Perspectiva de estudiantes de nivel medio superior respecto al uso de la inteligencia artificial generativa en su aprendizaje

Perspective of high school students regarding the use of generative artificial intelligence in their learning

Perspectiva de estudantes do ensino médio quanto ao uso da inteligência artificial generativa em sua aprendizagem

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Resumen

El presente trabajo tiene por objetivo documentar la percepción de estudiantes de nivel medio superior hacia el uso de la inteligencia artificial generativa en el aula con la intención de favorecer su aprendizaje. Para ello, en este estudio, se analizaron datos sobre su impacto en el proceso de aprendizaje en nivel medio superior, y se consideraron aspectos como la motivación, la creatividad y el pensamiento crítico. El método utilizado fue de tipo descriptivo, con un enfoque cuantitativo. Los resultados indican que los estudiantes valoran el uso de herramientas innovadoras al recibir sus clases, ya que desarrollan una comprensión más profunda de los temas. De hecho, el 73.4% de los estudiantes considera positiva o muy positiva su experiencia en el uso de herramientas de inteligencia artificial. Entre los beneficios que reconocen del uso de esta tecnología se encuentran que les brinda información adicional e innovadora sobre un tema buscado (52.63%), les explica de manera sencilla y

clara (20.55%) y estimula su formación escolar de forma personalizada (26.31%). Se destacan las posibilidades que brinda el uso en las sesiones de clase y se sugieren direcciones futuras para la investigación en este campo. De igual forma, se discuten los desafíos asociados con la implementación de la inteligencia artificial generativa y se considera una estrategia relevante para transformar los entornos de aprendizaje, la cual debe abordarse de manera reflexiva e incremental con atención a las particularidades de cada contexto.

Palabras clave: inteligencia artificial, tecnología, educación, enseñanza, aprendizaje.

Abstract

The aim of this paper is to document the perception of high school students towards the use of generative artificial intelligence in the classroom with the intention of favoring their learning. In this study, data on its impact on the learning process in high school were analyzed, considering aspects such as motivation, creativity and critical thinking. The method used was descriptive and with a quantitative approach. The results indicate that students value the use of innovative tools when receiving their classes, since they develop a deeper understanding of the topics. Some 73.4% of the students consider their experience in the use of artificial intelligence tools to be positive or very positive. Among the benefits they recognize from the use of artificial intelligence are: that it provides them with additional and innovative information about a topic (52.63%), that it explains it in a simple and clear way (20.55%) and that it stimulates their school education in a personalized way (26.31%). The possibilities offered by its use in classroom sessions are highlighted and future directions for research in this field are suggested. Similarly, the challenges associated with the implementation of generative artificial intelligence are discussed and it is considered a relevant strategy for transforming learning environments, which should be approached in a reflective and incremental manner, with attention to the particularities of each context.

Keywords: artificial intelligence; technology; education; teaching; learning.

Resumo

O objetivo deste trabalho é documentar a perceção dos alunos do ensino secundário relativamente à utilização da inteligência artificial generativa na sala de aula, com a intenção de favorecer a sua aprendizagem. Neste estudo, analisámos dados sobre o seu impacto no processo de aprendizagem no ensino secundário, considerando aspectos como a motivação, a criatividade e o pensamento crítico. O método utilizado foi descritivo e com uma abordagem quantitativa. Os resultados indicam que os alunos valorizam a utilização de ferramentas inovadoras na receção das aulas, uma vez que desenvolvem uma compreensão mais profunda das matérias. 73,4% dos alunos consideram positiva ou muito positiva sua experiência no uso de ferramentas de inteligência artificial. Entre os benefícios que reconhecem da utilização da inteligência artificial estão: o facto de lhes fornecer informação adicional e inovadora sobre um determinado tópico (52,63%), o facto de a explicar de forma simples e clara (20,55%) e o facto de estimular a sua educação escolar de forma personalizada (26,31%). São destacadas as possibilidades oferecidas pela utilização em sessões de sala de aula e são sugeridas direcções futuras para a investigação neste domínio. De igual modo, são discutidos os desafios associados à implementação da inteligência artificial generativa, sendo considerada uma estratégia relevante para a transformação dos ambientes de aprendizagem, que deve ser abordada de forma reflexiva e incremental, com atenção às particularidades de cada contexto.

Palavras-chave: inteligência artificial; tecnología; educação; ensino; aprendizagem.

Introduction

Years ago, the concept *artificial intelligence* (AI) was known mainly by students and scientists related to computing and robotics, and perhaps by some people fond of literature and science fiction. However, all this changed at the end of 2022 with the unexpected arrival of the ChatGPT-3 tool, developed and released to the public by the company OpenAI.

As a natural language model, ChatGPT pioneered the creation of thousands of generative AI applications. The way these models work consists of analyzing large amounts of data and using probabilistic techniques, which makes them susceptible to errors when answering certain questions. Despite this, generative AI is widely used by a sector of teachers

in the preparation of their classes and by students for the presentation and delivery of tasks (García-Peñalvo *et al.*, 2023).

Over time, various ideas have been raised about the nature of thinking in the human mind, as well as the risks and opportunities of providing intelligence to electrical and mechanical devices. Still, getting a machine to "think" has been the goal of many people for decades. In this sense, Haugeland (1988) provides valuable information to understand the implications and limitations of artificial intelligence in the current context.

For its part, for Hamilton *et al.* (2023) the degree of dissemination given to artificial intelligence tools has contributed to greater attraction by the educational sector, institutions, teachers and students, who begin to experiment with exercises to promote the improvement of teaching-learning processes. However, while this represents an opportunity, it also entails risks that are difficult to identify due to the short time these technologies have been on the market.

Regarding the benefits that AI has demonstrated so far in the quality of teaching and, therefore, in student learning, we can mention generation of novel material, interaction with the teacher, automation of evaluations. and the personalization of learning (Terrazas, 2023). As Aparicio (2023) expresses, artificial intelligence promotes the creation of interactive spaces where students actively participate in dynamics, projects, simulations and virtual environments, among other activities. Therefore, timely action is necessary so that there is equity in the type of stimuli that students receive. Additionally, AI can be a vehicle for students to develop critical thinking and express their creativity positively in classrooms.
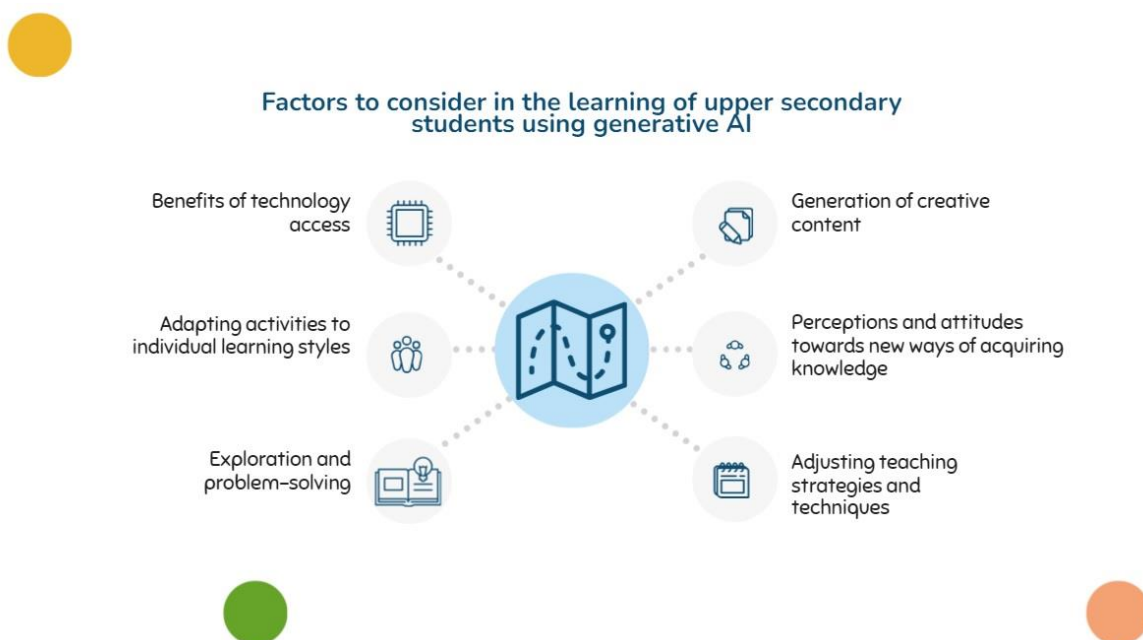
From the perspective of Sanabria-Navarro *et al.* (2023), there are two elements of main relevance for the use of generative artificial intelligence in educational centers. The first is the role that the teacher plays in the academic training of students by generating materials and content that serve as a guide for them in their different subjects. The second has to do with placing the student as the protagonist of their learning, for which the potential of generative AI can be taken advantage of, since they frequently use tools with this technology. In theory, this makes it easier for them to decide appropriately what they use them for and, at the same time, attend to quality and ethical aspects (Díaz-Arce, 2023a).

In recent months, articles have been published that investigate the impact of generative AI in education, from the basic level (Martínez- Comesana, 2023), through the secondary level (Ferrarelli, 2023; Leitner *et al.*, 2023) to the upper middle level (Díaz-Arce, 2023b) and higher (Vicente-Yagüe-Jara *et al.*, 2023). For example, Profuturo and OEI (2023)

analyze the role that AI will play in educational institutions in Latin America in the coming years. In their work, these authors include initial, primary, secondary, tertiary (middle) and university (higher) level institutions, and use the survey method to know the opinion of representatives of educational policies and academics from private institutions in seventeen countries of the mentioned region. The results show that members of each of the educational levels use the tools to the extent of their possibilities and scope. However, many, despite recognizing how innovative its incorporation is, resist doing so, which leads to an outdated knowledge and skills that will be necessary for students in their professional and personal horizon.

Now, for the writing of this article, different factors were analyzed (figure 1) in which generative AI accompanies the high school student in learning and constructing their own knowledge.

Figure 1. Factors to consider in the learning of high school students using generative AI

Factors to consider in the learning of upper secondary students using generative AI

Benefits of technology access

Generation of creative content

Adapting activities to individual learning styles

Perceptions and attitudes towards new ways of acquiring knowledge

Exploration and problem-solving

Adjusting teaching strategies and techniques

Source: self made

As Yu and Guo (2023) express, technology is already a convenient support instrument for students. Furthermore, next-generation computers, smartphones and mobile devices are contributing to the emergence of AI-based applications that provide students with greater efficiency in their learning. As a result of this, educational applications based on generative AI technology have become very important assistants for modern students, providing conveniences and learning opportunities that did not exist before.

Currently, the offer of generative AI applications is very broad, with *software* for image generation, natural language processing and the generation of proposals that are located in the artistic field (Lim *et al.*, 2022). However, although everything mentioned seems to speed up the generation of knowledge, new problems arise that require attention. In this regard, Zohny *et al.* (2023) mention two immediately visible problems: originality in the authorship of research products and academic integrity when carrying out evaluations with the use of generative AI tools. In the words of Lim *et al.* (2023), technological innovation represented in its multiple forms is a reality that is here to stay, so it must be conceived as an opportunity to transform education in educational centers and invent new scenarios in which students strengthen their cognitive abilities.

In this new context, the role of teachers in teaching is even more vital, regardless of the educational level at which generative AI is used (Terwiesch, 2023). Furthermore, it is a responsibility shared with students, since they must learn to get the most out of this type of resources (Pavlik, 2023). Thus, in class sessions, the teacher must promote different dynamics so that students participate actively, while the task of the latter, as mentioned above, consists of assuming the leading role in their learning, researching different sources. of information and, in turn, generate content that allows them to achieve school objectives.

Taking advantage of all these technologies allows us to provide students with more realistic, vivid and personalized learning experiences through virtual reality, augmented reality and, of course, the metaverse, which substantially improves student participation and interest in more intuitive and complete learning (Ouyang *et al.*, 2022). Even so, technological advances in this area will be perceived differently, as some will take advantage of them, while others will prefer not to use them (Abdullah *et al.*, 2022).

Kamalov *et al.* (2023) indicate that applications based on natural language processing (NLP), such as ChatGPT, are intelligent systems capable of understanding people's speech and text messages. They also highlight the great ease that these applications have to solve a wide range of tasks, from producing a song in the style of a fashionable artist to writing literary works and generating code for programming an information system. Therefore, it is most advisable to take advantage of the capabilities of this technology for teachers and students.

For their part, Chávez *et al.* (2023) present contributions and challenges related to the use of generative artificial intelligence in the training of high-level students. His work provides findings related to the role of the teacher in the face of the new paradigm and the

relationship of teaching with new ways of learning. In the same sense, the United States Department of Education (US Department of Education, 2023) published a report related to the interaction between AI and the future of teaching and learning, highlighting teachers' constant search for tools to improve students' learning experiences. Finally, Sorbara (2023) indicates that artificial intelligence should be used as an additional tool that complements and accompanies traditional teaching methods.

Materials and methods

With the intention of knowing the students' perspective on the role that generative artificial intelligence plays in their learning, it was proposed to work with advanced high school degrees, since it is precisely these groups that focus on subjects related to technology. To this end, the sample was selected using non-probabilistic sampling, particularly due to cost and time considerations (Ortega, sf). Likewise, convenience sampling was used, which consisted of 76 eleventh and twelfth grade students from a private institution of higher secondary education in the metropolitan area of Mexico City. The modality of the study was face-to-face and was carried out in the first semester of the 2023-2024 school year.

Although convenience sampling is not a random technique, it allows participants to be selected in a practical and accessible way. Additionally, given that understanding students' perceptions is critical to assessing the impact of generative AI on their learning, the sampling used facilitated the identification of those participants exposed to generative AI, allowing for a detailed exploration of both their experiences as well as their opinions.

Likewise, a methodology with a mixed approach was chosen, starting with a quantitative research strategy that used an exploratory and descriptive approach. Hernández-Sampieri *et al.* (2014) explain that exploratory studies are carried out when you want to investigate a little-known and little-studied topic. On the other hand, descriptive studies are mainly responsible for examining the characteristics of certain social phenomena.

Secondly, and in accordance with the nature of the intervention instrument used, a qualitative research route was followed (Hernández-Sampieri and Mendoza, 2018). This route not only focuses on the measurement of data, but also focuses on the understanding and interpretation of events during the investigation.

To achieve the proposed objective, data were collected among high school students who have experienced the use of artificial intelligence tools in their class sessions. The technique used was the survey, and the instrument was a questionnaire designed using the

Google Forms tool. Some authors propose adding a stage in which those items that may cause a decrease in general internal consistency are eliminated. This stage can be carried out iteratively until it is observed that the scale does not improve or that internal consistency is maintained (Quero, 2010). In the particular case of this study, at the beginning 13 items were considered. However, after the initial validation by three experts in the area of technology, it was suggested to discard 3 items, which resulted in a total of 10 items in the final questionnaire.

Once the design of the questionnaire was completed, a pilot test was carried out with three groups at the secondary level, in which a total of 32 students participated. As Díaz-Barriga and Luna (2014) point out, any research under the quantitative paradigm must follow the steps established by scientific methodology. In the specific case of the application of the survey, a rigorous procedure was followed, which allowed a particular analysis of the cross-sectional study carried out.

In the research cycle, the hypothesis generation stage has an important relationship with the formulation of the problem and the construction of objectives. Zambrano *et al.* (2014) develop a study that shares common characteristics with this research, such as the relatively small sample size, the use of questionnaires to measure perception in a specific student community, and the construction and application of tests to determine the internal consistency of the quantitative items. In most quantitative research, research hypotheses and/or assumptions are instruments that appear frequently, although they are presented less frequently in qualitative research. According to Naupas *et al.* (2018), every hypothesis is based on conjectures that arise from experience, the results of other studies or existing theories on the subject.

Regarding hypotheses, Bisquerra (2018) defines them as generalized propositions or testable statements that are formulated as a possible solution to the problem posed. From this, the following were proposed:

H_1: The implementation of generative artificial intelligence in the learning process allows high school students to develop creative and critical thinking skills more effectively, compared to traditional teaching methods.

H_0 : The learning process of high school students does not improve their skills when using generative artificial intelligence in the classroom.

Results

The methodological approach applied allowed us to select specific students who adequately represent the student population of interest, for which relevant criteria such as their academic degree and their level of experience with generative artificial intelligence were considered. Given the instrument used to obtain the data, the results were obtained in table format, which facilitated their statistical treatment. To summarize the responses and graphically represent them, the Microsoft Excel spreadsheet application was used. The next step was to establish formulas, functions, tables and graphs that would show correlation parameters between all the elements of the instrument.

To validate the internal consistency of the instrument, Cronbach's alpha coefficient was applied. The aforementioned index was applied to the four Likert scale items used in the instrument. In addition, descriptive statistics tools were used to analyze the data obtained after applying the instrument. Quero (2010) mentions that applying Cronbach's α coefficient (alpha) in research allows for stability of the measurement instrument. González and Pazmiño (2015) describe the analysis of a certain number of items using the formula to obtain the Cronbach coefficient (figure 2), which is reproduced below:

Figure 2. Formula to obtain the Cronbach coefficient

$$\alpha = \frac{K}{K-1}\left[1 - \frac{\Sigma Vi}{Vt}\right]$$

As

α = Cronbach coefficient.

K = number of items.

Vi = sum of the variance of each item.

Vt = variance of the total sum of the items.

This index was calculated by using IBM SPSS software. The analysis of the responses obtained in the application of the scale was carried out with the help of tables. The first of them is the table that concentrates the results of all the students who responded to the survey and served as a data source for statistical information related to the reliability of the scale. In the case of this work, the coefficient was 0.728 for the results of the four responses analyzed (see tables 1 and 2). This value indicates that the instrument obtains an acceptable degree of reliability.

Table 1. Summary of case processing

		No.	%
Cases	Valid	76	100.0
	Excluded to	0	.0
	Total	76	100.0
to. Listwise elimination is based on all variables in the procedure.			

Source: self made

**Table 2.** Reliability statistics of the results of questions with a pretest scale

Cronbach's alpha	# of elements
.728	4

Source: self made

Given the instrument used to obtain the data, the responses were evaluated using tables and subsequently represented graphically. Six of the questions in the intervention instrument were open-ended, in which students answered based on their experience with the use (or not) of generative artificial intelligence tools in their classes. To systematize the results of these questions, it was considered convenient to concentrate the significant responses and tabulate each of them. Likewise, the technique of analyzing and categorizing open responses based on content was applied and then assigning them to specific categories. This made it possible to determine the consistency and variability in the responses, as well as identify patterns or trends (Gil *et al.*, 1996).

The interpretation of the results is presented below. The response values obtained in question one (figure 3) show that 73.4% of respondents have had a positive or very positive experience in the use of artificial intelligence tools in their classes.

Figure 3. Question one of the research instrument.
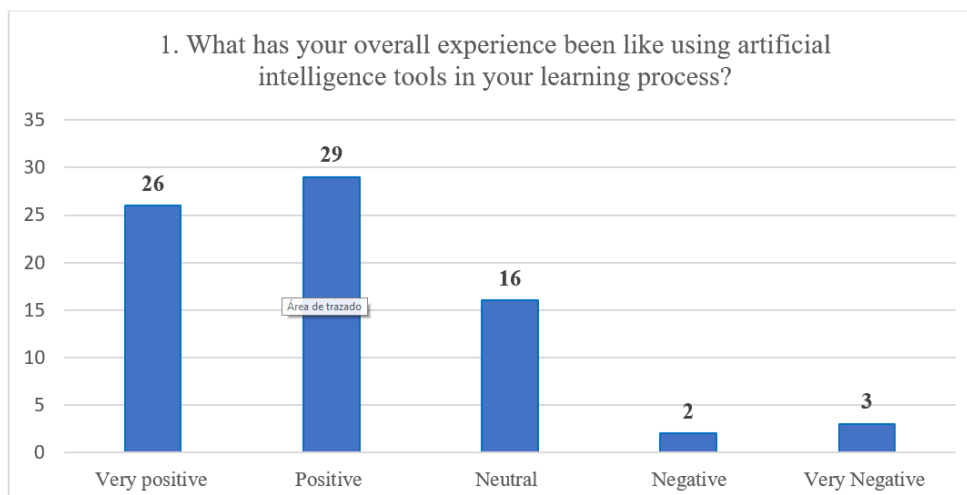
Source: self made

Regarding satisfaction with the usefulness of artificial intelligence tools during their classes, the responses of 59.2% of students (Figure 4) indicate that they are either satisfied or very satisfied with it. A percentage close to 32% of the students gave a neutral response.
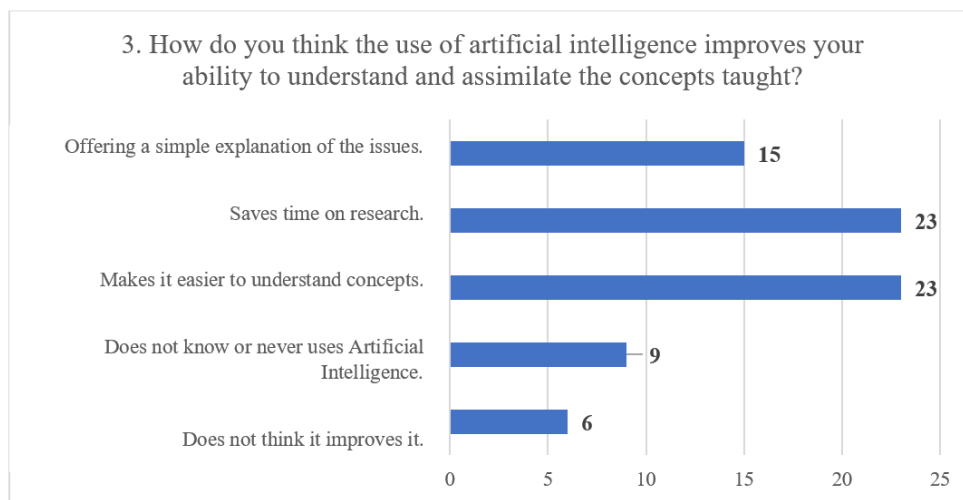
Figure 4. Question two of the research instrument.
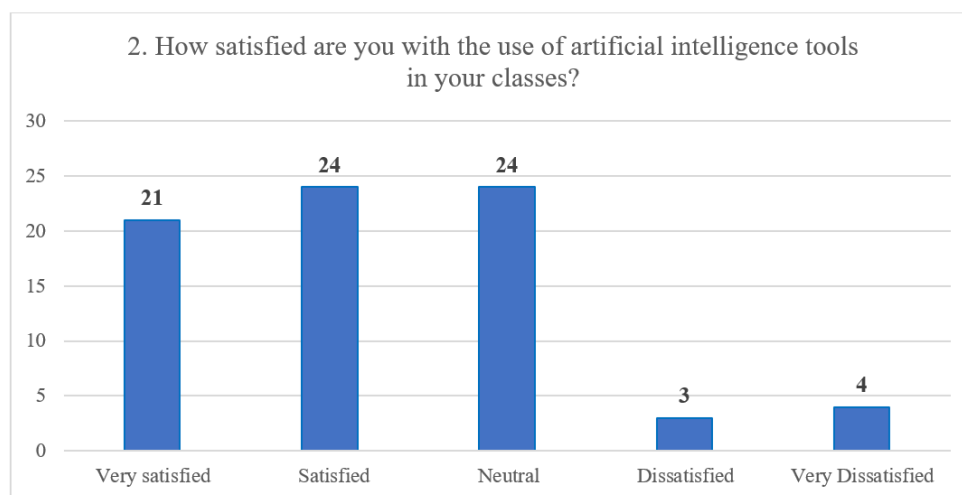
Source: self made

Question 3 is open-ended, so categorization is used to facilitate coding. Responses were defined by their highest frequency and the following was obtained: 83.5% of the students' responses about how artificial intelligence helps them understand concepts express that it facilitates their learning, improves their understanding of topics due to its simplicity. with which these tools present information and saves them time in their school assignments (figure 5).

Figure 5. Question three of the research instrument.

3. How do you think the use of artificial intelligence improves your ability to understand and assimilate the concepts taught?

Source: self made

In question 4, which also had open responses, students were asked about the extent to which they believe that artificial intelligence tools facilitate their learning compared to traditional teaching methods. The students' responses show that they perceive greater ease and accessibility to learning resources (31.5 %), efficiency and speed in searching for information with artificial intelligence (27.6%), and that the presentation of information is more innovative (21%) (figure 6).

Figure 6. Question four of the research instrument.

4. To what extent have artificial intelligence tools facilitated your learning process compared to traditional teaching methods?
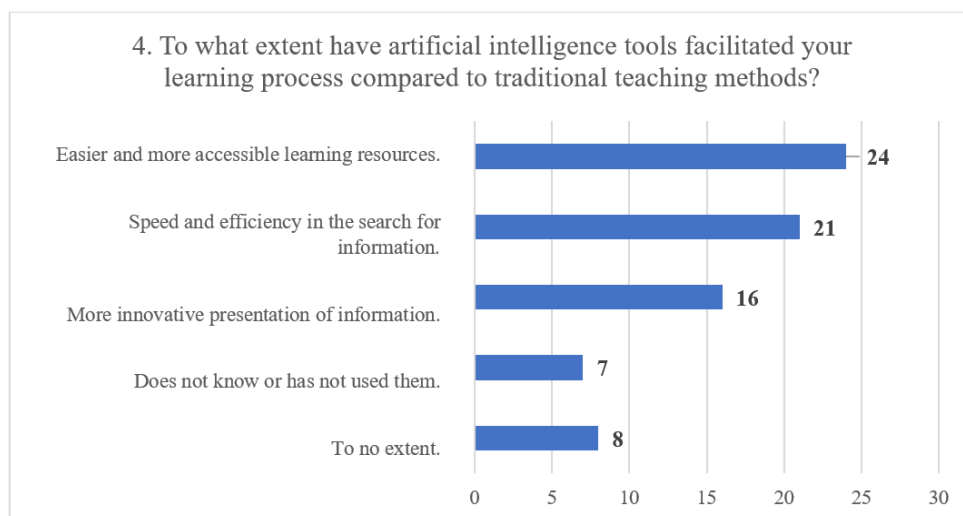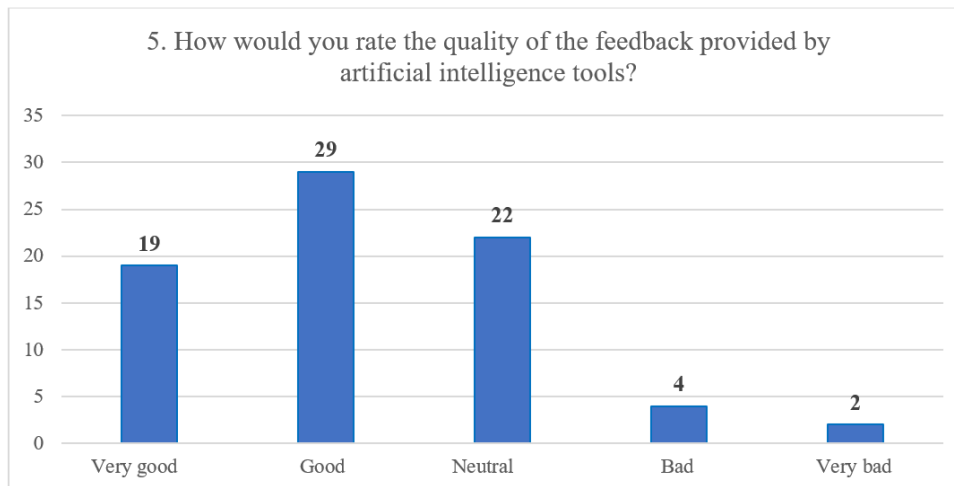
Source: self made

Question 5 offered responses on a Likert scale. The aim was to know how students would rate the quality of the feedback they obtain using artificial intelligence tools. 63.2% of them (figure 7) answered that the feedback is good or very good. A percentage of 28.9%

considers the quality as neutral and 7.8% of the students believe that the quality of the feedback is bad or very bad.
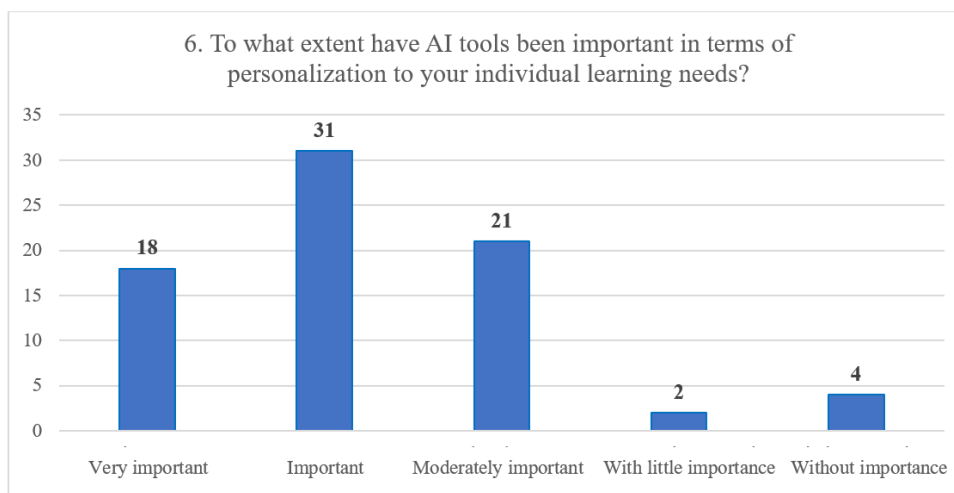
Figure 7. Question five of the research instrument.

Source: self made

In the case of item 6, 64.4% of students think that artificial intelligence tools are either important or very important in personalizing their individual learning needs. 27.63% consider this aspect as moderately important (figure 8).

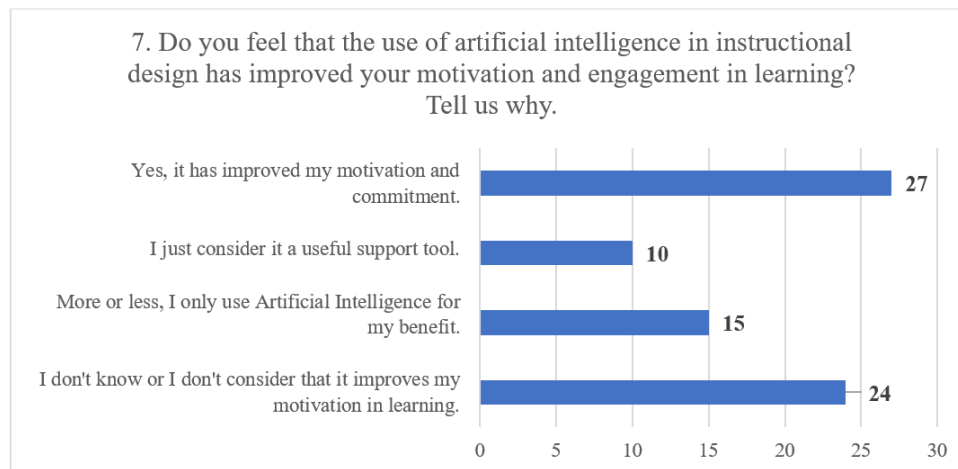**Figure 8.** Question six of the research instrument.

Source: self made

Regarding the students' perception of whether the preparation of class sessions with the use of artificial intelligence has increased their motivation and commitment to learning, 35.5% think that it has, 13.1% consider this technology as a support tool, 19.7% only use

artificial intelligence to obtain advantages from its use, and 31.5% of students do not consider that it increases their motivation and commitment to learning (figure 9).

Figure 9. Question seven of the research instrument.

7. Do you feel that the use of artificial intelligence in instructional design has improved your motivation and engagement in learning? Tell us why.
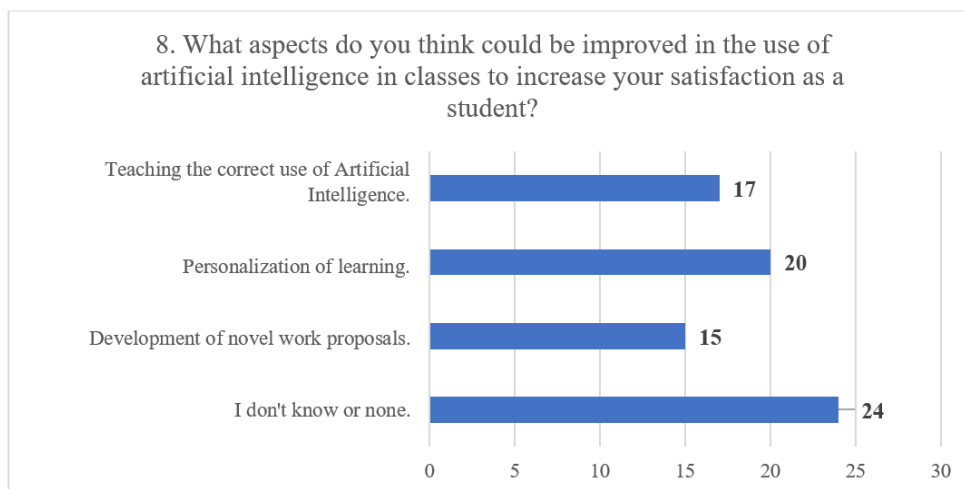
Source: self made

The point of view of the students in relation to what they consider could be improved in the use of artificial intelligence to increase their satisfaction in learning is concentrated as follows: 22.3% are in favor of being taught the correct use of artificial intelligence for your school benefit; 26.3% for the personalization of their learning; 19.7% for the use of novel strategies in teaching; and the highest percentage, 31.6%, does not know or thinks that any aspect should be improved (figure 10).

In this particular item, a high percentage of students are detected who indicate in some way that the operation of generative artificial intelligence is not so relevant in terms of learning motivation. With this result, it is possible to deduce that more students believe that there is still a lack of development in the field of artificial intelligence and, at the same time, they demonstrate an enthusiasm for acquiring knowledge that strengthens their learning.

Figure 10. Question eight of the research instrument.

Source: self made

Regarding question nine about the advantages of using artificial intelligence versus the use of traditional methods, the students' responses are distributed as follows: 30.2% consider that it improves the quality of teaching and learning, same value for those who appreciate the accessibility and convenience that artificial intelligence tools provide them. 21% value the speed they obtain in their information search tasks (figure 11).
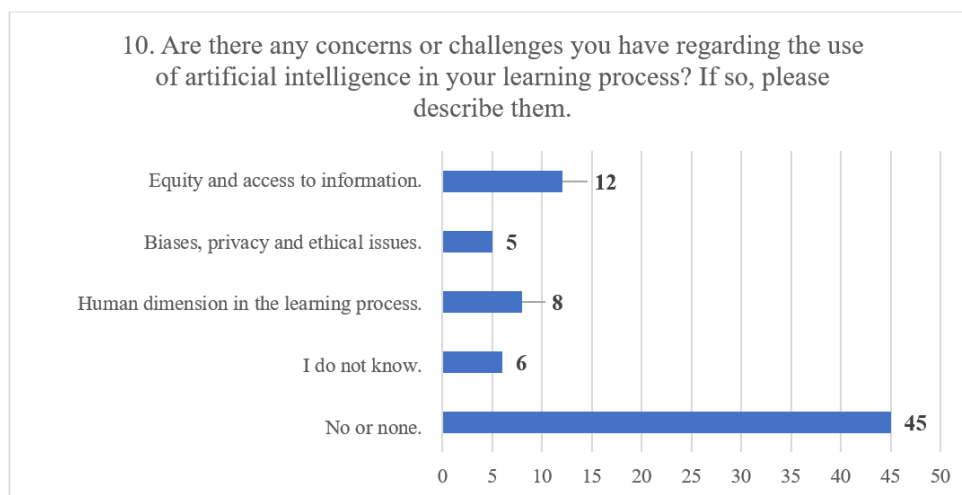
Figure 11. Question nine of the research instrument.
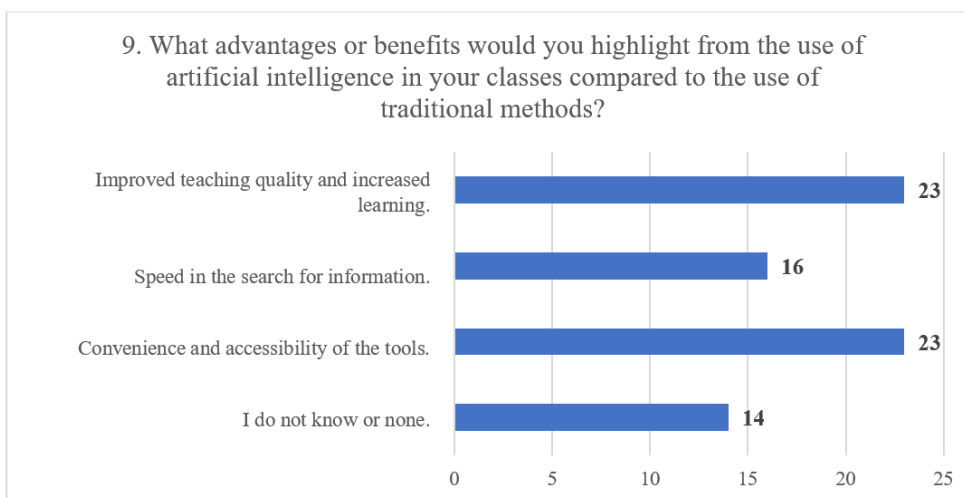
Source: self made

It is interesting to note that 59.2% of the total students surveyed have no concern about using artificial intelligence in their teaching-learning process. Equity, access to information, biases, privacy, ethical issues and the human dimension in learning, together, do not account for even 33 % of the results (figure 12).

Figure 12. Question ten of the research instrument.

10. Are there any concerns or challenges you have regarding the use of artificial intelligence in your learning process? If so, please describe them.

Source: self made

The responses reflect the students' perception of how generative AI improves their ability to learn and assimilate concepts during classes. The majority expressed that AI provides them with additional information on the topic sought, explains it in a simple and clear way, and stimulates their school education in a personalized way.

Regarding the comparison between AI and traditional teaching methods, students expressed themselves in various ways. A considerable percentage think that AI is now accessible, easy to use and offers quick responses to their requests, saving them time in their investigations. They also pointed out that it benefits them to use artificial intelligence tools because they consider them a powerful source of information, in addition to being a dynamic and innovative technology that helps them resolve a large number of doubts.

Regarding students' motivation and commitment to learning, many of them agree that AI contributes to improving these aspects in their classes. Some think that AI does not have a significant impact on their engagement in learning, while others responded that they do not know if AI has positive effects on their interest in learning. Furthermore, some perceive that AI does not represent a factor of change in their mood during classes.

Regarding the aspects that could be improved in the use of artificial intelligence in classes to increase student satisfaction, the responses were mainly distributed in three areas. Most students expressed a desire to be taught how to use AI tools correctly and functionally for their learning, while others expressed interest in teachers providing more engaging activities in their class sessions. Additionally, some students indicated that they would like to have access to generative AI tools in their educational projects, since in certain subjects they are not allowed to use them.

Simply put, students recognize several advantages of using AI in their classes compared to traditional methods. In fact, responses indicate that they find AI tools easier to use, provide faster feedback from the teacher, facilitate research, offer a greater variety of materials to use, and improve the quality of both learning and teaching.

Finally, students were asked about their fears or concerns regarding the use of AI in classrooms. In this sense, a high percentage of students expressed that they do not have any fear or concern when using AI. However, other responses were spread across concerns about learning how to properly use AI tools, fear of being replaced by AI, and even some students stating that they are not sure what to think about it.

Discussion

The results obtained suggest that the implementation of generative artificial intelligence in learning effectively promotes the development of creative and critical thinking skills in high school students, compared to traditional teaching methods. This finding coincides with the results of surveys carried out by ProFuturo and OEI (2023), which show a growing interest of students towards the use of AI, especially at tertiary and university levels compared to basic levels of education.

Furthermore, studies such as the one carried out in this work reveal the interest of high school students in the use of generative AI tools. These findings are consistent with what was expressed by Díaz-Arce (2023a, 2023b), who worked with high school students in his research. Although their focus is more on the ethical implications of using AI in academic tasks, there are similarities in the reasons why students use generative AI, such as its simplicity, speed, and support in complex topics or activities they prefer to avoid.

Students' responses to the use of generative AI during classes reflect an interest in learning its correct use and in teachers developing creative and innovative activities to maintain their attention. This point is related to what was mentioned by Sorbara (2023), who highlights the importance of teachers having the technical and pedagogical capacity to offer quality AI content that meets the needs of students and contributes to their learning.

On the other hand, Gallent *et al.* (2023) analyze the instructional mechanisms in higher education in the literature and point out that, despite the higher educational level, doubts and concerns persist similar to those of high school students. Issues such as the reliability of generative AI tools, copyright and intellectual property concern companies that

provide these services. Furthermore, ethical standards and the lack of adequate use guidelines for this technology in the educational field are delicate issues that require attention.

The practice of correctly citing and referencing research papers has been a constant challenge for professors, and is now exacerbated by the temptation of students to commit academic fraud or plagiarism, especially with the use of generative artificial intelligence tools (Wach *et al.*, 2023), as these often do not provide reliable sources or references, which exacerbates the problem.

Therefore, it is crucial to consider as a mandatory educational policy the implementation of a level of education or a certain degree of knowledge in which students can identify false data or possible errors in the information provided by generative artificial intelligence tools. This proposal is supported by Stojanov (2023), who also highlights the importance of the presence of a trained person who not only accompanies, but also supervises the activities of students in the classroom when they are using this high-risk technology.

Finally, Alenoghena *et al.* (2023) conducted a literature review to analyze the impacts of ChatGPT on the efficiency and access to artificial intelligence in education. Their findings indicate that natural language models like ChatGPT have the potential to improve not only personalization in learning, but also student engagement and morale.

Conclusions and limitations

In conclusion, the study highlights the potential of generative artificial intelligence as a promising tool in the learning of high school students. Likewise, the working hypothesis is accepted, that is, the implementation of generative artificial intelligence in the learning process allows high school students to develop creative and critical thinking skills more effectively than traditional teaching methods.

As technology advances, it is critical to explore how to effectively and ethically integrate these generative capabilities to take full advantage of the benefits that artificial intelligence can offer students. In this sense, the results reveal that generative artificial intelligence can play a significant role in improving student learning to the extent that it is used.

On the other hand, the evidence obtained in the research allowed us to verify the students' interest in learning to correctly use generative artificial intelligence tools. Likewise, they recognize that they can obtain clear advantages in their school performance, such as the

speed of response to their questions, the detailed explanation of unknown topics, the simplicity in the use of resources and the accessibility of useful material to carry out their homework. schoolchildren. It is undeniable, and reinforced with the feedback from the survey applied, that the arrival of artificial intelligence to the classrooms of upper secondary educational degrees will mean an opportunity to increase not only the knowledge, but above all the skills of the students.

Finally, limitations of this study include the fact that the research was conducted at a private institution. This is important because it limits the generalization of the results and conclusions towards public institutions, due to the characteristics of each of them. Furthermore, the research was carried out in a subject related to technology and innovation, so, if it were applied in other subjects such as science, languages or arts, the results are likely to be different. Another important limitation to consider is that technology advances rapidly, which could make the results of this study appear outdated in a relatively short period of time.

Future lines of research

If you search for information about generative AI, you will find numerous works that address the topic and its relationship with education in general. These explore, for example, how AI can help teachers in planning the content of their subjects and how it can support academic productivity through AI applications, among other aspects. However, it is still necessary to raise awareness among educational actors, especially teachers and students, that technology is a means and not an end in itself.

In terms of research, the panorama is very broad. Since the topic is relatively new, there are few studies on generative AI at the high school level. Furthermore, many of the existing works use the survey as a technique and the questionnaire as an instrument. Consequently, it would be beneficial to carry out quasi-experimental studies, where the results of the application of a pretest and a posttest to a specific sample of students are analyzed.

Regarding methodology, it is important to be attentive to this type of publications or develop studies that go beyond the quantitative approach, considering qualitative and mixed studies to enrich knowledge based on the results obtained. The growing advancement of emerging technology, such as generative artificial intelligence, and its impact on education will surely be something we will surely get used to, since, over time, permanent evolution

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will offer benefits and possibilities for all participants in academic fields. This means that many contexts will have to be carefully studied, such as the issue of ethics, privacy and security, to name a few. Likewise, a preventive attitude must be maintained to be able to detect cases that represent a risk in time, whether for teaching or learning in institutions of all grades and levels.

Finally, it is possible to advance lines of research individually or jointly, so educational institutions must expeditiously address some issues already present in the classrooms. For example, regulate the use of artificial intelligence in classes, establish institutional guidelines for academic tasks by teachers, and promote an ethical and responsible way of acting on the part of students.

Thanks

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Annex 1. Survey applied

1. What has your overall experience been like using artificial intelligence tools in your learning process?

   Very positive

   Positive

   Neutral

   Negative

   Very negative

2. How satisfied are you with the use of artificial intelligence tools in your classes?

   Very satisfied

   Satisfied

   Neutral

   Dissatisfied

   Very dissatisfied

3. How do you think the use of artificial intelligence improves your ability to understand and assimilate the concepts taught in class?

4. To what extent have artificial intelligence tools facilitated your learning process compared to traditional teaching methods?

5. How would you rate the quality of the feedback provided by artificial intelligence tools?

   Very good

   Good

   Neutral

   Bad

   Very bad

6. To what extent have AI tools been important in terms of personalization to your individual learning needs?

   Very important

   Important

   Moderately important

   with little importance

   Without importance

7. Do you think that the use of artificial intelligence in your classes has improved your motivation and commitment to your learning?

8. What aspects do you think could be improved in the use of artificial intelligence in classes to increase your satisfaction as a student?

9. What advantages or benefits would you highlight from the use of artificial intelligence in your classes compared to the use of traditional methods?

10. Are there any fears or concerns you have regarding the use of artificial intelligence in your learning process?