Examining the Impact of ChatGPT on Mexican Students' Performance in Higher Education

Lydia Velázquez-García[1], Antonio Cedillo-Hernández[2,*], Alejandra Colón-Vallejo[1], and María Del Pilar Longar-Blanco[1]

[1]Instituto Politécnico Nacional, CIECAS, México City, México
[2]Tecnologico de Monterrey, Escuela de Ingeniería y Ciencias, Monterrey, México
Email: lvelazquezg@ipn.mx (L.V.-G.); acedillo@tec.mx (A.C.-H.); acolon@ipn.mx (A.C.-V.); mlongar@ipn.mx (M.D.P.L.B.)
*Corresponding author
Manuscript received January 14, 2025; revised February 7 date, 2025; accepted April 14, 2025; published July 8, 2025

***Abstract*—Technology is improving daily, especially as we rapidly merge with the digital world, and it has simplified several processes, such as learning. Artificial Intelligence (AI) is an emerging technological innovation with much promise for education. In this study, we examine the impact of ChatGPT on the academic performance of 96 higher education students in two groups. One group used ChatGPT to resolve several tasks throughout the course, while the other used conventional tools. At the end of the course, both groups took a final exam in which neither was permitted to use any technological assistance. The study employed quantitative research methodology. For data collection, structured evaluations were the basis for the students' grades, and an online survey using a Likert scale gathered the students' perception of their learning experience. The student's t-test for independent samples and a descriptive analysis using frequency measures were utilized to analyze and interpret results. It was found that those students using ChatGPT attained better grades when the tasks were practical than when they were theoretical. In the final exam, the group not using ChatGPT obtained better results, possibly related to additional searches or comparisons that conventional tools usually require. Regarding the students' perceptions analysis, the students who used ChatGPT had higher levels of satisfaction and motivation in the course; however, they identified that the tool's utility needs to be further evaluated, and they committed to using it carefully.**

***Keywords*—ChatGPT, artificial intelligence, educational innovation, higher education, professional learning**

I. Introduction

Integrating Artificial Intelligence (AI) technologies into educational systems represents a conceptual sea change in how teaching, learning, and evaluation are considered and carried out. ChatGPT is a highly advanced natural language processing model from OpenAI and one of the most important AI developments of the last decade [1–3]. It is currently at the forefront of global attention because it can produce coherent and contextually appropriate text resembling a human writer. It allows for various functions, including essay answering, brainstorming, and idea development, thus, a valuable tool for both professors and students. This new access to AI-powered support transcends previous educational tools and can be an innovative tool to change learning [4]. As colleges and higher education institutions incorporate new developments in digital technology into teaching and learning methods, they must examine how ChatGPT could affect student achievement and performance [5].

The creation of ChatGPT was only a part of a process of general digitalization, which is the result of vast efforts in education worldwide [6]. During this research, the COVID-19 pandemic spawned the introduction of hybrid teaching and learning programs at record rates, demonstrating the need and proving the potential that digital technologies can be used to support teaching and learning in a virtual setting [7, 8].

AI-enabled tools are a good solution to the educational gap related to scalability, customization, and accessibility. ChatGPT is particularly appealing as an educational resource due to its distinctive features [9]. It is always available; unlike with conventional teaching resources, pedagogic tools, or human tutors, the student can be provided support outside regular working hours. Additionally, the ability of the model to make personal adaptations to user queries allows for adaptive learning, a pedagogical method that has been shown to lead to more knowledge retention and engagement [10, 11].

Apart from availability, the potential deconstruction of education is among the most affirmed features of ChatGPT [12]. Disparities in educational resources erode the students' achievements, particularly in disadvantaged schools or communities. However, ChatGPT is a readily accessible AI tool that overcomes these drawbacks by giving students previously unavailable materials, such as transparent explanations of advanced topics, model-written academic prose, and support in planning and organizing studies. Improvement in results achieved through AI-based education platforms has been reported in the literature as providing the symbolic role of contextualized support and the instrumental one of personalized learning trajectories [13]. ChatGPT's scalability enables it to be accessed by practically infinitely many users who are free of the limitations in resource input, which are signatures of personalized instruction [14].

Despite these benefits, incorporating ChatGPT into university education raises vital questions about its general impact on pedagogy and scholarship. The program has demonstrated significant effectiveness in increasing student productivity; however, potential ethical misuse and abuse of the program have been raised as one of several challenges [15]. AI tools, such as generative language models, can lead to academic dishonesty by enabling students to perform assignments with minimal effort. This raises questions about the authenticity of student work and the effectiveness of traditional assessment methods [16, 17]. ChatGPT is a potent tool; however, it may contribute to academic dishonesty and plagiarism concerns without appropriate guidelines. To preserve integrity and leverage the advantages of AI, educational organizations must modify

their policies and assessment methodologies [18, 19].

A common issue of ChatGPT has been the concern that it might prevent the further development of crucial abilities, such as critical thinking, independent problem-solving, and creativity skills, that are the foundation of academic and workplace success [20].

In addition, inputting pre-trained data into ChatGPT makes it possible to incur inherent biases and errors from the training data [21]. Experiments with AI models have consistently revealed that training data biases can result in biased outputs, amplifying prejudices or propagating misinformation [22]. These biases can also shape the efficacy of the service provided by ChatGPT, producing lower quality and less valid output, which may, unknowingly, facilitate the spread of false information among students or exacerbate the existing academic phenomena of knowledge inequality.

AI tools such as ChatGPT are transforming education, necessitating students and teachers to cultivate resilience to adapt to this technological transition. By carefully integrating AI, modifying pedagogical approaches, and fostering critical thinking abilities, educators and students can optimize the advantages of AI while preserving academic integrity and substantive learning [23]. These issues highlight the importance of studying the acceptance of ChatGPT and the more subtle concerns of its acceptance in institutional practices, codes of ethics, and teaching approaches [24].

The debate about the role of AI in and affecting teaching and learning sometimes overshadows AI's influence and changes in pedagogical tasks. Supporters claim that the assistance of tools such as ChatGPT makes it possible to increase efficiency, optimize personalized learning, and help educators spend less time on traditional teaching tasks and responsibilities [25]. However, critics caution against its overuse and emphasize the need for human-centered methods to foster empathy, guidance, and interpersonal strengths [26]. These opposing positions reflect the need for an integrative integration of AI tools to ensure AI improves rather than replaces traditional pedagogical practices.

Integrating AI-powered tools such as ChatGPT into academic settings raises questions about assessment integrity and carries profound psychological and pedagogical implications. Cognitively, AI-assisted learning may impact metacognition and self-regulated learning strategies. Studies have shown that excessive reliance on AI-generated responses can lead to cognitive offloading, where students become dependent on technology rather than developing their analytical skills [27]. This phenomenon may reduce critical thinking abilities, as learners might prioritize efficacy over deeper engagement with the material [28]. Furthermore, pedagogical research suggests that AI facilitates personalized learning by adapting responses to student queries. However, it may also contribute to over-reliance and reduced intellectual autonomy if not adequately integrated with active learning methods [29].

From a psychological viewpoint, AI-driven education tools can positively and negatively affect student well-being. On the positive side, AI platforms provide immediate feedback and round-the-clock assistance, reducing anxiety and increasing engagement in students who struggle with traditional instructional methods [30]. However, there is also a risk that AI-mediated learning could diminish intrinsic motivation, as students may feel detached from the learning process if tasks become excessively automated [31]. The illusion of competency, where students perceive themselves as mastering content without actually developing deeper comprehension, has been identified as a concern in AI-enhanced learning environments [32].

Given these dynamics, this study aims to investigate the influence of ChatGPT on students' academic performance and learning experiences in a higher education context. Specifically, we focus on how the use of ChatGPT compares to conventional learning tools in the completion of theoretical and practical tasks within a course on database analysis. The study is situated within a broader conversation about the integration of AI in education and its potential to transform traditional learning environments.

To guide this investigation, we address the following research questions:

1) What is the impact of using ChatGPT on the academic performance of higher education students?
2) How do students perceive the use of ChatGPT in their academic activities?

By exploring these questions, the study contributes empirical evidence to the growing body of literature on AI-assisted learning and offers insights into the opportunities and limitations of integrating generative AI tools such as ChatGPT in teaching and learning processes.

II. Literature Review

The incorporation of ChatGPT into higher education has generated significant scholarly attention, especially about its effects on student performance and learning perceptions. An expanding corpus of literature emphasizes the educational prospects and obstacles posed by generative AI techniques in academic settings.

Several syntheses of current research have emphasized the significant potential of ChatGPT to improve the academic performance of students, particularly in tasks that necessitate problem-solving, language-based reasoning, or access to immediate explanations. Generative AI has the potential to facilitate learning by providing personalized, adaptive responses that enhance student engagement and alleviate the cognitive burden of intricate tasks, as per Al-Smadi [33] and Dempere *et al.* [34]. ChatGPT is particularly effective in applied disciplines, as it allows students to more easily navigate technical instructions and iterative processes. Montenegro-Rueda *et al.* [35] further assert that ChatGPT improves performance when it is administered under the supervision of a qualified instructor, indicating that its educational advantages are context-dependent.

However, the effectiveness of ChatGPT varies depending on how it is used. While improvements in practical task execution are well-documented, the literature raises concerns regarding its use in theoretical learning. Overreliance on AI-generated content may hinder deep conceptual understanding and critical thinking. As Bhullar *et al.* [36] note, ChatGPT can create a false sense of mastery, where students complete assignments without fully internalizing the material. These concerns are echoed by Galindo-Domínguez *et al.* [37], who found that frequent users of ChatGPT demonstrated lower levels of academic autonomy and reported challenges in independently

developing ideas.

This debate is fundamentally concerned with the issue of academic integrity. Research shows that students frequently don't check the source or accuracy of ChatGPT-generated content, which might lead to their submissions including fake references or copied sections. In order to encourage the ethical use of AI in academic environments, Montenegro-Rueda *et al*. [35] and Dempere *et al*. [34] draw attention to the dangers of abuse and emphasize the need for institutional rules.

In terms of student perceptions, global surveys suggest generally positive attitudes toward ChatGPT as a learning assistant. Ravšelj *et al*. [38] report that students value the tool for clarifying difficult concepts, increasing productivity, and reducing stress, particularly in asynchronous or self-directed learning scenarios. Diaz-Leon and Iraola-Real [39] found that students view ChatGPT as a convenient and nonjudgmental source of academic help, although these students also express concern about getting overly dependent on it. The perceived effectiveness of ChatGPT appears to be influenced by demographic and disciplinary factors; Galindo-Domínguez *et al*. [37] found significant differences in usage patterns across gender and academic fields, suggesting that integration strategies must consider student diversity.

Taken together, the literature indicates that ChatGPT has a multifaceted impact on higher education. It can improve academic performance when used appropriately and with guidance, and it is generally well-received by students. However, concerns remain regarding its effect on critical thinking, academic ethics, and the development of autonomous learning. Future research should prioritize longitudinal studies and experimental designs to assess how sustained AI influences learning outcomes and cognitive development over time.

III. Methodology

A. Participants

This study assessed the academic outcomes obtained in a second-semester course on database analysis in the bachelor's degree educational program in Business Relations in the College of Commerce and Administration. Two groups (classes) of students were evaluated, one group utilizing ChatGPT as an assistant for performing their activities in the subject and the other using conventional tools but explicitly avoiding ChatGPT or any similar chatbot. The research was conducted with the assistance of two professors who led the study groups and two other professors who assisted in the analysis of the data and the presentation of the results. The data analyzed was obtained in the years 2022 and 2023.

The total sample involved $N = 96$ students divided into two groups. The initial set, S1 = 47, pertained to students utilizing ChatGPT for their coursework, whereas the second set, S2 = 49, denoted students using conventional tools, which include notes, presentations, videos, and tutorials that provide knowledge to assist students in completing their assignments.

The assignment of the students to both groups was carried out through the pairing technique [40], whose objective is to find the equivalence between the groups based on a given variable. The obtained Grade Point Average (GPA) from the first semester of study was the variable employed to pair the students. In contrast to American universities, where the GPA is determined using a four-point scale, Latin universities, such as those in Mexico, grade students between one and ten, i.e., a 10-point scale. Students who achieved a grade point average of eight or higher during their first semester were selected for this research. This ensures that the students' academic performance was comparable before the experiment. Table 1 shows the statistical data for each of the groups. S1 comprised 32 male and 15 female students, with an average age of 19.1 years, while S2 had 30 male and 19 female participants, with an average age of 18.9 years.

Table 1. Statistical data of participants

Set	Gender			GPA	Average age
	Male	Female	Total		
S1	32	15	47	8.72	19.1
S2	30	19	49	8.69	18.9

B. Study Design

This study utilized quantitative research methodology. Structured evaluations were used as a data collection method to obtain students' grades, while an online survey utilizing the Likert scale was implemented to assess students' perceptions of their learning experience. The independent samples t-test and a descriptive analysis employing frequency measures were employed to analyze and interpret data. The quantitative methodology used data collection and analysis to answer research questions, evaluate hypotheses, and detect behavioral patterns within a population. It generalized results from a small group to a broader population and then enabled the replication of experiments [41]. The research used an independent-groups experimental design, where students were divided into two groups (in this case, those using ChatGPT and those using conventional tools). In addition, the groups were independent, meaning there was no overlap of participants between the groups, and each group received a different intervention. The effect of the study techniques on the students' grades was evaluated, allowing the results of both groups to be compared to determine which method was more effective.

C. Method

The activities assigned to students can be divided into theoretical and practical activities. The course on database analysis deals with teaching spreadsheet software from basic to advanced topics. Specifically, the study focuses on three types of theoretical activities and three types of practical activities. Fig. 1 shows this classification, indicating the types of activities evaluated in the study. It is essential to note that the subject syllabus and the activities applied were not altered during the research period; the only difference was how the activities were resolved. Therefore, the learning objectives and topics were the same for the two sets of students.

Various metrics were used to assess student performance to guarantee an objective evaluation consistent with the learning objectives. The assessment of theoretical activities included grammar, clarity, coherence, plagiarism, and orthography. In contrast, in practical activities, the efficient use of functions, the accuracy of results, errors, file structure, and correct automation were assessed.

The students involved in theoretical tasks found ChatGPT

exceptionally user-friendly, as such functionalities are among the tool's most frequently used features. It is presumed that students who did not utilize ChatGPT could independently produce summaries, conduct theoretical studies, and compose essays without additional guidance.

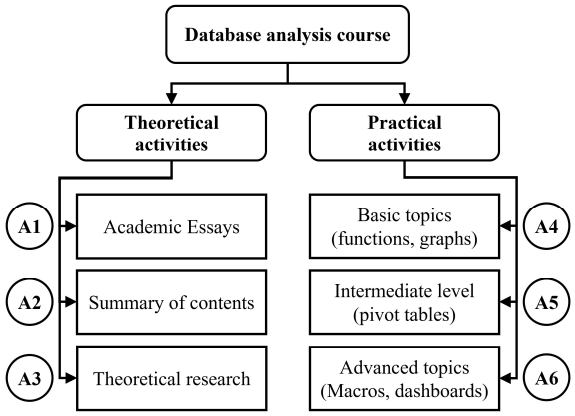

Fig. 1. Practical and theoretical activities considered in the study.

Practical activities relate to the disciplinary abilities and knowledge that the student must develop during the course. Given that the course focuses on spreadsheets, all students require additional support. Students using ChatGPT received a tutorial providing specific examples of using the tool to solve spreadsheet tasks. Materials such as notes, videos, and tutorials aided the other students, the only difference being their inability to use chatbots.

D. Data Collection

The evaluation of the study's results involved objective and subjective metrics. The student grades obtained through structured evaluations were considered objective metrics. The first parameter considered for comparison was the grade point average for the activities assigned during the course, received by each group of students. We obtained an overall average for each activity type shown in Fig. 1 (A1 through A6). We also considered the overall grade point average (AG), which considers all students who take the final exam, irrespective of their course pass or failure.

Subjective metrics refer to the data obtained through the application of the online survey to students at the end of each course to gauge their experience with the teaching-learning process. The survey is split into three sections: satisfaction, motivation, and utility, each related to a research variable and containing two questions. Each survey item has a scoring system on a scale of 5 to 10, which is aligned with the Likert scale. Table 2 shows the items that comprise the evaluation instrument proposed for this study.

Table 2. Research variables from online survey

Variable	Question ID	Description
Satisfaction	Q1	Evaluation methodology
	Q2	Interaction and the assistance expected
Motivation	Q3	Learning experience
	Q4	Intellectual difficulty
Utility	Q5	System and learning activities
	Q6	Comprehension of concepts

E. Limitations

It is essential to acknowledge some limitations that may affect the generality of the findings and the interpretation of the data. The research's small sample size may limit its applicability to other educational settings. Additionally, the fact that the participants were affiliated with a single institution and course limits the generalizability of the results to different academic levels or disciplines. Additionally, the study focused on a single course and did not conduct a long-term follow-up on the impact of ChatGPT. The online survey relies on students' subjective perceptions and uses a Likert scale, which, although efficient for finding trends, does not consistently provide an objective assessment of learning efficacy. Lastly, the results may have been affected by the absence of a prior diagnosis to ascertain the students' initial level of AI tool usage proficiency. It is conceivable that certain students possessed preexisting abilities that aided their performance in practical activities.

IV. Results and Discussion

The first objective metric consisted of obtaining the average grade (on a scale of 0 to 10) for the activities assigned to both groups during the academic period. As mentioned above, there was no change in the educational content of both groups, and this also applies to the rubric used to evaluate the activities. Fig. 2 shows the outcome of this measurement with a radar plot where each of its edges corresponds to the average grade of each of the types of activities applied. The graph includes the results for both groups, S1 and S2. From Fig. 2, we found a lower performance of S1 compared to S2 when the activities are theoretical in nature. These activities included completing academic essays (A1), content summaries (A2), and theoretical research (A3).

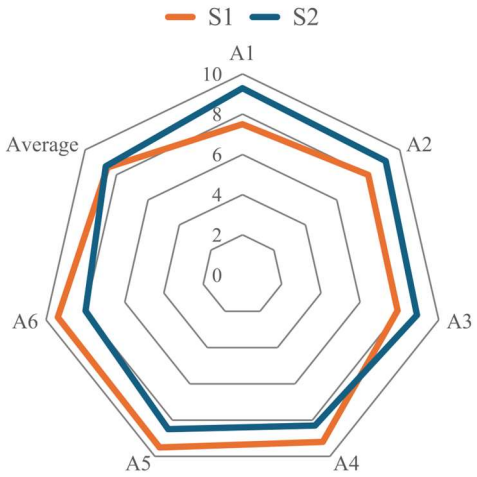

Fig. 2. Mean grade for activities allocated to both groups.

In the theoretical activities, students utilizing ChatGPT obtained lower grades. The evaluators of these activities identified two major findings. Students have significant opportunities to cite the sources of information appropriately. Teachers have noted that students replicate texts generated by ChatGPT without recognizing that such content may originate from existing works that necessitate proper citation, thereby inadvertently engaging in plagiarism. It is essential to note that the rubric evaluation of the activities included plagiarism considerations, thereby placing full responsibility for proper citations on the students. Educators employ the Turnitin® tool for automated plagiarism identification, reporting percentages ranging from 20% to 80% in the most severe instances. Moreover, evaluator teachers detected that

student submissions using ChatGPT included fabricated references. Like the prior instance, it appears that students were merely reproducing the text generated by ChatGPT without testing the accuracy of the information in the references. Students can identify references with a straightforward, simple Internet search; however, they appear to place excessive trust in ChatGPT's information. These findings are essential for two reasons: first, they provide feedback to students that will enhance their ability to use ChatGPT, and second, they may contribute to formulating academic guidelines regarding AI usage across many disciplines.

On the other hand, practical activities (from A4 to A6) generate a contrasting result. In this case, students who utilized ChatGPT got better results than those using conventional tools. This indicates that students exploiting ChatGPT effectively utilized the tool's information to solve spreadsheet problems, particularly complex ones (A6), where the most significant difference between the two groups was observed. In practical activities, the teacher has limited ability to ascertain whether solutions were derived using the ChatGPT tool, as it can provide comprehensive directions for resolving a problem upon request. Thus, it is crucial to determine whether the students retain the knowledge supplied by the tool.

It should be noted that Fig. 2 includes the overall average of the six activities assessed, which reveals very close values between S1 = 8.6 and S2 = 8.7. This indicates that, in general, students performed similarly when using traditional tools or ChatGPT in activities that, while testing some competencies, did not accurately reflect the knowledge they learned throughout the course.

The second objective metric was each group's overall grade point average (AG). Fig. 3 shows the result of this metric. In this case, it is noteworthy that the evaluation aimed to reflect the knowledge acquired by the students per a final exam, which was applied without letting the students use any technical aids.

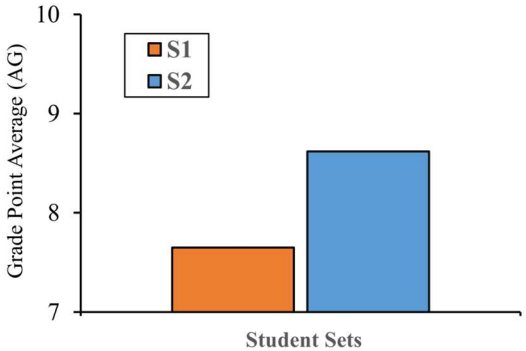

Fig. 3. Grade point Average (AG) for both student sets.

The objective was to determine the degree of knowledge students retained after performing their activities. It was found that students who utilized traditional methods (S2) achieved better results than those using ChatGPT (S1). This outcome may be attributable to numerous factors. In theory, the student not utilizing ChatGPT is subjected to a process of analysis that develops better knowledge retention because of the necessity to consult authentic information sources and analyze their content. Furthermore, ChatGPT may induce a degree of dependence during practical activities by providing speedy responses, thereby removing the technical challenge students must experience to enhance their understanding.

To fully understand the students' perception of their learning experience, it is essential to compare the results of both groups by examining the responses to the questionnaire administered at the conclusion of the course. A technique is necessary to determine an average value for each research variable. This is needed because there are responses from two different academic periods (2022 and 2023), and, in addition, each research variable is measured by two questions within the evaluation instrument. It is possible to find the average of all the samples (M) by using Eq. (1), which treats each set of responses as a separate population:

$$M = \frac{p_1 \cdot X_1 + p_2 \cdot X_2}{p_1 \cdot p_2} \tag{1}$$

where p_1 and p_2 are the total samples of the first and second populations, respectively, and X_1 and X_2 are the population averages. For the calculation of the standard deviation of combined samples (D), Eq. (2) is used:

$$D = \left(\frac{C_n \cdot (p_1 + p_2) \cdot M^2}{p_1 + p_2 - 1}\right)^{0.5} \tag{2}$$

where C_n represents the cumulative sample variances, calculated from Eq. (3), where C_i can be found from Eq. (4):

$$C_n = C_1 + C_2, \tag{3}$$

$$C_i = (p_i - 1) \cdot (d_i) + p_i \cdot X_i^2, \tag{4}$$

where d_i represents the standard deviation of population i. The average and standard deviation of the two questions are combined, and this procedure is repeated for each academic period. Table 3 shows the results of calculating each research variable's average (M) and standard deviation (D).

Table 3's results make it possible to observe a higher value for group S1 in the SATISFACTION and MOTIVATION variables but a lower value in the UTILITY variable compared to group S2. The scores obtained for each question from the students on the evaluation instrument are displayed below to analyze the meaning of these results in more detail. It should be noted that an analysis of the statistical reliability of the data was also determined.

Table 3. Research variables result comparison for S1 and S2

Research Variable	S1			S2		
	N	*M*	*D*	N	*M*	*D*
SATISFACTION	47	9.531	0.743	49	9.012	0.856
MOTIVATION		9.542	0.698		9.102	0.935
UTILITY		8.851	0.702		9.265	0.780

Fig. 4 shows the result of the SATISFACTION research variable, where students who used ChatGPT to solve their activities attained a higher value.

In the satisfaction evaluation, students using ChatGPT (S1) had a more favorable opinion than those using conventional tools (S2). Concerning the learning methodology employed in the course, S1's mean was 9.55, while S2 attained 8.82. This disparity indicates that group S1 perceived the learning methodology as more satisfactory, suggesting they like using

these AI-based tools in their courses. This is especially notable when considering that the group of students who rated ChatGPT as most satisfactory coincides with the lowest grades at the end of the course. This may be because students were willing to put their grades second in exchange for enjoying a course that offers them an active learning experience using AI tools. In addition, ChatGPT may have made learning clearer and more tailored, supporting problem-solving that involves complex concepts for students.

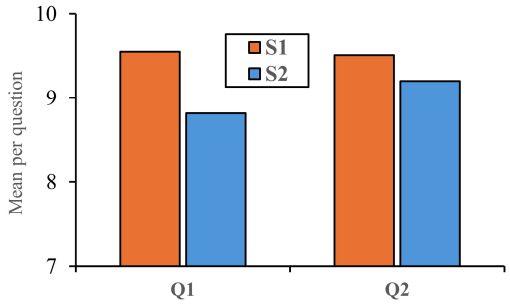

Fig. 4. Results obtained for the research variable SATISFACTION.

Concerning the interaction and assistance provided by the teacher, S1's mean was 9.51, while S2 averaged 9.20. Despite the slight difference, this outcome may suggest that students utilizing ChatGPT experienced enhanced support in their learning. The ability to rapidly address uncertainties with technology provided them with an extra resource, improving their confidence in practical activities and diminishing their reliance on the teacher. Conversely, students in S2, depending on conventional resources like notes and books, may have experienced more challenges in obtaining prompt responses to their inquiries, thus resulting in a marginally diminished perception of teacher assistance.

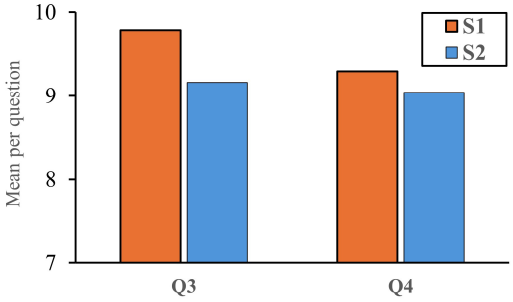

Fig. 5. Results obtained for the research variable MOTIVATION.

Fig. 5 displays the results for the MOTIVATION research variable. In this case, group S1 found completing their course activities more meaningful using ChatGPT than group S2. This difference is greater in question Q3, where the student was asked about the learning experience.

Regarding question Q3 about the learning experience, S1 attained an average score of 9.79, while S2's mean was 9.16. This difference suggests that students using ChatGPT found the learning process more engaging and motivating. Immediate access to answers and detailed explanations may have reduced frustration and waiting time to resolve questions, making learning more dynamic and efficient. In addition, the possibility of continuously interacting with the tool and receiving immediate feedback may have generated a sense of linear progress, producing more motivation to complete the activities. In contrast, S2 students, relying on books, notes, and guided examples, may have faced more barriers to accessing information, which decreased their enthusiasm for learning.

Regarding the perception of intellectual difficulty (Q4), S1 scored 9.30, while S2 scored 9.04. Although the difference is small, it indicates that students who used ChatGPT felt that the course was slightly less challenging than the other group. This could be related to ChatGPT allowing students to approach complex problems in a more structured way, providing clear explanations tailored to their needs. By feeling more prepared to tackle the activities, S1 students may have developed greater confidence in their abilities, which may have boosted their motivation to continue learning. In contrast, S2 students, by relying on traditional resources, may have perceived the course to be more difficult due to the extra effort required to find answers and clarify concepts on their own.

Fig. 6 displays the result of the last research variable evaluated, i.e., UTILITY. This is the only case where group S2 had a higher mean value than S1.

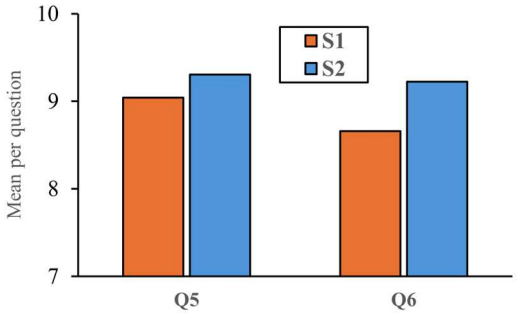

Fig. 6. Results obtained for the research variable SATISFACTION.

In question Q5, concerning the perception of the system and learning activities, Group S1 scored 9.04, while Group S2 scored 9.31. This difference suggests that students who used traditional tools valued the course activities more, possibly because they required more effort to develop skills in a structured way. In contrast, students in Group S1, supported by ChatGPT, may have felt that the activities did not present many challenges, which could have reduced their perception of usefulness in terms of effective learning.

Regarding question Q6 about perceived conceptual comprehension, Group S1 scored 8.66, while Group S2 scored 9.22. This coincides with the fact that students who worked with traditional resources achieved better grades, which is interpreted as a higher level of comprehension than those who used ChatGPT. One possible explanation is that, by relying on books, notes, and guided tasks, Group S2 had to analyze the information reflectively in more depth, which contributed to better conceptual assimilation. In contrast, students in Group S1, receiving quick and direct responses, may have developed a more superficial understanding, focusing on executing tasks without delving into the theoretical foundations.

These results reveal that while using ChatGPT may assist in completing activities, it does not necessarily guarantee a better understanding of the concepts or more appreciation of the learning system. In contrast, Group S2, facing a more structured learning process requiring more cognitive effort, perceived the course as more beneficial for their academic development.

The results for each research variable in the models were statistically examined using the student's t-test to formalize the results and ascertain the presence of significant statistical differences. The student's t-test is a statistical tool to evaluate the mean value of one or two groups through hypothesis testing. The value derived from this test signifies the number of standard units that differentiate the means of the two assessed groups. The student's t-test assumes continuous data that exhibit homogenous variance and a normal distribution. It is crucial to note that the student's t-test necessitates that the populations being compared possess equal sizes. In our research, the population of students using ChatGPT was S1 = 47, whereas the total number of students employing traditional methods was S2 = 49. To resolve this issue, it was necessary to normalize both populations by randomly removing two data points from population S2. The significance threshold for the student's t-test was $p < 0.05$, conducted utilizing Minitab ® for Windows ® software.

Table 4. Results of the statistical analysis using student's t-test

Variable	*t*	*df*	*p*	*Cd*	*Interval*
SATISFACTION	2.972	91.97	0.0037	0.613	[0.30, 1.53]
MOTIVATION	2.497	83.60	0.0144	0.515	[0.15, 1.34]
UTILITY	−3.371	90.81	0.0011	−0.695	[−1.49, −0.38]

Table 4 shows the statistical analysis comparing the SATISFACTION, MOTIVATION, and UTILITY variables of S1 and S2 using student's t-test for independent samples. Table 4 presents the t-value, the degrees of freedom (*df*), *p*-values, Cohen's effect sizes (*Cd*), and 95% confidence intervals for the mean difference (*Interval*).

In the case of the SATISFACTION variable, S1 obtained a mean of 19.06 compared to S2's mean of 18.15. The *p*-value (0.0037) indicates a statistically significant difference. The effect size ($Cd = 0.61$) indicates a difference of moderate magnitude. The confidence interval [0.30, 1.53] suggests that the observed difference is consistent and not a random result. Regarding the MOTIVATION variable, S1 attained a mean of 19.09, while S2's was 18.34. The *p*-value (0.0144) suggests a statistically significant difference. The effect size ($Cd = 0.51$) indicates a moderate difference. The confidence interval [0.15, 1.34] supports the validity of the difference. Finally, concerning the variable UTILITY, S1 produced a mean of 17.70, while the S2 group obtained 18.64. The *p*-value (0.0011) indicates that the difference is highly significant. The effect size ($Cd = -0.69$) indicates a moderately large difference in favor of S2. The confidence interval [−1.49, −0.38] reinforces the strength of the difference.

The interpretation of these results is that students using ChatGPT reported a more satisfying and motivating experience, indicating that using AI can improve the perception of learning and make teaching more engaging. However, students using traditional tools perceived the course as more useful, suggesting that conceptual learning and comprehension of topics may be more robust with traditional methods. In practical terms, the effects found are moderate to large, indicating that these results are relevant and not just statistical findings.

V. Conclusion

This paper analyzes how using an AI tool, specifically ChatGPT, influenced the academic performance of higher education students. We measured the academic performance of 96 Mexican university students enrolled in a database analysis course. Theoretical and practical course activities were assigned to all students. The total number of students was divided into two groups. The first group was instructed to use ChatGPT to help resolve their activities, while the second group had to use traditional tools (tutorials, videos, notes, and presentations), being expressly forbidden to use chatbots. Finally, the students' performance was measured by their course grades, including the final exam, which had to be taken without technical assistance in both groups, and a survey to understand their learning experience.

The findings of this study reveal that while students who used ChatGPT performed notably better in practical tasks, predominantly those necessitating technical execution and procedural guidance, students who worked with traditional tools achieved higher results in theoretical tasks and in a final exam that required unaided knowledge recall and conceptual understanding. Moreover, the group using ChatGPT stated higher levels of satisfaction and motivation throughout the course, whereas students in the traditional group reported a stronger sense of utility and learning value.

These findings have several implications. On a practical level, the study highlights the potential of AI-based tools like ChatGPT to support tailored learning and increase student engagement, particularly in skill-based or task-oriented subjects. Theoretical implications point to the challenges of maintaining academic rigor and cognitive engagement when AI tools are involved. The abuse of using ChatGPT may lead to reduced information processing and critical thinking, encouraging dependency on generated content. It also raises serious concerns about academic integrity, such as citation issues, plagiarism, and fabricated references. These outcomes suggest a need to rethink current assessment strategies, strengthen academic ethics policies, and develop institutional frameworks for responsible AI integration.

Given these implications, educators, academic institutions, and policymakers can implement several recommendations to improve AI-assisted teaching processes:

1) For educators: Selectively integrate ChatGPT, especially for practical activities that can improve task completion and comprehension. Additionally, promote independent analysis and reflection by assigning theoretical tasks to cultivate higher-order thinking abilities. The practical implications include an increase in motivation, support for applied learning, and an improvement in technical tasks.
2) For academic institutions: Establish formal guidelines on ethical AI usage, including detection tools, training for faculty and students, and integration of AI literacy into existing curricula.
3) For policymakers: Encourage interdisciplinary research on the long-term cognitive, ethical, and pedagogical impacts of generative AI tools. Support policies that promote equity in AI access and reinforce students' digital responsibility.

In conclusion, ChatGPT has the potential to be a valuable educational support tool when integrated thoughtfully and ethically. Its use must be accompanied by clear guidance, critical thinking reinforcement, and appropriate assessment

practices to ensure that learning remains meaningful and intellectually enriching. This study offers empirical evidence on the opportunities and challenges of using ChatGPT in higher education. Its findings can help guide future research on better teaching methods for using AI tools in education, making sure that information is easy to access, learning is of good quality, and deep-thinking skills are developed.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualization, ACH and LVG; methodology, MDPLB; research and analysis, ACH and MDPLB; software and first version of paper, ACV; validation and final version of the paper, LVG and ACV; all authors had approved the final version.

FUNDING

This research was funded by Writing Lab, Institute for the Future of Education, Tecnologico de Monterrey, Mexico, as well as the Instituto Politécnico Nacional (IPN) through the SIP project 20241152.

ACKNOWLEDGMENT

The authors wish to thank the Instituto Politécnico Nacional, the Tecnologico de Monterrey and the Ministry of Science, Humanities, Technology and Innovation (SECIHTI) for their support during this research.

REFERENCES

[1] T. Rasul, S. Nair, D. Kalendra, M. Robin, F. O. Santini, W. J. Ladeira, and L. Heathcote, "The role of ChatGPT in higher education: Benefits, challenges, and future research directions," *Journal of Applied Learning and Teaching,* vol. 6, no. 1, pp. 41–56, 2023. doi: https://doi.org/10.37074/jalt.2023.6.1.29

[2] F. Fauzi, L. Tuhuteru, F. Sampe, A. M. A. Ausat, and H. R. Hatta, "Analysing the role of ChatGPT in improving student productivity in higher education," *Journal on Education,* vol. 5, no. 4, pp. 14886–14891, 2023. doi: https://doi.org/10.31004/joe.v5i4.2563

[3] R. Baskara, "Exploring the implications of ChatGPT for language learning in higher education," *Indonesian Journal of English Language Teaching and Applied Linguistics,* vol. 7, no. 2, pp. 343–358, 2023.

[4] S. Sok, and K. Heng, "Opportunities, challenges, and strategies for using ChatGPT in higher education: A literature review," *Journal of Digital Educational Technology,* vol. 4, no. 1, 2024. doi: https://doi.org/10.30935/ jdet/14027

[5] F. W. Putra, I. B. Rangka, S. Aminah, and M. H. Aditama, "ChatGPT in the higher education environment: Perspectives from the theory of high order thinking skills," *Journal of Public Health,* vol. 45, no. 4, pp. 840–841, 2023. doi: https://doi.org/10.1093/pubmed/fdad120

[6] A. Habibi, M. Muhaimin, B. K. Danibao, Y. G. Wibowo, S. Wahyuni, and A. Octavia, "ChatGPT in higher education learning: Acceptance and use," *Computers and Education: Artificial Intelligence,* vol. 5, 100190, 2023. doi: https://doi.org/10.1016/j.caeai.2023.100190

[7] A. N. Ansari, S. Ahmad, and S. M. Bhutta, "Mapping the global evidence around the use of ChatGPT in higher education: A systematic scoping review," *Education and Information Technologies,* vol. 29, no. 9, pp. 11281–11321, 2024. doi: https://doi.org/10.1007/s10639-023-12223-4

[8] S. Aithal and P. S.Aithal, "Effects of AI-based ChatGPT on higher education libraries," *International Journal of Management, Technology, and Social Sciences,* vol. 8, no. 2, pp. 95–108, 2023. doi: https://dx.doi.org/ 10.2139/ssrn.4453581

[9] P. Newton and M. Xiromeriti, "ChatGPT performance on multiple-choice question examinations in higher education: A pragmatic scoping review," *Assessment & Evaluation in Higher Education,* vol. 49, no. 6, pp. 781–798, 2024. doi: https://doi.org/10.1080/02602938.2023.2299059

[10] V. Benuyenah, "Commentary: ChatGPT use in higher education assessment: Prospects and epistemic threats," *Journal of Research in Innovative Teaching & Learning,* vol. 16, no. 1, pp. 134–135, 2023. doi: https://doi.org/ 10.1108/JRIT-03-2023-097

[11] A. Strzelecki, "Students' acceptance of ChatGPT in higher education: An extended unified theory of acceptance and use of technology," *Innovative Higher Education,* vol. 49, no. 2, pp. 223–245, 2024. doi: https://doi. org/10.1007/s10755-023-09686-1

[12] O. Tayan, A. Hassan, K. Khankan, and S. Askool, "Considerations for adapting higher education technology courses for AI large language models: A critical review of the impact of ChatGPT," *Machine Learning with Applications,* vol. 15*,* 100513, 2024. doi: https://doi.org/ 10.1016/j.mlwa.2023.100513

[13] H. Singh, M. H. Tayarani-Najaran, and M. Yaqoob, "Exploring computer science students' perception of ChatGPT in higher education: A descriptive and correlation study," *Education Sciences,* vol. 13, no. 9, 924, 2023. doi: https://doi.org/10.3390/educsci13090924

[14] A. R. Vargas-Murillo, I. N. M. Asunción, and F. J. Guevara-Soto, "Challenges and opportunities of AI-assisted learning: A systematic literature review on the impact of ChatGPT usage in higher education," *International Journal of Learning, Teaching and Educational Research,* vol. 22, no. 7, pp. 122–135, 2023. doi: https://doi.org/10.26803/ ijlter.22.7.7

[15] C. A. G. D. Silva, F. N. Ramos, R. V. Moraes, and E. L. D. Santos, "ChatGPT: Challenges and benefits in software programming for higher education," *Sustainability,* vol. 16, no. 3, 1245, 2024. doi: https://doi.org/ 10.3390/su16031245

[16] B. Kayalı, M. Yavuz, Ş. Balat, and M. Çalışan, "Investigation of student experiences with ChatGPT-supported online learning applications in higher education," *Australasian Journal of Educational Technology,* vol. 39, no. 5, pp. 20–39, 2023. doi: https://doi.org/10.14742/ajet.8915

[17] S. Onal and D. Kulavuz-Onal, "A cross-disciplinary examination of the instructional uses of ChatGPT in higher education," *Journal of Educational Technology Systems,* vol. 52, no. 3, pp. 301–324, 2024. doi: https://doi.org/10.1177/00472395231196532

[18] B. H. Nam and Q. Bai, "ChatGPT and its ethical implications for STEM research and higher education: A media discourse analysis," *International Journal of STEM Education,* vol. 10, no. 1, 66, 2023. doi: https://doi.org/10.1186/s40594-023-00452-5

[19] B. A. Anders, "Is using ChatGPT cheating, plagiarism, both, neither, nor forward-thinking?" *Patterns*, vol. 4*,* no. 3, 2023. doi: https://doi.org/10.1016/j.patter.2023.100694

[20] A. A. Mohammed, A. Al-Ghazali, and K. A. Alqohfa, "Exploring ChatGPT uses in higher studies: A case study of Arab postgraduates in India," *Journal of English Studies in Arabia Felix,* vol. 2, no. 2, pp. 9–17, 2023. doi: https://doi.org/10.56540/jesaf.v2i2.55

[21] S. R. Das and J. V. Madhusudan, "Perceptions of higher education students towards ChatGPT usage," *International Journal of Technology in Education,* vol. 7, no. 1, pp. 86–106, 2024.

[22] N. Forman, J. Udvaros, and M. S. Avornicului, "ChatGPT: A new study tool shaping the future for high school students," *Future,* vol. 5, no. 6, 2023. doi: https://doi.org/10.59287/ijanser.2023.7.4.562

[23] M. Singh, "Maintaining the integrity of the South African university: The impact of ChatGPT on plagiarism and scholarly writing," *South African Journal of Higher Education,* vol. 37, no. 5, pp. 203–220, 2023.

[24] K. Fuchs and V. Aguilos, "Integrating artificial intelligence in higher education: Empirical insights from students about using ChatGPT," *International Journal of Information and Education Technology,* vol. 13, no. 9, pp. 1365–1371, 2023. doi: https://doi.org/10.18178/ijiet.2023 .13.9.1939

[25] N. M. Alnaqbi and W. Fouda, "Exploring the role of ChatGPT and social media in enhancing student evaluation of teaching styles in higher education using neutrosophic sets," *International Journal of Neutrosophic Science,* vol. 20, no. 4, pp. 181–190, 2023. doi: https://doi.org/10.54216/ IJNS.200414

[26] H. L. Lelepary, R. Rachmawati, B. N. Zani, and K. Maharjan, "ChatGPT: Opportunities and challenges in the learning process of Arabic language in higher education," *Journal International of Lingua and Technology,* vol. 2, no. 1, pp. 11–23, 2023. doi: https://doi.org/10.55849/jiltech.v2i1.439

[27] J. Kim, H. Lee, and Y. H. Cho, "Learning design to support student-AI collaboration: Perspectives of leading teachers for AI in education," *Education and Information Technologies,* vol. 27, no. 5, pp. 6069–6104, 2022. doi: https://doi.org/10.1007/s10639-021-10831-6

[28] C. Zhao, "AI-assisted assessment in higher education: A systematic review," *Journal of Educational Technology and Innovation*, vol. 6, no. 4, 2024. doi: https://doi.org/10.61414/jeti.v6i4.209

[29] A. Nguyen, H. N. Ngo, Y. Hong, B. Dang, and B. P. T. Nguyen, "Ethical principles for artificial intelligence in education," *Education*

and Information Technologies, vol. 28, no. 4, pp. 4221–4241, 2023. doi: https://doi.org/10.1007/s10639-022-11316-w

[30] L. Yuan and X. Liu, "The effect of artificial intelligence tools on EFL learners' engagement, enjoyment, and motivation," *Computers in Human Behavior*, vol. 162, 108474, 2025. doi: https://doi.org/10.1016/j.chb.2024 .108474

[31] Q. Xia, T. K. Chiu, M. Lee, I. T. Sanusi, Y. Dai, and C. S. Chai, "A Self-Determination Theory (SDT) design approach for inclusive and diverse artificial intelligence (AI) education," *Computers & Education*, vol. 189, 104582, 2022. doi: https://doi.org/10.1016/j.compedu. 2022.104582

[32] C. Song and Y. Song, "Enhancing academic writing skills and motivation: assessing the efficacy of ChatGPT in AI-assisted language learning for EFL students," *Frontiers in Psychology*, vol. 14, 1260843, 2023. doi: https://doi.org/10.3389/fpsyg.2023.1260843

[33] M. Al-Smadi. (Nov 2023). ChatGPT and Beyond: The Generative AI Revolution in Education. *arXiv 2023*. [Online]. Available: https://doi.org/10.48550/arXiv.2311.15198

[34] J. Dempere, K. Modugu, A. Hesham, and L. K. Ramasamy, "El impacto de ChatGPT en la educación superior," In *Frontiers in Education*, vol. 8, no. 1, pp. 1–13, 2023. doi: https://doi.org/10.3389/feduc.2023.1206936

[35] M. Montenegro-Rueda, J. Fernández-Cerero, J. M. Fernández-Batanero, and E. López-Meneses, "Impact of the implementation of ChatGPT in education: A systematic review," *Computers*, vol. 12, no. 8, 153, 2023. doi: https://doi.org/10.3390/computers12080153

[36] P. S. Bhullar, M. Joshi, and R. Chugh, "ChatGPT in higher education-a synthesis of the literature and a future research agenda," *Education and Information Technologies*, vol. 29, no. 16, pp. 21501–21522, 2024. doi: https://doi.org/10.1007/s10639-024-12723-x

[37] H. Galindo-Domínguez, N. Delgado, L. Campo, and M. S. de la Maza, "ChatGpt use in higher education. An analysis as a function of gender, academic performance, year and university grade of the student body," *REDU. Revista de Docencia Universitaria*, vol. 22, no. 2, pp. 16–30, 2024. doi: https://doi.org/10.4995/redu.2024.21647

[38] D. Ravšelj, D. Keržič, N. Tomaževič *et al*., "Higher education students' perceptions of ChatGPT: A global study of early reactions," *PloS One*, vol. 20, no. 2, e0315011, 2025. doi: https://doi.org/10.1371/journal.pone.0315011

[39] I. Diaz-Leon and I. Iraola-Real, "The use of ChatGPT by Peruvian university students: An exploration of actual usage and intention to use," *Revista Ibérica de Sistemas e Tecnologias de Informação*, no. E69, pp. 89–101, 2024.

[40] R. H. Sampieri, C. F. Collado, and P. B. Lucio, *Research Methodology,* 4ª ed., McGraw-Hill Interamericana, 2018.

[41] J. L. A. González and M. C. Gallardo, *Research Design and Methodology,* Enfoques Consulting EIRL, 2021.