


Critical minds: enhancing education with ChatGPT

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ABSTRACT

The use of AI tools, particularly ChatGPT, has been widespread in recent years. Its application in education has been criticized by some and supported by others. In this article we present the case of a work carried out as part of a course unit in a computer science degree program in which the use of ChatGPT was not only encouraged but required. Students were asked to use this tool ethically and critically, comparing the results with bibliographical references. A questionnaire addressing students' perceptions about the work and ChatGPT usage was performed after delivering the task. Results showed that students were motivated to carry out the work and understood that its widespread use requires critical thinking and compliance with ethical principles. The teacher acknowledge that some students developed these competences while performing this task and were able to deliver a quality, well supported essay. The development of this competences was also identified by some students.

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Introduction

Artificial intelligence (AI) applications are becoming increasingly changing not only the way humans interact with technology but also how they interact with knowledge (Arista et al., 2023). Their daily use is also changing behaviors in our day-to-day life, as well as in Education – teaching and especially learning. The popularization of the use of AI has been greatly influenced by OpenAI, an artificial intelligence research laboratory whose mission is research for promoting and developing 'friendly AI' in a way that benefits humanity (Rudolph et al., 2023a).

In 2020, OpenAI introduced Generative Pre-Trained Transformer (GPT-3), until now the largest and most powerful language model ever created, capable to respond directly to questions and generate text in different styles, including essays, stories, poems and others (Rudolph et al., 2023a).

In 2022, OpenAI launched a new AI chatbot named ChatGPT. A chatbot is an artificial intelligence-based software application capable of responding in a few seconds to questions and establishing a conversation with the user (Arista et al., 2023; Rudolph et al., 2023a). The success of the platform was immediate, with approximately one million users achieved within the first five days of its launch. (Rudolph et al., 2023a). Recently, OpenAI launched a new version of the chatbot called ChatGPT-4, which is more versatile and up-to-date, but for the time being, not a free version (Firat, 2023a).

In the field of education, the emergence of artificial intelligence (AI) tools, such as ChatGPT, has the potential to revolutionize how students access knowledge and approach their academic tasks (Firat, 2023a). Although its emergence is still very recent, AI technology has quickly become a trending topic

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for both the community and researchers in the beginning of 2023. AI technology has the potential to revolutionize the field of education. Recent scientific literature has demonstrated that AI technology can significantly enhance learning outcomes, particularly in terms of students' performance, motivation and engagement in learning environments (Ding et al., 2023; Firat, 2023a, 2023b; Ouyang & Jiao, 2021; Rudolph et al., 2023a, 2023b; Singh et al., 2023). Despite the apparent advantages of using ChatGPT in education, there is still no consensus on the impacts of its usage (Firat, 2023b).

It is important to consider all perspectives to make informed decisions. Researchers focus on various aspects of the topic, such as the potential benefits or the risks of its usage, ethical implication and the impact of its use during students' assessments (Firat, 2023b). The advantages that have been attributed to the use of ChatGPT in education are diverse. Hasanein and Sobaih (2023) list some of these possible advantages, namely, the possibility of ChatGPT improve knowledge accessibility, promote learning experience by offering personalized support, help students in the process of assignments and exams' preparation but also help in research activities and the production of academic works. Some authors consider the possibility of a student having a personal assistant that supports their study 24 h a day, seven days a week, as a huge advantage compared to traditional study methods where students' access to resources is limited (Acosta-Enriquez et al., 2024; Nikitina & Ishchenko, 2024). Nonetheless, it is important to demonstrate to students the necessity of verifying the information obtained, as this is also a way to develop critical thinking (Nikitina & Ishchenko, 2024). Hakiki et al. (2023) emphasize the importance that ChatGPT can have in transforming learning, making it more flexible and accessible. The authors also highlight the positive effect this technology has on engagement in academic activities, as it enables the transformation of teaching into a more interactive, personalized process and motivates students to actively participate in the learning process. Thus, according to the research conducted by the authors, the use of ChatGPT improves student learning outcomes (Hakiki et al., 2023). Complementing most authors who refer to the advantages and disadvantages of students using AI tools, Tan (2023) discusses the possibilities these tools bring to teachers and teaching processes. In this regard, they emphasize that chatbots can contribute to increased innovation and the promotion of intelligence and creativity in teaching strategies and methods.

From a more psychological perspective, a study based on self-determination theory aimed at understanding the impact of ChatGPT on learning motivation concluded that 'ChatGPT is capable of meeting university students' autonomy, competence, and relatedness needs by providing diverse and timely feedback and guidance through intelligent dialogue, developing personalized teaching plans and educational programs, and enhancing learning engagement and experience' (Zhou & Li, 2023, p. 19). The importance of this advantage is enormous considering that these needs contribute to students' health and well-being and form the foundations of intrinsic motivation for academic activities (Zhou & Li, 2023).

Despite all these advantages, there are valid concerns about its usage in education. One limitation is the scope of information provided (in the free version), which do not incorporate data beyond 2021. Additionally, there are concerns regarding the veracity of the information provided, as chatbots have been observed to fabricate data, including the use of false quotations. Other disadvantages have been highlighted, particularly its reduced effectiveness when using languages other than English; the 3000-word limit for text production in the basic model; and the refusal to address certain topics due to ethical considerations (Hasanein & Sobaih, 2023; Nikitina & Ishchenko, 2024). Some authors express their concern with the potential negative impact on students' cognitive skills as critical thinking and problem solving (Acosta-Enriquez et al., 2024; Hasanein & Sobaih, 2023). Tan (2023) also expresses concern about the excessive dependence that this type of tool might cause, potentially leading to addictive behaviors. The same author also mentions the possible weakening of the teacher's role and status, as well as the difficulties in assessment mechanisms.

The use of chatbots in education raises ethical issues that must be carefully considered (Acosta-Enriquez et al., 2024; Bhullar et al., 2024; Hakiki et al., 2023; Hasanein & Sobaih, 2023; Nikitina & Ishchenko, 2024; Tan, 2023). Acosta-Enriquez et al. (2024) even consider that the potential transfer of students' academic tasks to chatbots can lead to a degradation of academic integrity and honesty, manifesting in behaviors such as plagiarism and an uncritical acceptance of AI-generated content. Another

consequence of the widespread use of these tools and technology in general is the potential decline in interpersonal communication and social skills. (Zhou & Li, 2023).

Considering all these benefits/concerns and limitations, the reaction of higher education institutions has also been diverse, ranging from their frontal opposition to the use of the tool, to the promotion of its use (Hasanein & Sobaih, 2023). In a literature review made in 2023, Pradana et al. concluded that:

ChatGPT is a powerful AI tool that has the potential to transform the education sector. Its ability to conduct tasks that require knowledge and creative intelligence, such as grading assignments and offering student counseling, can revolutionize the way education is provided. However, there are also challenges associated with integrating AI in education, including the need to guarantee the precision and reliability of AI-generated answers and concerns about replacing teachers. Education must find a balance between employing AI to improve education and preserving the human touch and interpersonal communication that are so important to the transfer of knowledge. (Pradana et al., 2023, p. 9)

In recent years, extensive research has been conducted with the goal of studying students' perception about the use of ChatGPT in their school activities (Ding et al., 2023; Farhi et al., 2023; Firat, 2023b; Ngo, 2023; Petricini et al., 2023; Sáiz-Manzanares et al., 2023; Shoufan, 2023; Singh et al., 2023; Valova et al., 2024; Yilmaz et al., 2023). Research shows that students are aware of the tools' potential and recognize it can be utilized in both constructive and destructive ways. (Singh et al., 2023). Other authors point out students perceive ChatGPT as a robust, ease and helpful resource or even, as Ding et al. (2023) mention 'a know-it-all machine', blindly trusting its answers. In line with these conclusions, Shoufan (2023) emphasizes the high motivation and interest that students have in the use of ChatGPT. However, some authors remark that unfortunately this enthusiasm does not appear correlated with students' self-regulation, collaboration, problem-solving and joy of learning (Farhi et al., 2023; Ngo, 2023; Sáiz-Manzanares et al., 2023; Shoufan, 2023; Valova et al., 2024). Even though some authors state students do not perceive ChatGPT as a threat to learning or academic integrity, as they only moderately evaluate its disadvantages (Shoufan, 2023), others point to the fact that students are aware of some of the disadvantages of using ChatGPT, namely regarding the quality and reliability of the fonts it uses (Ngo, 2023).

It is important to acknowledge that the use of these AI tools presents a new challenge, analogous to the advent of the internet or Google in the latter decades of the 20th century. It is a game changer, and students will inevitably use these tools, regardless of the teachers' preferences. Based on this assumption, some authors emphasize the need for teachers and schools to encourage students to use these tools judiciously. This involves developing critical thinking, ethical behavior and promoting interaction between students and between students and teachers to reinforce social skills (Bhullar et al., 2024; Pradana et al., 2023; Zhou & Li, 2023). On the other hand, it is imperative that educational institutions review their academic integrity policies to integrate guidelines that support students in the use of AI tools (Bhullar et al., 2024).

In line with the concern of alerting students to the pros and cons of using ChatGPT, particularly regarding the trustfulness of the information obtained, development of critical thinking and ethical issues, we invited students to carry out an academic work that allowed the use of ChatGPT and a mandatory consequent validation of the information obtained using bibliographic sources. In this article, we describe this work and the research results of a study about the students' perceptions about the task, namely in terms of the level of satisfaction about the work and the ChatGPT usage and the level of outcomes fulfilled with this activity.

Methodology

The aim of this article is to describe an assignment involving the use of ChatGPT and to present the results of a study whose objective was to evaluate students' perceptions about the task. More specifically, we can state that the objectives of the present work are:

- To evaluate students' perceptions regarding the use of ChatGPT in the proposed task;
- To evaluate the degree of student satisfaction with the completed task;
- To evaluate students' perceptions of the outcomes and achievements they attained through this work.

Student assignment description

This assignment was carried out as part of the Organizational Behavior course in the third year of a degree in Computer Engineering at a Portuguese Engineering School. It was an optional assignment which would allow students to get a maximum of extra 2 out of 20 points in their final grade. Of the 260 students enrolled in the course, 86 decided to do this optional task.

To carry out this assignment, students had to choose a topic from the course syllabus and prepare five questions to ask to ChatGPT. Based on the text obtained by the ChatGPT, their work was to apply the following tasks: (1) Verify the veracity of each idea and/or concept based on the knowledge developed in class and bibliographic research; (2) Substantiate these ideas and concepts by researching bibliographic sources; (3) Expand and deepen the proposal presented by the ChatGPT by adding new data or new aspects collected in the bibliographic references that enrich the information or remove those that are not consistent with the researched bibliography and; (4) Write a final text with the validated and enriched knowledge.

Survey description

To address our research goal of understanding students' perceptions about the work developed in this assignment, a questionnaire was assembled, bearing in mind our main concerns: their perception on ChatGPT usage and their accomplishments and acknowledgments. To undertake it, a survey was applied through an on-line questionnaire (google form). Before data collection, teachers informed students of the importance and relevance of the study and assured them that the collected data would only be used for the purposes of this research. Students were briefed about the study aims, the type of information collected and what their participation would entail. Students were also informed that their participation was voluntary, anonymous and that their identities would remain confidential. So, the study participation was voluntary, anonymous and based on informed consent. Considering the above, we used a non-probabilistic sampling technique, more specifically voluntary response sampling.

Based on the type and nature of data collected, our study fell outside the scope of research requiring ethical review, as outlined in the national regulations and guidelines provided by national law 80/2018 of 15 October. No personal data was collected, and the data collected cannot reveal the identity of the subjects in the sample, thus complying with the provisions of the EU General Data Protection Regulation (2016/679) GDPR regulation.

The questionnaire had some personal characterization questions and the quantification of the time spent doing the assignment and five main questions concerning the research. The first two, assessed on a five-point Likert scale (with 1 corresponding being not at all satisfied/relevant and 5 being very satisfied/relevant), asked students about the degree of satisfaction and relevance attributed to the assignment; the third queried them to freely choose from a list of factors, which ones had motivated them to do the assignment; the fourth question assessed their perception of the achieved outcome while performing this assignment choosing from a list of outcomes aligned with Bloom's taxonomy. Finally, the fifth posed an open question: 'What was your opinion about this assignment?'. Bloom's Taxonomy is a classification of the different outcomes and skills that educators set for their students (learning outcomes). The taxonomy was proposed in 1956 by Benjamin Bloom and has been recently updated, including now six levels of learning. (1) Remembering; (2) Understanding; (3) Applying; (4) Analyzing; (5) Evaluating and (6) Creating (Stanny, 2016).

Research methodology

An experimental, correlational and cross-sectional study was carried out followed by a mixed analysis of the quantitative and qualitative data provided (Cohen et al., 2007). As data was collected for the whole population at a single moment and our purpose was to establish relationships between variables, a correlation procedure, was the best option. Correlation is a bivariate analysis which purpose is to establish the extent to which two variables are statistically correlated, which was what we intended. The qualitative analysis was used to treat the results of the open question posed in the questionnaire. This question

was addressed through content analysis, which is defined as a set of techniques for analyzing communications through systematic and objective procedures for describing the content of messages (Bardin, 2011). First, each response was analyzed and categorized in one or several key concepts. Subsequently, they were refined in order to group similar meanings into a common category. Finally, the categories that emerged were linked to the responses and a final counting was performed.

Results

Analyzing the result of the work performed by students in this optional assignment, from the 86 who attempted to do it, more than 50% delivered a well-crafted, well-structured and well-organized essay. According to the teacher, they demonstrated research abilities, producing interesting ideas supported by credible bibliographical references. So, in terms of the learning outcomes, the teacher considered the assignment fulfilled the objective of showing students that the use of the AI tool can be useful if it is done in a judicious way, based on credible references and complying with appropriate ethical concepts. The teacher perception of the students' usage of the ChatGPT was that the majority understood that ChatGPTs' results should not stand on its own and should be corroborated by other resources.

The data collected from the survey regarding the students' perception about the task, and namely about the use of ChatGPT, were quantitatively and qualitatively analyzed. Firstly, a descriptive analysis of the students' answers to the questionnaire in terms of: (a) the time allocated to the proposed task; (b) level of satisfaction with it and (c) level of relevance they considered the task had in their learning (Figure 1(a–c)). Most students (64.2%) took less than 6 h to complete the task, although 13.2% needed more than 9 h for its completion. In general students expressed satisfaction for carrying out of the task, with 77.3% reaching level 4 or 5, and considered it was relevant in their learning process, with 66.1% reaching level 4 or 5. Considering the reasons that led them to carry out the task in question, the most listed one, with 92.5% of the answers, was naturally 'increase the UC's grade'. In fact, it would be expected that all students listed this one. Still a substantial number of students was (also) motivated for other reasons, specially 'it is an interesting challenge' (43.4%), as illustrated in Figure 2(a).

Also, in Figure 2(b) it is clear students consider they achieved several learning outcomes. Curiously, the learning outcomes were represented accordingly to Bloom Taxonomy, but they do not follow the same distribution as illustrated in Figure 3. In fact, the least mentioned learning outcome, with 20 answers, was 'apply the concepts to new situations', which is level 3, in Bloom Taxonomy. Apart from this lower value in competence level 3, the remaining levels have very similar results, which turns the typical Boom pyramid in nearly a parallelepiped.

To pursue our goals of understanding the perception of students about the assignment developed, several correlations between different aspects were studied. Before deciding which correlation procedure to apply – parametric (Person) or nonparametric (Spearman) – it is necessary to verify the normality as well as the skewness and the kurtosis of the variables in study. From the normality test results, and as the null hypothesis (H_0 : the variables follow a normal distribution) was rejected (p value bigger than .05), Spearman correlations were addressed between several study variables: time allocated to the assignment, level of satisfaction, level of relevance, number of work reasons (the total number of reasons students chose that led them to perform the assignment), number of learning outcomes (total number

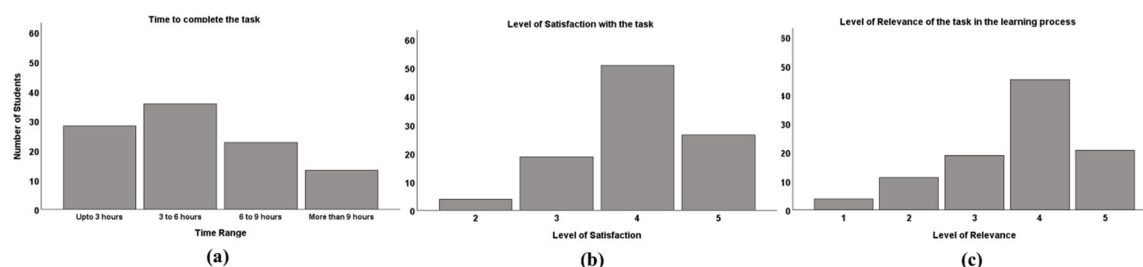


Figure 1. Descriptive analysis of students' answers.

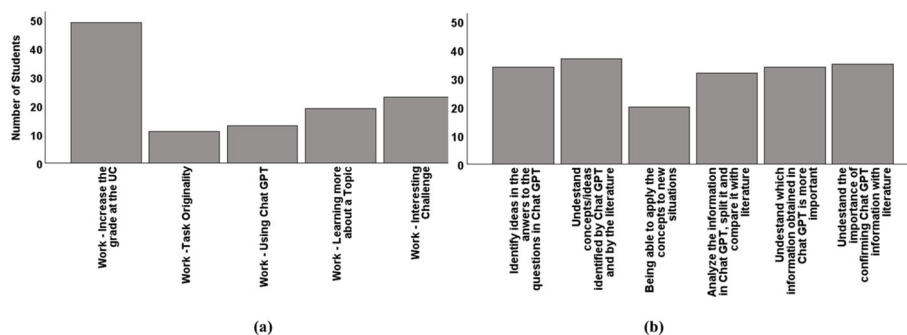


Figure 2. Reasons and learning outputs.

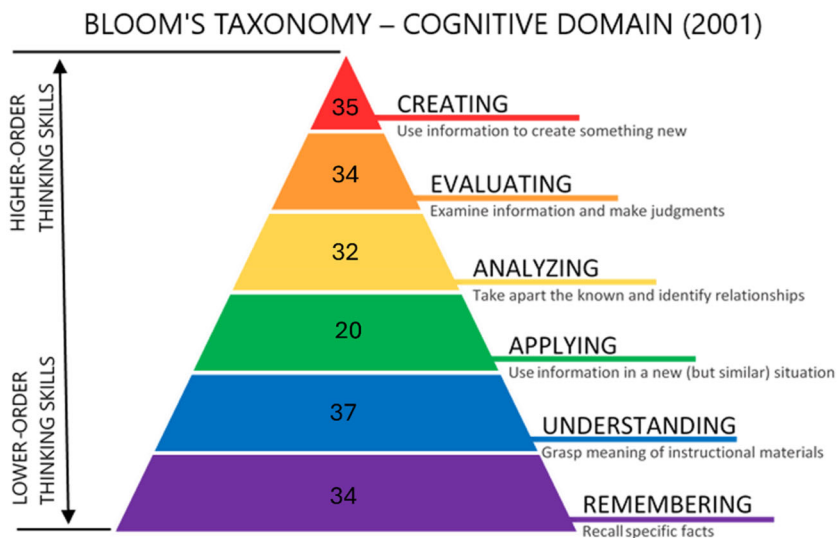


Figure 3. Learning outputs according to Bloom Taxonomy (adapted from Soozandehfar & Adeli, 2017).

Table 1. Correlations.

	Level of satisfaction	Level of relevance
Time range	n.s.	n.s.
Work – number of reasons	0.470 ($p < .001$)	0.367 ($p = .007$)
Outputs – total number	n.s.	n.s.

Note: Correlation is significant at the .01 level (two-tailed).

of learning outcomes students considered they have achieved with the task). Table 1 illustrates the correlations found between the variables.

There is a moderate correlation between the number of reasons they gave for completing the task and both their satisfaction with it and the degree to which they felt it was relevant to their learning. A correlation between the level of satisfaction and the level of relevance also and as expected stood out (.533). But also of importance is the lack of correlation between their satisfaction or the relevance they attribute to the task in their learning with the time taken to complete the task and the number and level (lower level, higher level) of learning outcomes they believe they have achieved. This was somewhat surprising, as one could expect to see correlations between the outputs (especially the higher-level ones) and, for instance, the level of relevance.

In parallel, a qualitative analysis was performed in relation with the open question of the questionnaire: 'What was your opinion about this assignment?'. Since the question was mandatory, 53 answers were collected, however 3 were considered invalid. After performing the content analysis of the 50 valid answers representing these students' remarks, 111 codes were made regarding each aspect of each

answer. Each student could have remarks in several categories and sometimes more than one in the same category. For instance, one of students' answer was:

It was a good piece of work that helped me look at ChatGPT as a support tool and not as a tool that can transmit both true and false information. The method of checking whether the information is correct is a good way of deepening knowledge and developing critical thinking skills.

The underlined parts of this statement were considered relevant and were coded:

- coded as 'understand its capacities/limitations';
- coded as 'critical thinking';
- coded as 'learn more/better'.

Finally, after doing so to every answer, these codes were grouped into categories, and five categories emerged, as shown in Table 2. In the case of this answer, into three different categories (respectively):

- in category 'Remarks about ChatGPT';
- in category 'Identification of competencies';
- in category 'Acknowledgement of achievements'.

In relation with the first category, denoting strategic thinking, some students reiterated their appraisal (again) for the fact that this assignment could allow them to 'improve their grade' (9 students directly said that), others expressed the acknowledgment of 'reward' for the extra work (3 student). One student confessed 'I was going to use ChatGPT anyway ...', assuming their strategic thinking of using an AI tool from the beginning.

In relation to the remarks about the assignment proposed to students (second category), there were 47 remarks made by students, mostly positive: identified it as a 'good (initiative, work, idea, etc.)' (16 students); 'interesting' (12 students), 'different/original' (5 students); 'useful/enrichment' (6 students); 'challenging' (3 students); 'important' (2 students). However, three students expressed more negative feeling toward this task: 'it shouldn't be possible to choose a topic that hasn't yet been covered in class' (2 students); 'extremely tiring and labour-intensive' (1 student).

The third category comprises the students' thoughts about the usage of ChatGPT. Almost all students were glad to be able to use ChatGPT, however there was one student who convey his reserves toward this tool, already acknowledging its limitations in terms of reliability. The remarks were joined in five codes: 'learn to use' (5 students); 'understand its reliability' (4 students); 'understand its most-values' or

Table 2. Qualitative analysis on the open question.

Emerged category	Denoting strategic thinking	Remarks about the assignment	Remarks about ChatGPT	Identification of competencies	Acknowledge achievements
Identified codes	'Improve their grade'	'Good (initiative, work, idea, etc.)'	'Learn to use'	'Critical thinking'	'Learn more/ better (the content of the topic)'
	'Reward'	'Interesting'	'Understand its reliability'	'Validate information'	'Learn to (productively) use ChatGPT'
	'Intention of using it anyway'	'Different/ original'	'Understand its most-values'	'Link concepts'	'Personal development'
		'Useful/ enrichment'	'Understand its capacities/ limitations'	'Gather useful information'	'Combining subject matter with creativity'
		'Challenging'	'Embrace new tools/ future/ technology'		
	'Important'	'Extremely tiring and labour-intensive'			
N-number of identifications	13	47	18	10	23
Percentage (N/53)	25%	89%	34%	19%	43%

'understand its capacities/limitations' (3 + 3 = 6 students); 'embrace new tools/future/technology' (3 students).

Students were able to identify some competence development while doing this task. By level of complexity: 'critical thinking' (4 students); 'validate information' (2 students); 'link concepts' (1 student); 'gather useful information' (3 students).

Finally, students also had the capability to identify two major achievements while performing this assignment: 'learn more/better (the content of the topic)' (14 students); 'learn to (productively) use ChatGPT' (7 students). One student acknowledged his 'personal development' while performing this work and another student expressed 'combining subject matter with creativity'.

Discussion

As Johansen (2012) identified, some of the most important skills for Engineers in the XXI century are novel, adaptive and computational thinking. ICT (Information and Communication Technology) literacy and critical thinking are imperative to address current and future problems in society, especially in engineering and sustainability.

The use of new artificial intelligence tools is perceived as extremely attractive by students, not only because they consider it a mean of making their work easier, but also because of the normal interest that young people have in technological innovation. (Ding et al., 2023; Firat, 2023a, 2023b; Ouyang & Jiao, 2021; Rudolph et al., 2023a, 2023b; Singh et al., 2023). However, the challenge is to use these tools with a critical spirit and ethical sense. It is the responsibility of the Educational Institutions and in particular the teachers, to encourage the use of these tools in a judicious manner, based on crossing its results together with other credible bibliographical references and in accordance with ethical precepts. One of the main objectives of the work here presented was to understand students' perceptions regarding the use of ChatGPT and help them understand its potential and limitations. The results point to a high level of satisfaction and relevance attributed by students to the aforementioned work. 43% of respondents actually consider this to be an interesting challenge. The content analysis carried out on the answers obtained in relation to the open question 'what is your opinion about this assignment?', points to the fact that 89% of students gave answers categorized as 'remarks about the assignment', 43% responded with aspects related to 'acknowledge achievements' and 34% mention aspects related to 'remarks about ChatGPT'. Studies show that, in fact, there is a natural motivation among young people to use these new tools, so their use could contribute to increase student engagement in school activities (Ding et al., 2023; Firat, 2023a, 2023b; Ouyang & Jiao, 2021; Rudolph et al., 2023a, 2023b; Singh et al., 2023). Hakiki, et al. (2023) for example, say that ChatGPT has the potential to engage students in learning activities. This perspective is reinforced by other authors such as Zhou and Li (2023). This is an important finding because the relation between engagement and learning outcomes was already established by some researchers (Hakiki et al., 2023; Zhou & Li, 2023).

Regarding the level of satisfaction, it is interesting to discuss here the results obtained through the correlation procedure conducted. In fact, a correlation was found between the number of reasons students cite for choosing to undertake the work and the level of satisfaction and relevance they attribute to the task. In our opinion, this may be due to the relationship that could be established between the number of reasons and the motivation to complete the work. Thus, perhaps the more motivated students are those who present a greater number of reasons for engaging in academic activity. Therefore, the relationship found with the level of satisfaction and relevance is justified. Interestingly, no significant relationships were found between the levels of satisfaction and relevance and the time students spent on completing the work or the number and level of outcomes they believe they achieved. As a hypothesis, we suggest the fact that students are motivated by the content of the task not making it dependent on the number of hours spent on the task or even on the level of outcomes.

It should also be noted that 19% of students report that the assignment allowed them to develop skills such as critical thinking and validating information through bibliographic references. This is in line with other researchers like Nikitina and Ishchenko (2024), Acosta-Enriquez et al. (2024) and Bhullar et al. (2024). If, as Ngo (2023) states, students are aware of some of the disadvantages of using ChatGPT, namely regarding the quality and reliability of the sources, our results point to the fact that students are

able to understand the need to use this tool in a judicious manner, and it is important that they are properly guided, as was the case in the work carried out in this course. Our results are also aligned with Shoufan (2023) who states that the use of AI tools could contribute to increasing students' motivation for school activities, as long as there is a pedagogical concern on the part of teachers, particularly in terms of promoting its use with a critical spirit and ethical sense.

Regarding the type of outcomes, students say that, in general, the assignment allowed them to identify and understand the ideas obtained by ChatGPT, but also to reflect upon these ideas, understanding the importance of confirming the results obtained by ChatGPT through relevant literature. As far as Bloom's taxonomy is concerned, the lowest score is for application to new situations, which is understandable considering that this was not one of the requirements of the assignment. What is noteworthy, however, is the students' understanding that the use of ChatGPT in this assignment allowed them to reach high-level outcomes, going beyond the simple level of comprehension. This is an interesting result, particularly as this is also one of the main objectives of higher education (Stanny, 2016). It should also be noted that this finding reinforces previous research, namely by Ding et al. (2023) and Hakiki et al. (2023). The latter authors have even reinforced the effectiveness of the use of AI tools in education as a way to improve student learning outcomes.

Conclusion

This paper describes an assignment carried out in a course unit using ChatGPT. The aim of this work was to show students that it is possible to use AI tools as long as they use it critically and ethically. At the same time, a research study was carried out with the aim of understanding the students' perception of the use of the chat in this specific assignment, as well as understanding the students' perception of the level of outcomes that the assignment enabled them to achieve.

The results point to a high level of satisfaction and relevance attributed by the students to the use of the AI tool in a school context. The results of the content analysis carried out showed that most students gave positive remarks about the use of ChatGPT in this assignment: they identified it as a 'good' (initiative, work, idea, etc.), or an 'interesting' and 'different/original', 'useful/enrichment', 'challenging', or 'important'.

Results also show that students felt that the work developed in this assignment has allowed them to acknowledge achievements and develop skills such as critical thinking and validating information. So, from the point of view of the level of outcomes, students believe that this work allowed them to reach high levels of Bloom's taxonomy. This reinforces the idea put forward by some authors of the advantages of using AI tools in higher education, if students are properly guided.

In conclusion, we affirm that the use of ChatGPT in a school context is advantageous, since it may help students to carry out their tasks while contributing to increase their enthusiasm and motivation. If properly incorporated it may contribute to mitigate the excessive reliance some students have in this type of tools. In fact, the use of this and other AI tools should be guided by teachers, so that students develop a critical spirit in their use, understand the need to validate the obtained results with credible bibliographic sources and use the tool ethically. As one student mentioned 'I was going to use it anyway ...', so instead of forbidden, perhaps it is better to show them how to use it properly and ethically.

This work has limitations that should be considered in future research works about this thematic, particularly in engineering related topics. The cross-sectional methodology is inappropriate in causal research as it cannot sustain causal analysis unless the data it is repeated overtime. It would be interesting to gather data in different time moments and involve more students to study development patterns and causality.

The challenges ahead are great and require an effort not only from the entire educational community but also from researchers to support schools and teachers to apply AI tools in teaching in a productive and effective way. Thus, more research should be developed that allows, for example, the development of guidelines and best practices for the application of ChatGPT in teachers' didactical implementations and its usage in academics works. Another important area of research is related to the impact of the use of AI on academic performance and in the assessment of knowledge and skills. Research on the ethical implications of the use of AI tools is urgent and will allow a balance to be established between

innovation and technology usage and the maintenance of the necessary academic rigor. Finally, it is important to develop research on the impact of the use of these tools on students' interpersonal, social skills and mental health.

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