Generative Artificial Intelligence Among Business Management Engineering Students: Academic Uses, Learning, and Responsible Practices

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ABSTRACT

Generative artificial intelligence (GenAI) is already part of many students' academic activities, but it remains necessary to understand what they use it for, how they learned to use it, and what responsible practices they follow. This study described these aspects among Business Management Engineering students at the Pachuca Institute of Technology and gathered their recommendations for the institution. A cross-sectional, non-experimental, descriptive study was conducted, with a predominantly quantitative approach and exploratory analysis of one open-ended question. All 410 students in the program were invited to participate. Of the 397 questionnaires received, nine were excluded because of inconsistencies. Of the remaining 388 records, 386 included consent and formed the analytical sample. A total of 85.5% reported currently using GenAI. ChatGPT was the most frequently selected primary tool (52.8%), followed by Google Gemini (29.8%). The most common use was searching for information and clarifying questions (82.6%), while the main way students learned to use these tools was by exploring and practicing on their own (58.0%). In their self-assessments, 62.0% considered themselves moderately capable of writing prompts, and 58.7% of identifying errors. Regarding responsible practices, 53.6% reported checking information against reliable sources frequently or always, and 50.0% reported disclosing their use when required by the rules. In response to the question, "What recommendation would you make to the Pachuca Institute of Technology to promote the academic, ethical, and responsible use of AI?", the most common suggestion was to offer practical courses or workshops. Participants also proposed clarifying when and how AI may be used, including the topic in courses, and providing guidance for instructors. Overall, the findings point to the value of practical training and clear rules to support responsible GenAI use.

Keywords: Generative Artificial Intelligence; Higher Education; Responsible Practices; Artificial Intelligence Literacy.

INTRODUCTION

Generative artificial intelligence (GenAI) can produce explanations, summaries, ideas, and other content in response to prompts. In higher education, these tools can help students explore concepts, support writing, or clarify questions, but they can also provide inaccurate information, invent references, or process data that users should not share. UNESCO (2023) recommends a human-centered approach that includes oversight, critical evaluation, and attention to privacy and educational relevance. This study addresses how GenAI is incorporated into the everyday academic practices of Business Management Engineering students and what kind of educational guidance they consider useful. Survey responses in this population show that use is concentrated on searching for information and clarifying questions, while learning to use the tools occurs mainly through individual exploration and practice. These patterns describe instrumental use and a predominantly self-directed learning path; they do not demonstrate that students lack solid foundations or are unaware of ethics, as the questionnaire did not directly assess those matters. Research on GenAI in higher education documents perceived

benefits as well as concerns, including reliability, academic integrity, and possible effects on learning (Chan & Hu, 2023; Abbas et al., 2024). Reviews also call for greater attention to ethics, collaboration, and rigor in research on artificial intelligence in education (Bond et al., 2024; Yusuf et al., 2024). Yet patterns of use, ways of learning, and responsible practices may vary across programs and institutions. Context-specific evidence is therefore needed to describe what students do and what support they request, without treating self-reports as measures of knowledge or performance. The Department of Economic and Administrative Sciences at the Pachuca Institute of Technology offers Business Management Engineering and a Bachelor's degree in Administration. This study focused on Business Management Engineering. Administration students were not included because, during the final semesters of their specialization, they take two courses related to artificial intelligence applied to administration; this curricular difference was reserved for separate analysis. The aim of this study was to describe GenAI use among Business Management Engineering students in terms of the tools used, frequency of use, ways of learning, perceptions of usefulness and reliability, self-reported responsible practices, and recommendations for the institution. The study provides a descriptive account to inform educational initiatives while clearly delimiting what the data can support.

LITERATURE REVIEW

In higher education, generative artificial intelligence offers ways to support studying and completing tasks, while also raising questions about the reliability of its responses, privacy, and academic integrity. The literature reports both perceived benefits and concerns about its use (Chan & Hu, 2023; Abbas et al., 2024). In this context, it is relevant to describe not only which tools students use, but also what they use them for and which responsible practices they report. As a related antecedent in management education, Orán-Muñoz et al. (2026) analyzed technological and artificial intelligence competencies associated with the future manager's profile through a data architecture designed to identify labor-market demands. This work provides context for the relevance of these competencies in the education of management professionals; however, it does not examine the GenAI practices of the students surveyed here. The present study complements that work by describing students' academic uses, learning approaches, perceptions, and responsible practices.

THEORETICAL FRAMEWORK

The analytical framework is descriptive and follows the study objectives and questionnaire rather than a single technology-acceptance model. It groups the evidence into three dimensions: GenAI use and perceived usefulness; learning approaches, self-assessed skills, and training needs; and self-reported responsible practices and institutional guidance. For the responsible-use dimension, UNESCO's (2023) guidance on generative artificial intelligence in education and research provides a reference. It promotes a human-centered approach and emphasizes human oversight, data protection, and validation of results. The questionnaire addressed these topics through items about checking information, verifying references, reviewing generated content, disclosing AI use when required by instructions or rules, avoiding the sharing of sensitive data, and taking responsibility for the final work. These dimensions guide the presentation and interpretation of the findings. They do not directly measure ethical knowledge or competencies, and they do not establish causal relationships.

METHODOLOGY

Research Design

A cross-sectional, non-experimental, descriptive study was conducted, with a predominantly quantitative approach and an exploratory qualitative component to organize responses to one open-ended question. The quantitative component described participants' experience, frequency, and purposes of GenAI use, as well as their perceptions and self-reported responsible practices. The qualitative component summarized participants' recommendations for promoting the academic and responsible use of these tools.

Population and Sample

The target population comprised 410 students enrolled in the Business Management Engineering program at the Pachuca Institute of Technology, according to information provided by the Office of the Head of the Department

of Economic and Administrative Sciences. All enrolled students were invited to participate, with support from the academic tutors for each group, who followed up on questionnaire administration. This was a census-style invitation with voluntary participation, not a random sample. A total of 397 questionnaires were received. During data cleaning, nine records were excluded because participants initially reported never having used GenAI and subsequently answered items inconsistently with that statement. Of the 388 remaining records, 386 included affirmative consent and two indicated that they did not agree to participate; only the former were analyzed. The analytical sample represents 94.1% of the 410 students invited (386/410). This proportion describes observed participation and does not guarantee statistical representativeness, given the voluntary nature of participation.

Instrument

A questionnaire was administered through Google Forms. Its introduction defined GenAI and provided examples of systems capable of producing texts, summaries, images, and ideas. The terms "AI" and "GenAI" were used in subsequent items in accordance with that initial definition. The instrument addressed background information, experience and frequency of use, tools, academic activities, learning approaches, training needs, perceptions, responsible practices, critical thinking, institutional guidance, and one open-ended question.

Six experts reviewed the items: two specialists in technology, one in higher education, two in research methodology, and one in artificial intelligence. The review considered clarity, relevance, coherence, and appropriateness. In addition, a pilot test with 22 second-semester Administration students examined question comprehension and questionnaire functioning; their responses were not included in the main dataset. Wording was revised after the review, GenAI was defined in the introduction, and an option concerning use during exams or assessments was added. This process aimed to improve the instrument and does not, by itself, constitute a statistical estimate of validity or reliability.

Procedure and Quantitative Analysis

Participation was voluntary, and the form included a question on informed consent. Data cleaning applied the inconsistency criterion described above; all other records were retained, even when responses to different items did not align. Accordingly, each result was calculated by question using its valid denominator, and perfect consistency across all individual responses was not assumed.

Descriptive frequencies and percentages were calculated. For multiple-selection questions, percentages represent the proportion of participants who selected each option; categories are therefore not mutually exclusive and may sum to more than 100%. For Likert items, missing values were excluded and, when the option "I do not have enough experience to answer" was available, it was also excluded from the valid-response denominator. For frequency-based practices, "Frequently" and "Always" were combined. Self-reported perceptions and skills were interpreted as participants' opinions, not as direct measures of competence or performance.

Analysis of the Open-Ended Question

The question "What recommendation would you make to the Pachuca Institute of Technology to promote the academic, ethical, and responsible use of AI?" was analyzed for the 386 records with affirmative consent. Responses were classified as blank, non-substantive, or interpretable. Interpretable responses were organized into non-exclusive thematic categories using textual criteria documented in a working matrix; one response could contribute to more than one category. The author team reviewed and approved the assignments.

RESULTS AND DISCUSSION

Participant Profile and Use Experience

The analytical dataset included 386 participants with affirmative consent. Age and gender each had one missing response, so their percentages were calculated using n = 385. The semester distribution was calculated using N = 386. The data are presented in Table 1.

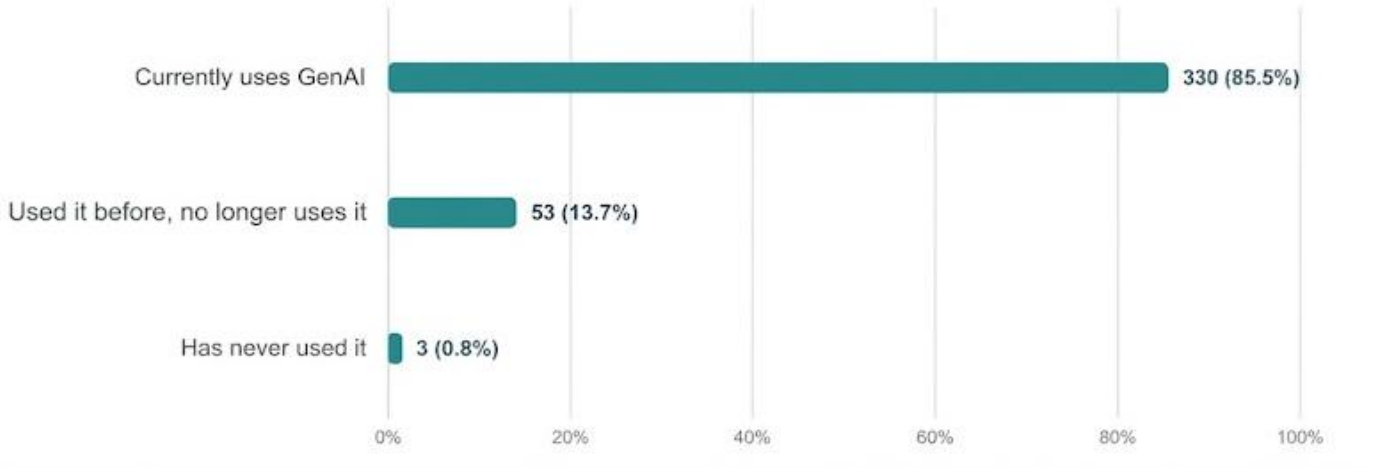
Table 1: Profile of participants with affirmative consent

Variable	Category	n	Percentage
Age	17 years or younger	7	1.8%
Age	18–20 years	221	57.4%
Age	21–23 years	134	34.8%
Age	24 years or older	23	6.0%
Gender	Woman	256	66.5%
Gender	Man	128	33.2%
Gender	Another gender identity	1	0.3%
Semester	First	79	20.5%
Semester	Second	38	9.8%
Semester	Third	73	18.9%
Semester	Fourth	17	4.4%
Semester	Fifth	59	15.3%
Semester	Sixth	15	3.9%
Semester	Seventh	55	14.2%
Semester	Eighth	29	7.5%
Semester	Ninth or later	21	5.4%

Note. Valid n for age and gender = 385; semester N = 386. Percentages were calculated using the valid denominator for each variable.

Regarding experience, 330 participants (85.5%) reported currently using GenAI, 53 (13.7%) had used it previously, and three (0.8%) indicated that they had never used it. The distribution is shown in Figure 1. For academic frequency of use, 188 participants (48.7%) responded “Sometimes,” 116 (30.1%) “Frequently,” 50 (13.0%) “Rarely,” 30 (7.8%) “Very frequently,” and two (0.5%) “Never.” Although current use was reported by a high proportion of participants, discrepancies across items were retained, and results were interpreted item by item.

Figure 1. Self-reported experience using generative artificial intelligence



Note. N = 386 participants who gave affirmative consent. Source: Authors’ calculations based on the questionnaire**.**

Tools, Uses, and Learning Approaches

ChatGPT was the most frequently selected primary tool (204; 52.8%), followed by Google Gemini (115; 29.8%) and Claude (19; 4.9%). Table 2 presents all responses. One participant selected “I have not used AI in academic activities”; this response was retained as given and was not used to recode the general report of experience.

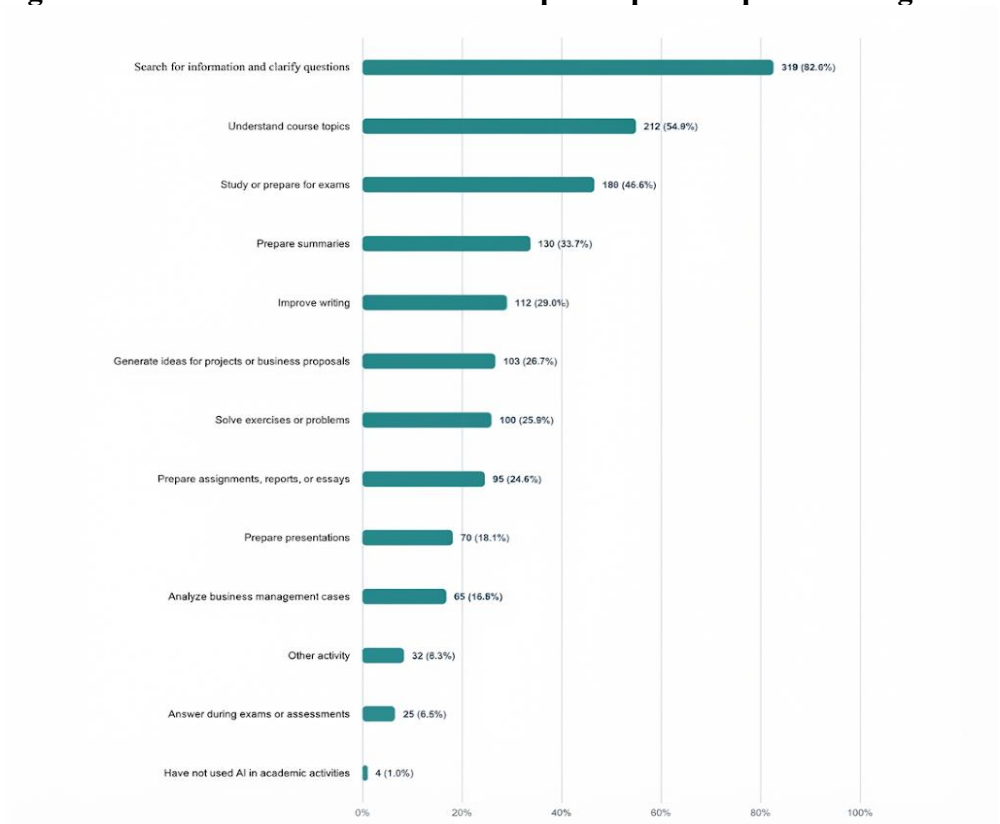
Table 2. Primary tool reported for academic activities

Variable	Category	n	Percentage
Primary tool	ChatGPT	204	52.8%
Primary tool	Google Gemini	115	29.8%
Primary tool	Claude	19	4.9%
Primary tool	Other tool	15	3.9%
Primary tool	Canva with AI features	13	3.4%
Primary tool	Meta AI	9	2.3%
Primary tool	Microsoft Copilot	7	1.8%
Primary tool	Perplexity	3	0.8%
Primary tool	I have not used AI in academic activities	1	0.3%

Note. Participants were asked to select one primary tool; percentages are based on N = 386. Minor differences may occur due to rounding.

The most common activities were searching for information and clarifying questions (319; 82.6%), understanding course topics (212; 54.9%), and studying or preparing for exams (180; 46.6%). Participants also reported preparing summaries (130; 33.7%), improving their writing (112; 29.0%), and generating ideas for projects or business proposals (103; 26.7%). Figure 2 presents the selected options. Because this was a multiple-selection question, the percentages do not represent mutually exclusive shares of a total**.**

Figure 2. Academic activities for which participants reported using AI



Note. Multiple-selection question; N = 386. Percentages may sum to more than 100%. Source: Authors' calculations based on the questionnaire.

Exploring and practicing on their own was the main way participants learned to use these tools (224; 58.0%), followed by social media (49; 12.7%) and help from classmates, friends, or family members (42; 10.9%). In the self-assessment, 238 of 384 valid responses (62.0%) were "Moderately capable" of writing clear prompts, and 226 of 385 (58.7%) were in the same category for identifying errors or inaccurate information. These findings describe perceptions, not direct measures of performance. Individual exploration is a form of self-directed learning; the data do not show that it was ineffective or that participants lacked basic knowledge. However,

considering that the most commonly reported activity was searching for information or clarifying questions, the findings suggest complementing experimentation with guidance on writing prompts, cross-checking responses, and recognizing when a task requires other sources or procedures.

This pattern is consistent with the self-directed learning described by Wang et al. (2024) in a mixed-methods study of 384 postsecondary students and ten interviews on ChatGPT-assisted writing. Their participants reported idea generation and support for writing tasks, while self-monitoring of learning and external feedback emerged as relevant areas for development. The comparison is contextual, not an equivalence between measures: the present study primarily asked how students learned to use GenAI and did not measure the learning process or its outcomes. Training needs most often involved writing prompts (229; 59.3%), using AI to study and understand course subjects (194; 50.3%), and applications in business management (155; 40.2%). Information and source verification was selected by 109 participants (28.2%), while 100 (25.9%) selected ethical AI use, academic integrity, and data protection. Table 3 presents the six most frequently selected options. These selections reflect perceived needs; they are not objective evidence of a lack of skills or knowledge.

Table 3. Most frequently selected training needs

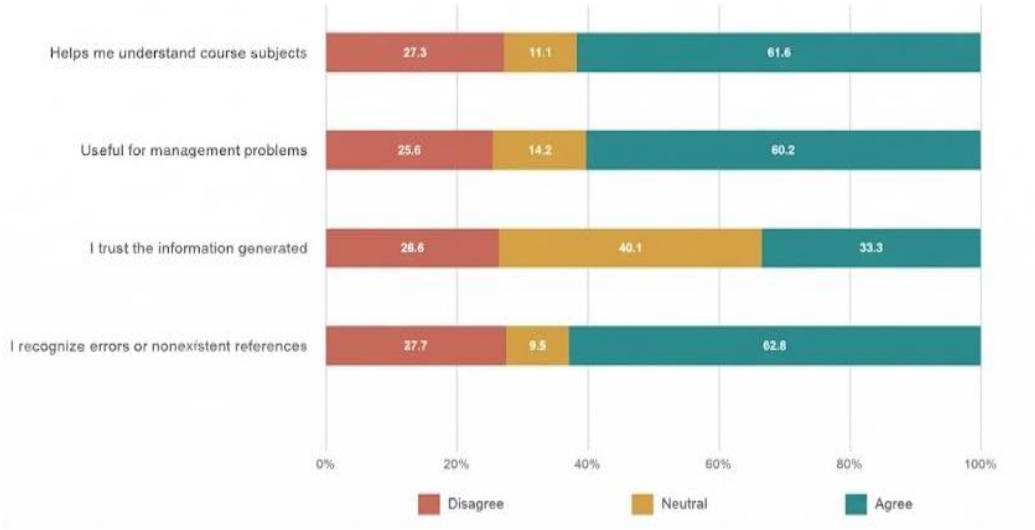
Variable	Category	n	Percentage
Training need	Writing prompts to obtain better results	229	59.3%
Training need	Using AI to study and understand course subjects	194	50.3%
Training need	AI applications in business management	155	40.2%
Training need	Data analysis and decision support	118	30.6%
Training need	Verifying information and sources	109	28.2%
Training need	Ethical AI use, academic integrity, and data protection	100	25.9%

Note. Multiple-selection question; percentages are based on N = 386, and categories are not mutually exclusive.

Perceptions and Responsible Practices

Among valid Likert responses, 228 of 370 (61.6%) agreed or strongly agreed that AI can help them understand course topics; 221 of 367 (60.2%) agreed or strongly agreed that it is useful for management problems. By contrast, 124 of 372 (33.3%) agreed or strongly agreed that they trust AI-generated information. In addition, 218 of 347 (62.8%) recognized that AI can produce inaccurate information or nonexistent references. Figure 3 compares disagreement, neutrality, and agreement after excluding missing responses and "I do not have enough experience to answer."

Figure 3. Perceptions of usefulness, trust, and recognition of possible errors



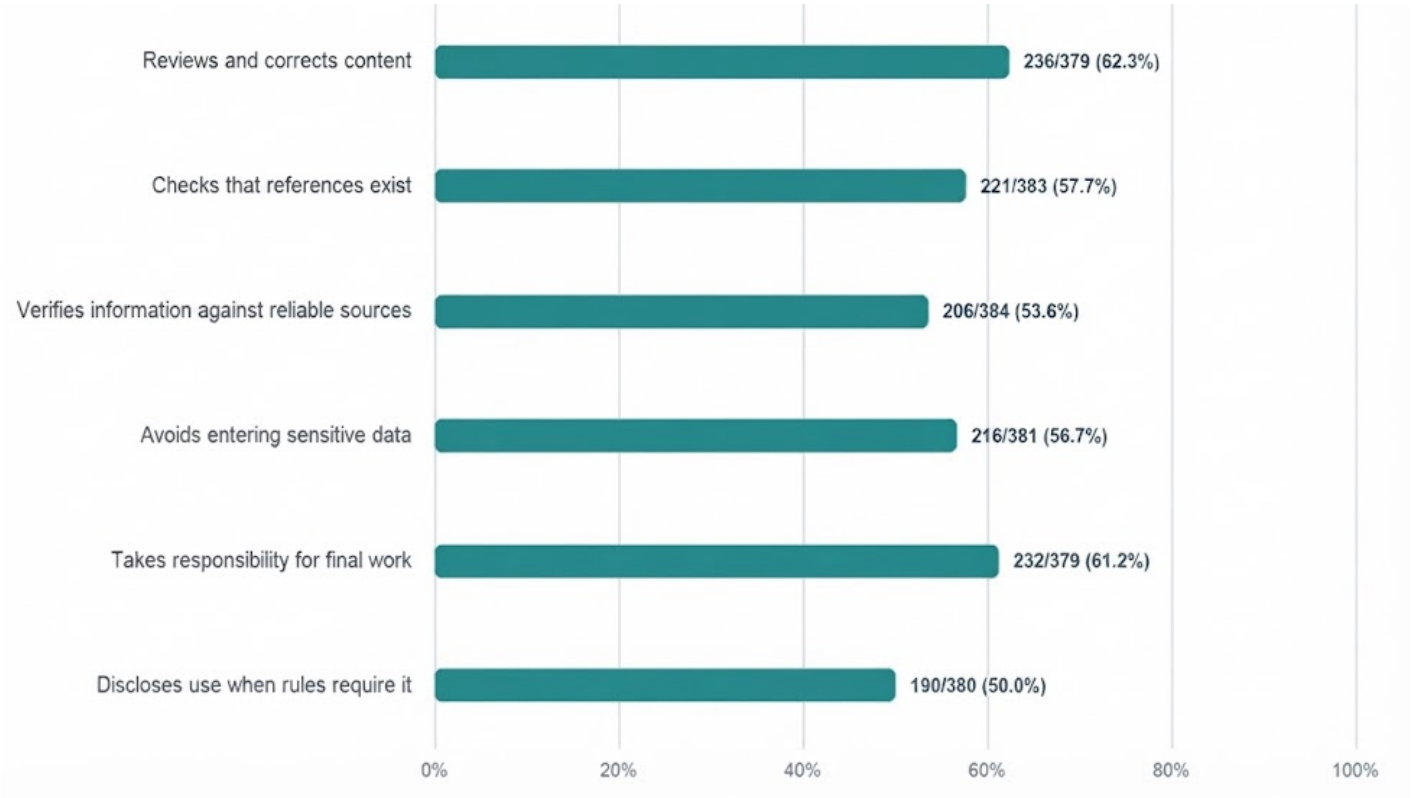
Note. Percentages are grouped as disagreement, neutral, and agreement; missing responses and "I do not have enough experience to answer" were excluded. Valid denominators: 370, 367, 372, and 347, respectively. Source: Authors' calculations.

The difference between perceived usefulness and trust in the information indicates that valuing AI support for understanding does not mean considering every response reliable. This caution is consistent with UNESCO's (2023) guidance, which recommends oversight and verification, and with studies reporting both benefits and concerns among university students (Chan & Hu, 2023; Abbas et al., 2024). Because the accuracy of system-generated responses and learning outcomes measured through performance tests were not assessed, these results describe opinions rather than effects.

The relationship between use and institutional context also appears in Baek et al. (2024), who analyzed a survey of 1,001 university students in the United States. In that study, the type of institutional policy was associated with ChatGPT use, and many participants did not know whether their institution had a specific policy. In the present study, 64.4% considered it important for the institution to provide ethical and responsible-use guidance. Although the samples and questions differ, both findings underscore the value of communicating clear rules rather than assuming that students know institutional expectations.

Among self-reported practices, 236 of 379 valid responses (62.3%) indicated that participants reviewed and corrected content "Frequently" or "Always." The corresponding figures were 221/383 (57.7%) for checking references and 206/384 (53.6%) for verifying information against reliable sources. Avoiding the entry of sensitive data was reported by 216/381 (56.7%); taking responsibility for the final work by 232/379 (61.2%); and disclosing AI use when instructions or rules require it by 190/380 (50.0%). Figure 4 presents these six indicators.

Figure 4. Self-reported responsible practices



Note. Percentage who responded "Frequently" or "Always"; the valid denominator varies by item. Responses are self-reports and do not constitute external verification of behavior. Source: Authors' calculations.

In addition, 246 of 382 participants (64.4%) agreed or strongly agreed that the institution should provide guidance on the ethical and responsible use of AI. Regarding critical thinking, 241/382 (63.1%) agreed that using

AI without reviewing its responses may reduce critical thinking. These findings indicate that a substantial proportion values guidance and recognizes the risks of using AI without reviewing its responses.

Disclosure of AI use requires a narrow interpretation: the item asked whether participants disclose their use when assignment instructions or rules require it; it did not ask whether they disclose it in every circumstance or why they might not do so. In a mixed-methods study with students at a university in Singapore, Qu, Loo, and Wang (2025) found that disclosure decisions were related to policy ambiguity and students' understanding of AI contributions, with differences across disciplines. This prior study reinforces the relevance of transparent rules, but it does not allow motives to be attributed to responses in the present study.

Taken together, the concentration of use on searching for information and clarifying questions, the prominence of individual learning, and requests for practical training indicate an opportunity to encourage more deliberate use. The ethical dimension is supported by self-reported practices, the value placed on institutional guidance, and open-ended recommendations; it is presented as a need for support and understandable rules, not as evidence that students lack ethical awareness.

Recommendations from the Open-Ended Question

Of the 386 records with affirmative consent, 102 responses were blank, 29 were classified by the team as non-substantive, and 255 contained interpretable recommendations. In the exploratory coding, the most frequent category was practical training and guidance (148 mentions; 58.0% of substantive responses). Other categories included ethical and responsible use and clear rules (53; 20.8%), curriculum integration and instructor training (49; 19.2%), and using AI as support without replacing learning (42; 16.5%). Table 4 presents all categories reported by the author team. Because categories are not mutually exclusive, percentages do not sum to 100%.

The recommendations support the interpretation of the closed-ended items: participants proposed workshops, courses, and guidance, as well as curriculum integration, instructor training, and rules for use in coursework and assessments. Some responses suggested using AI to clarify questions and study without delegating all the work. As anonymized textual examples, one response proposed using it "as an academic support tool, without replacing critical thinking or one's own effort"; another recommended "clearly defining the academic contexts in which AI is permitted." These statements reflect participants' suggestions and do not show that other students lack responsible practices.

Table 4. Categories identified in the open-ended recommendations

Variable	Category	n	*Percentage*
Recommendation	Practical training and guidance	148	58.0%
Recommendation	Ethical and responsible use and clear rules	53	20.8%
Recommendation	Curriculum integration and instructor training	49	19.2%
Recommendation	AI as support without replacing learning	42	16.5%
Recommendation	Institutional openness and updating	29	11.4%
Recommendation	Professional applications and management practices	8	3.1%
Recommendation	Academic assessment and integrity	15	5.9%
Recommendation	Information and source verification	11	4.3%
Recommendation	Equitable access to tools	5	2.0%
Recommendation	Data protection and privacy	1	0.4%

Note. Percentages are based on the 255 substantive responses. Categories are not mutually exclusive. Frequencies and percentages correspond to the coding reviewed and approved by the author team; there was no independent second coding or estimate of inter-coder agreement.

The open-ended question complements the description but is not equivalent to interviews and does not support a claim of qualitative saturation. Frequencies should be read as an exploratory summary of the interpretable responses. Reproducibility of the themes depends on the matrix and coding criteria used by the team.

The study's contribution is to bring together, for a Business Management Engineering program, descriptive evidence on the tasks for which GenAI use is reported, learning on one's own, self-assessed skills, selected responsible practices, and requested forms of support. This account can inform training tailored to the program; its scope does not include testing GenAI effectiveness, measuring competencies, or establishing causal relationships.

CONCLUSION

The descriptive objective was achieved: the study characterized the tools, frequency and activities of use, learning approaches, perceptions, self-reported responsible practices, and recommendations of Business Management Engineering students. The dataset included 386 participants who consented, equivalent to 94.1% of the 410 students invited. Voluntary participation in a single program and institution limits statistical generalization.

Use was primarily instrumental: 82.6% used GenAI to search for information and clarify questions, 54.9% to understand course topics, and 24.6% to prepare assignments, reports, or essays. Interpreting this as support for immediate needs is consistent with those responses, although the questionnaire did not measure whether use followed a learning plan. The main way participants learned was by exploring and practicing on their own (58.0%); in addition, 62.0% considered themselves moderately capable of writing prompts and 58.7% of identifying errors. Demand for training in prompts (59.3%), studying (50.3%), and management applications (40.2%) supports offering guided instruction without inferring that students lack solid foundations.

Responsible practices were reported at different frequencies: 53.6% said they frequently or always verify information against reliable sources; 57.7% check references; 56.7% avoid entering sensitive data; 50.0% disclose their use when rules require it; and 61.2% take responsibility for the final work. In addition, 64.4% valued institutional guidance, and 20.8% of substantive open-ended responses recommended ethics, responsibility, or clear rules. Overall, the figures support strengthening guidance and understandable criteria, and suggest that these practices are not reported uniformly. They do not demonstrate a lack of ethical awareness or actual behavior, because they are self-reports and were not corroborated through a knowledge test or direct observation.

ACKNOWLEDGEMENTS

The authors thank the Business Management Engineering students who took the time to complete the questionnaire and the academic tutors who followed up on its administration.

Ethical Approval

Administration of the questionnaire received prior authorization from the Academic Committee of the Department of Economic and Administrative Sciences at the Pachuca Institute of Technology. Participation was voluntary, and the instrument included a consent question through which each participant accepted or declined to take part. The information provided for this version does not include an approval number from an institutional ethics committee; therefore, no ethics committee approval beyond the stated academic authorization is claimed.

Conflict Of Interest

The authors declare that they have no conflict of interest related to the conduct of this research, the analysis of the results, or publication of the article.

Data Availability

The data supporting the results may be requested from the corresponding author upon reasonable request. If shared, an anonymized version will be provided to protect participant confidentiality.

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