ChatGPT, whose prior knowledge is based on data up to the year 2021, only articles/books published up to that year were considered. The students were instructed to answer the first two cycles (rounds 1 and 2) using exclusively the ChatGPT 3.5 tool. In this case, they were instructed to collect the first response

provided by the artificial intelligence. The third round of questions contained the same questions as the second round. However, instead of using ChatGPT, students had to answer themselves, based on the available references previously selected by the professor. Figure 1 shows the list of disciplines in which the study was applied.

Figure 1. Courses selected for the implementation of guided study.

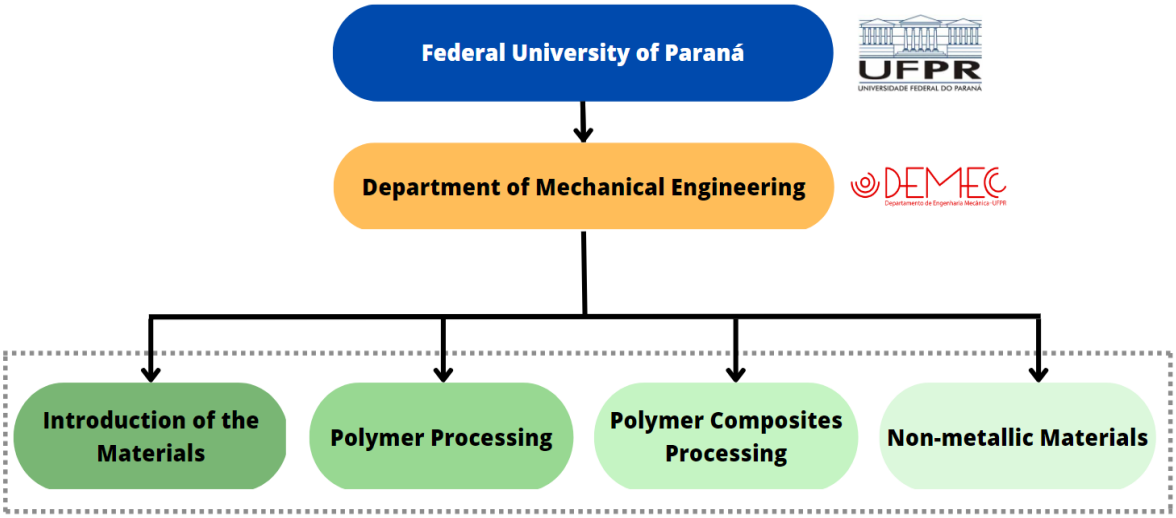
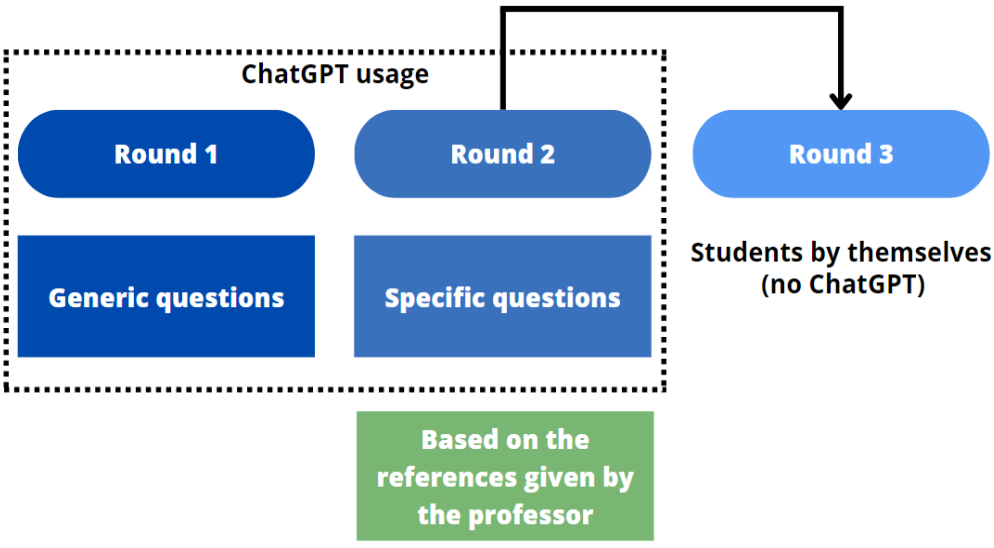


Figure 2 presents the study's adopted structure, comprised of two questionnaires and threerounds.

Figure 2. Schematic representation of the assessment of students' perceptions regarding ChatGPT use.



All students were given the same amount of time to complete the activities, corresponding to 7 days. At the end of the guided study, students were invited to complete a questionnaire to evaluate the experience. This questionnaire was designed to ensure student

anonymity and had 11 questions, plus a space for comments, suggestions, and observations. The questionnaire was sent to students after the end of the courses, as conducted by Groothuijsen et al (2024). The items contained in the document are presented in **Table 1.**

Table 1. Questionnaire submitted to students.

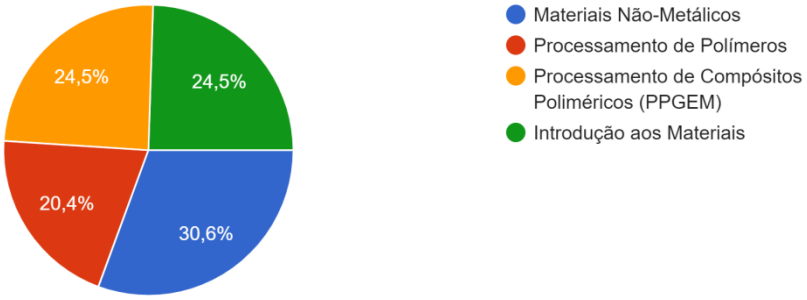
A	Were the statements clear and objective?
B	Did you have any difficulty answering the questions?
C	If you answered "yes" to the previous question, please indicate the types of difficulties you encountered.
D	Regarding the teacher's approach and experience, how would you classify the activity? “Engaging”, “Innovative”, “Tiring”, “Pointless”.
E	Based on the activity and the professor's approach using ChatGPT, would you recommend this activity to other professors in the course?
F	How would you rate your experience with ChatGPT for academic work?
G	Using ChatGPT as a tool for academic activities allowed me to: better understand the topic; learn about ChatGPT's limitations; and recognize the importance of focused study and reading references without relying on AI for answers.
H	Do you find the ChatGPT tool helpful for your studies and academic work?
I	Would you trust ChatGPT to complete academic tasks entirely, such as theses and academic articles?
J	Would you trust ChatGPT to assist with specific parts of academic work, like theses and research papers, under the guidance of your professor? “Specific parts” means the activity is done in part and under the specific guidance of the professor.

RESULTS AND DISCUSSION

The forms were created using Google applications and made available to students. The responses, collected anonymously, were analyzed to construct graphs and their respective interpretation. Figure 3 shows the distribution of responses by course. It can be observed that there was a practically homogeneous quantity of responses. However, the Non-Metallic

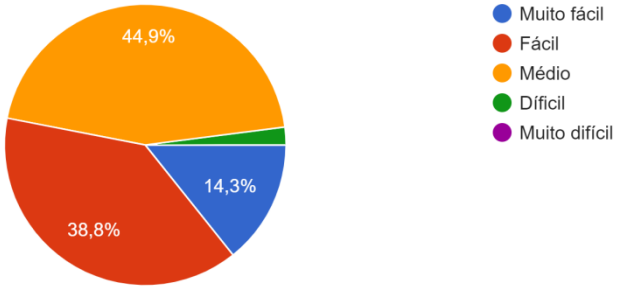
Materials course was the one that obtained a slightly higher number of form submissions (30.6%). The Polymer Processing course, on the other hand, had the lowest adherence (20.4%).

Figure 3. Distribution of student participation.



Regarding the level of understanding of the activity offered by the professor, only 2% considered it "very difficult". A percentage of 83.7% classified it as an activity of "medium" or "easy" comprehension. And 14.3% of those consulted considered the understanding of the study "very easy", as shown in Figure 4.

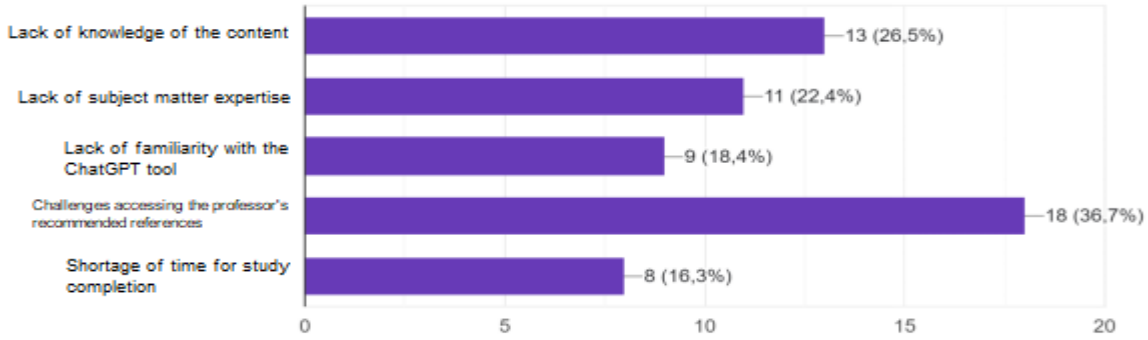
Figure 4. Perception of students' understanding of the subject matter.



Regarding the clarity of the statements in the guided studies, offered in rounds 1, 2, and 3, there was unanimity that they were clear. Therefore, the low comprehension of the activity pointed out by 2% of the students may be related, perhaps, to the language of the selected texts, which were in English.

Regarding the resolution of the guided study, 46.9% of the students encountered some type of difficulty. When presented with potential obstacles, difficulties in accessing the references indicated by the professor were considered the main ones (36.7%), followed by the student's lack of knowledge of the content (26.5%) and the student's lack of mastery of the subject (22.4%). Figure 5 shows this distribution.

Figure 5. Obstacles identified by students for solving the task.



When asked about the professor's experience and approach, the activity was classified as "attractive" and "innovative," demonstrating the students' interest in more dynamic activities. When asked about the prospect of other professors in the course adopting this type of activity (encouraging the use of ChatGPT), 95.9% of students stated that they would recommend it to other professors in the Mechanical Engineering course at UFPR. This perception and engagement of the students seems to be shared by the academic environment analyzed by Vazquez (2024), whose students also evaluated the methodological approach positively.

The experience of using ChatGPT for academic purposes was rated as "Good" by 46.9% of students and "Excellent" by 20.4%. The 28.6% of students who rated this experience as "Regular" may be linked to some infrastructure factors, such as the availability of a data network (internet) and electronic devices (desktops, laptops, smartphones, etc.) which, depending on the model/year, can affect the browsing and digital study experience.

When asked about the limitations of ChatGPT in professor-guided studies, 65.3% of students strongly agreed that the tool is limited. Furthermore, 57.1% of students recognized the importance of guided study focused on reading references without the use of generative language tools to provide answers. This perception, although inferred through a different methodology, was also observed in Vazquez's study (2024). After challenging their students in a project supported by ChatGPT, the author found that the students in a mini-aerospace engineering course perceived the superficial level of content offered by the language tool. This perception was also verified by Caccavale et al. (2024) who, in their studies directed at chemical engineering students, concluded that more than 70% of the students were concerned about the quality of the responses generated by AI.

CONCLUSIONS

The impact of artificial intelligence on human life is undeniable. In this case, it has also affected education. The generative language tool ChatGPT has proven to be an important ally for the development of concepts related to polymeric materials. However, as it currently stands, it should be used in the classroom with caution and under the guidance of the teacher. In other words, responsibly. The proposed activity model in rounds of questions revealed that AI, on its own, is still insufficient for constructing technical responses. And, most importantly, it is unable to effectively promote the discussion of results. In these cases, human dedication

and reading remain fundamental to establishing a high level of discussion and interpretation of academic results. Although newer generations of students are already familiar with technology and use generative language tools in their studies, the majority still believe that it, on its own, is insufficient. There is, therefore, a significant role for the teacher, who must invariably be enthusiastic about new technological tools for use in education and knowledge construction.

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