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Integrating Generative AI in Engineering Education: Enhancing Learning and Attendance in a Vehicle Theory Course

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Abstract

This paper presents the results of a two-year innovative teaching project in the Vehicle Theory course, a fourth-year Mechanical Engineering subject at Universidad Carlos III de Madrid. The project explored the integration of generative artificial intelligence (GenAI) tools, particularly ChatGPT, to enhance student engagement, support project work, and promote ethical academic use. Key strategies included a flipped classroom approach, where students summarized previous lessons with GenAI assistance, and the use of AI to aid in the design and optimization of a tubular chassis project. Survey results and course observations indicate high student adoption of GenAI, with positive impacts on understanding theoretical concepts, completing exercises, and generating project outputs. Students reported that GenAI facilitated idea generation, technical problem-solving, and the creation of more effective and visually appealing presentations. Limitations included information bias, overreliance on GenAI, and variability in response quality depending on prompt formulation. Overall, the project improved attendance, engagement, and academic performance, highlighting the potential of GenAI as a complementary educational tool. Additionally, by requiring students to critically evaluate the GenAI responses, the project encouraged the development of judgment and decision-making skills, which are essential competences for future engineers.

Keywords: generative artificial intelligence; ChatGPT; engineering education; Vehicle Theory; flipped classroom; student engagement; project-based learning; active learning; AI-assisted learning; mechanical engineering

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1. Introduction

The emergence of generative artificial intelligence (GenAI) tools such as ChatGPT, Gemini, Deepseek, Stable Diffusion, and DALL·E has reshaped the landscape of digital technology since their introduction in 2022 (Grassini, 2023; Imran & Almusharraf, 2024; Llerena-Izquierdo et al., 2024; Lo, 2023). These systems, built upon advanced generative models, are capable of producing a wide range of outputs including text (Huynh & McNamara, 2025), images (Thampanichwat et al., 2025), audio (Wei et al., 2025), video (Bercaru & Popescu, 2025), software code (Swacha & Gracel, 2025), and synthetic data (Kamruzzaman et al., 2025; Rai et al., 2025). By learning from large-scale datasets, GenAI models can create new content that mirrors the characteristics of human-produced material, thereby expanding opportunities for creativity, problem-solving, and automation. Among these tools, ChatGPT, developed by OpenAI, has become one of the most widely adopted

language-based application, enabling users to generate contextually relevant responses customized to different levels of detail, style, or format (Naznin et al., 2025).

The integration of GenAI into education has generated growing interest, as these tools offer new ways to support learning, teaching, and assessment (Wang & Guo, 2025). Research suggests that systems like ChatGPT can enhance the student learning experience by providing adaptive explanations, personalized feedback, and accessible educational resources (Tillmanns et al., 2025). For instance, they can simplify complex topics, produce study materials, and offer individualized support for learners with diverse needs (Ribeirinha et al., 2025). Beyond knowledge delivery, GenAI also holds potential for developing critical thinking skills, improving student engagement, and supporting inclusive education by tailoring information to different learning profiles (Cordero et al., 2024; Martínez-Peláez et al., 2025).

Nevertheless, the adoption of GenAI in educational contexts is not without challenges (Francis et al., 2025; Fulsher et al., 2025). Concerns have been raised regarding its influence on academic integrity, as the ease of generating assignments or assessments introduces potential risks of plagiarism and reduces opportunities for authentic student work (Huang et al., 2025; Kovari, 2025; Yavich & Davidovitch, 2024). Another emerging concern is the possibility of increased absenteeism, since students may come to rely on GenAI tools as a substitute for classroom participation, diminishing engagement with instructors and peers and weakening the collaborative aspects of learning (Franco et al., 2025). In addition, questions of accuracy, bias, and reliability in AI-generated outputs remain central to debates about its responsible use (Đerić et al., 2025a). Furthermore, issues surrounding data privacy, security, copyright, and transparency add layers of complexity to its implementation in formal learning environments (Đerić et al., 2025b). These tensions highlight the importance of carefully considering how GenAI should be integrated into specific subject areas, such as engineering, where accuracy, active participation, and ethical learning practices are fundamental.

This study focuses on the Vehicle Theory course, taught in the fourth year of the Mechanical Engineering degree program. This specific course was selected because it has historically faced significant challenges with student absenteeism, making it a suitable environment for testing engagement interventions. As a subject that combines theoretical principles with applied knowledge in areas such as vehicle dynamics, safety, and performance, it offers a meaningful context for examining how GenAI can be incorporated into technical education. Beyond supporting the understanding of complex concepts, a key objective of integrating these tools is to foster greater student participation and reduce absenteeism by making learning more interactive, engaging, and accessible. At the same time, particular emphasis is placed on encouraging ethical and responsible use of GenAI, ensuring that students leverage its capabilities as a complement to, not a replacement for, active learning and classroom involvement. In the following sections, we examine both the opportunities and challenges associated with GenAI in this course, highlighting strategies that promote innovation, participation, and responsible academic practice.

2. Challenges in Vehicle Theory Education

The Vehicle Theory course, delivered in the fourth year of the Mechanical Engineering degree program, spans 14 weeks with two sessions per week and combines lectures, problem-solving exercises, and laboratory work. By the end of the course, students are expected to demonstrate a systematic understanding of vehicle dynamics and automobile systems (Rajamani, 2006), apply analytical and modeling methods, design and conduct experiments, and integrate theory with practice to address engineering problems.

The syllabus progresses from foundational topics such as vehicle types, to more advanced subjects including chassis design, tire mechanics (Garcia-Pozuelo et al., 2017), aerodynamics, longitudinal and lateral dynamics (Viadero-Monasterio et al., 2023), brak-

ing systems (Meléndez-Useros et al., 2023), suspension (Viadero-Monasterio et al., 2022), rollover behavior, and hybrid electric vehicles. It should be noted that the team members are authorities in the aforementioned subjects. Complementing these lectures, four laboratory sessions provide hands-on experience: the design and testing of a tubular chassis, analysis of tires and vehicle components, and procedures related to periodic motor vehicle inspection. In addition to developing technical expertise, the course emphasizes teamwork, problem-solving, and the ability to translate theoretical concepts into practical applications, making it a comprehensive foundation for advanced study and professional practice in automobile engineering.

To improve the quality of teaching, Universidad Carlos III de Madrid (UC3M) launches calls for innovative teaching projects every year. These initiatives aim to help professors try new methods and tools that make learning more engaging and effective for students. The projects can cover different areas, such as creating new learning materials, encouraging student participation, improving assessment methods, or testing new teaching methodologies. Recently, a special focus has been placed on the use of generative artificial intelligence in education, recognizing its potential to transform the way students learn and interact with course content. Through these calls, UC3M supports teachers in adapting their courses to new challenges and in better preparing students for their professional future.

Over the past two years, the professors leading the Vehicle Theory course have actively participated in the university's calls for innovative teaching projects, focusing on enhancing two key aspects of the course, with the help of GenAI:

1. **Increasing student engagement and attendance**. Classes are made more interactive and motivating to encourage consistent attendance. At the start of each session, students complete a 10 min flipped classroom activity, summarizing previous lessons and using GenAI to support their understanding and explanations.
2. **Supporting student projects**. Students apply GenAI tools to assist in the design and optimization of a tubular chassis for automobiles. The AI supports them in generating ideas, performing analyses, and exploring alternative solutions throughout the project.

Specifically, our innovative teaching projects aim to achieve the following:

- Promote active attendance in typically theoretical lecture sessions.
- Facilitate understanding of key concepts by highlighting essential ideas and practical examples, supported by GenAI.
- Raise awareness of environmental and sustainability considerations within the design process.
- Develop teamwork skills, enabling students to collaborate effectively.
- Foster critical thinking, particularly regarding results obtained using GenAI tools.
- Train students to produce justified reports documenting their use of GenAI in projects.
- Enhance communication skills, ensuring clarity and technical rigor in both written and oral presentations.

For these purposes, the first class introduces students to the core concepts of GenAI, explaining how these models operate and providing practical guidance on how to construct effective prompts. While students were permitted to use any GenAI platform, the majority utilized ChatGPT or Google Gemini. To ensure equitable access and data security, the University provided a professional Gemini license to the entire academic community. Usage was monitored through a required "AI Disclosure" in project submissions, where students documented the specific tools and prompts used in their work.

The following sections examine the strategies implemented to meet these objectives and their impact on student learning. In Section 3, the use of GenAI for improving student attendance through a flipped classroom experience is described. In Section 4, the use of GenAI for supporting engineering projects is presented.

3. Improving Student Attendance and Learning Through Active Participation Based on GenAI

The objective is to promote collaborative, self-directed, and active participation through brief exercises at the beginning of each lecture.

Students voluntarily deliver a two-minute "elevator pitch" summarizing key concepts from the previous class and provide practical examples. They then have 30 s to discuss how they used GenAI, noting its strengths and weaknesses in completing the task. The activity, lasting no more than 15 min, includes presentations, peer questions, and a final summary by the instructor, with additional points awarded to those who present.

This activity led to a range of notable student outcomes, reflecting both student engagement and the ability to apply GenAI tools for learning. Students applied GenAI to structure presentations, summarize key concepts and generate visual aids. While some outputs were simplified or occasionally inaccurate, many students successfully used AI to clarify complex topics, create graphs, or compare theoretical and practical scenarios. The activities encouraged self-directed learning, critical evaluation of AI-generated content, and active participation, with students presenting material in class and integrating GenAI to enhance clarity and organization. Overall, this activity fostered technical understanding, creative problem-solving, and improved communication skills, showing how GenAI can support both individual and collaborative learning.

During the first four weeks of the course, no students volunteered for the brief presentations. However, starting in week five, participation gradually increased, culminating in week 14 with five presentations in a single lecture, exceeding the originally planned maximum of three per session. Students quickly realized that while GenAI provided useful theoretical information, its outputs for the practical case study were often inaccurate or incomplete. This prompted them to actively seek additional sources, adapt the AI's suggestions, and explore alternative solutions, a learning mechanism that sparked significant interest and discussion, particularly during the 30 s segment devoted to explaining the AI's role in each task.

Students also discovered the potential of GenAI for generating presentations and infographics, skills not typically emphasized in engineering courses. Their enthusiasm grew as they experimented with different tools and approaches, motivating more students to present voluntarily and attend lectures to see the insights their peers had uncovered.

In the 2023–2024 academic year, no specific measures were applied to the main lectures. In contrast, the 2024–2025 academic year implemented the brief presentations and assessed their impact on both attendance and overall learning outcomes. This approach successfully stopped the usual decline in lecture attendance observed in previous years, resulting in a 23% increase in average attendance by the end of the 14-week course.

Participation in the voluntary presentations showed a positive correlation with academic success. Notably, 100% of the students who volunteered for these sessions passed the course on their first attempt. While these results may partly reflect the high motivation of the volunteers, the 0.25-point incentive (up to 0.5 points total) encouraged active engagement with complex topics. This suggests that the process of preparing and delivering GenAI-supported presentations reinforced the students' mastery of the material, contributing to their successful completion of the course.

4. Supporting Engineering Projects with GenAI

Throughout the Vehicle Theory course, students are required to design and construct a tubular chassis model using balsa wood, followed by an evaluation of its stiffness, which constitutes a fundamental parameter in characterizing the dynamic response of vehicle structures to external excitations.

The incorporation of GenAI (during the academic years 2023–2024, 2024–2025) must serve students on multiple functions, including facilitating information retrieval, supporting design optimization, and ensuring adherence to technical and sustainability criteria. This pedagogical innovation is structured around two complementary approaches. First, the Active Learning in Digital Teaching framework allows students to employ AI as a resource for exploring automotive engineering concepts, gathering relevant data, and proposing designs aligned with the United Nations Sustainable Development Goals (SDGs). Second, the Service-Learning approach fosters collaborative project development, wherein students apply AI-assisted methodologies to optimize material selection and resource efficiency in the design of sustainable chassis models. Collectively, the project seeks to strengthen students' technical competencies while promoting their capacity to address contemporary challenges in sustainable engineering.

The project is carried out collaboratively in groups of three students, fostering teamwork and the development of interpersonal skills essential to engineering practice. Two dedicated course sessions are allocated to the project:

- **Session 1. Week 3**. During this class, students are introduced to the technical guidelines governing the chassis design, including specifications such as maximum weight, track width, and permissible wheelbase range. In addition, instructions are provided on the integration of GenAI tools to support the decision-making process in chassis selection and preliminary design.
  The chassis represents the primary structural element of a vehicle, serving as the foundation upon which all other components are mounted. It bears static and dynamic loads while ensuring structural integrity and occupant protection in the event of a collision. Consequently, students are expected to design their chassis by considering critical engineering trade-offs between stiffness, weight, and spatial efficiency. Emphasis is therefore placed on the necessity of adhering to defined project requirements, as these are integral to professional engineering practice.
  Following this introductory session, students begin independent group work in teams of three. To support this, a dedicated technical session is held during the main course to provide training in the use of finite element analysis software, specifically ANSYS and Abaqus. Each group is then tasked with developing a chassis design, supported by these tools to model the geometry and assess its structural performance prior to physical construction (see Figure 1). To complement their technical analysis, students are encouraged to employ generative AI tools for tasks such as retrieving design information, exploring alternative solutions, and seeking software guidance, with the caveat that all AI-generated outputs must be critically evaluated and validated against authoritative sources.

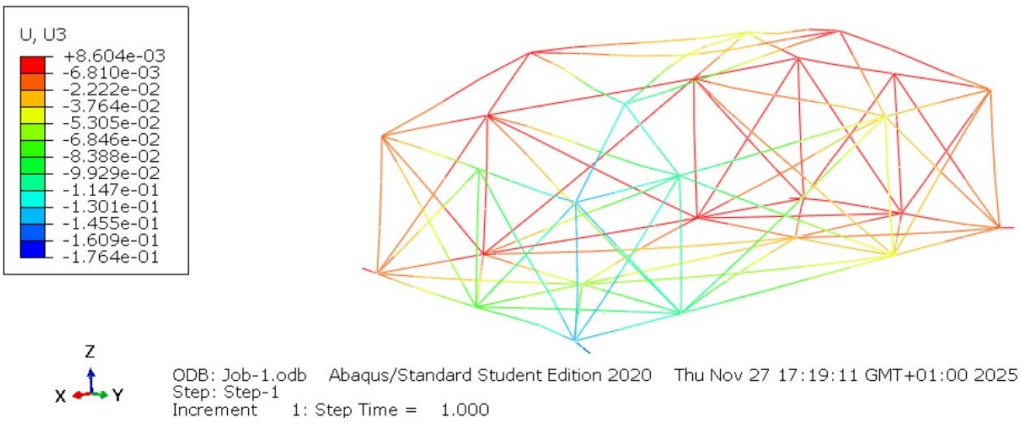

Figure 1. An example of a structural evaluation of a vehicle chassis using Abaqus.

- **Session 2. Week 14**. In this class, students deliver an oral presentation in which they justify their chassis design (see Figure 2) and describe how GenAI tools supported them throughout the different phases of the project. Following the presentations, each chassis is weighed and subjected to an experimental test in which a vertical load is applied at the ends of the axle shafts in order to evaluate torsional stiffness.

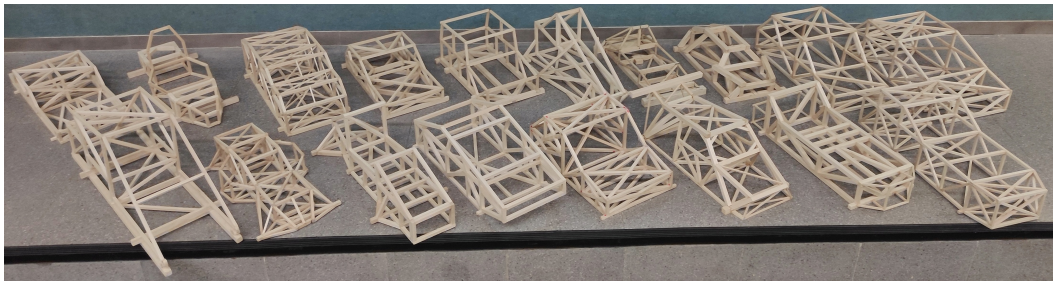

Figure 2. Some of the vehicle chassis designed by the Vehicle Theory students.

Once the tests are completed, each group receives a technical score based on the relative performance of their chassis with respect to two key parameters: the lowest mass achieved within the class and the highest torsional stiffness measured. The final score is calculated according to the following expression:

$$\text{Score} = 0.4\left(0.3\frac{P_{min}}{P_i} + 0.3\frac{\delta_{min}}{\delta_i} + 0.4\frac{\min(\delta_i P_i)_{class}}{\delta_i P_i}\right) + 0.6G_{design} \quad (1)$$

where:

- G_{design}: Evaluation of design parameters, including the group presentation and the accompanying technical report that explains the rationale behind the final design.
- P_{min}: Mass of the lightest chassis among all groups.
- P_i: Mass of the chassis being evaluated.
- δ_{min}: Minimum vertical displacement recorded during testing among all groups.
- δ_i: Vertical displacement measured for the chassis being evaluated.
- $\min(\delta_i P_i)_{class}$: Minimum product of vertical displacement and mass obtained among all groups, used as a reference value for comparative assessment.

From the perspective of the department, the implementation of this proposal has contributed to measurable improvements in both student autonomy and overall course outcomes. The number of tutorial requests declined by approximately 30% compared to previous academic years, indicating that students were more capable of resolving difficulties independently. Furthermore, the project coincided with an average increase of 8% in final grades compared with the mean of the three preceding courses, during which grade variation had consistently remained below 5%. While a definitive causal relationship cannot be established, it is noteworthy that the integration of GenAI constituted the sole modification to the course structure during the period under consideration.

5. Evaluation of Student Perspectives on Learning with GenAI

In order to evaluate how students perceived the use of GenAI in the Vehicle Theory course over the past two years (academic years 2023–2024, 2024–2025), an anonymous survey was distributed to enrolled students using the Moodle platform. The purpose of this survey was to gather information on three aspects of student experience: (1) prior experience with GenAI tools; (2) course-related experience, such as the ease of interacting with GenAI in tasks related to Vehicle Theory and the adequacy of the responses received; and (3) engineering experience, including students' assessment of the suitability of GenAI for engineering applications.

The survey was distributed at the conclusion of the course through the Moodle platform. In an effort to promote engagement, professors underscored the confidentiality of responses and the survey's significance in enhancing the quality of future instruction. The sample consisted of 132 students, representing approximately 60% of the total enrollment for the subject, with half drawn from the 2023–2024 academic year and the remainder from 2024–2025. The survey is provided in Appendix A.

The survey revealed that only 2 students reported no prior knowledge of Generative AI tools, while 9 had never used them before enrolling in the Vehicle Theory course. Among the students who had previously used GenAI, 94% indicated that they had done so for academic purposes. Overall, ChatGPT emerged as the most popular tool, selected by over 95% of the students.

Regarding the quality of GenAI responses, over 93% of students consider these tools easy to use for technical purposes. However, their suitability at the university level is somewhat limited, as 15% of students expressed concerns about the usefulness of GenAI in an academic context. About response clarity and completeness, 59% of students found GenAI responses suitable during the 2023–2024 course, increasing to 68% in the 2024–2025 course. This improvement is reasonable, given the rapid evolution of GenAI tools. Student feedback on prompt iteration further supports this trend: students in the 2024–2025 course reported that fewer iterations were needed to obtain an adequate technical answer.

Attending to response validation, students exhibited high confidence in GenAI tools, with only 18% reporting that they consulted external sources to verify the responses. This observation is noteworthy, considering that 50% of students identified instances of information bias in the generated responses, highlighting a potential overreliance on these tools despite recognized limitations. Some relevant anonymous student answers on the GenAI bias are cited below:

- *The responses generated are often vague and overly general; when specific, concrete questions are posed, the AI frequently fails to provide clear or precise answers.*
- *It can be challenging to obtain answers that are tightly focused on the intended topic. For instance, when inquiring about strength of materials, the AI often digresses, addressing broader mechanical issues or the composition of materials rather than the specific topic.*
- *The effectiveness of the responses heavily depends on how the questions are formulated. While the AI performs well with theoretical inquiries, it may struggle to generate responses that require creative or nuanced reasoning.*

Many students found GenAI tools to be very useful for engineering projects, such as designing and building the wooden chassis in this course. These tools helped students solve technical problems, organize their work, and make decisions more efficiently. AI was especially helpful for tasks that are repetitive, complex, or require careful calculations, allowing students to focus on design and analysis rather than tedious manual work. The following anonymous student comments show how they used AI to improve their workflow, optimize materials, and better understand technical concepts:

- *To optimize the use of wooden slats, we tested whether artificial intelligence could help determine the most efficient way to cut 1 m rods into different lengths. The results showed the optimal combination of rod lengths to minimize waste. AI was particularly useful for automating the tedious task of sorting and optimizing groups within larger sets, which is more efficient for a computer than a human.*
- *ChatGPT proved to be a valuable resource when using the ABAQUS program. It helped clarify differences between TRUSS and BEAM elements and guided us in extracting high-resolution images from the software, which were included in the report.*

- *In general, AI tools supported technical problem-solving by providing clear guidance on computational and structural tasks, streamlining work that would otherwise be time-consuming and prone to errors.*

  Results are summarized in Figure 3.

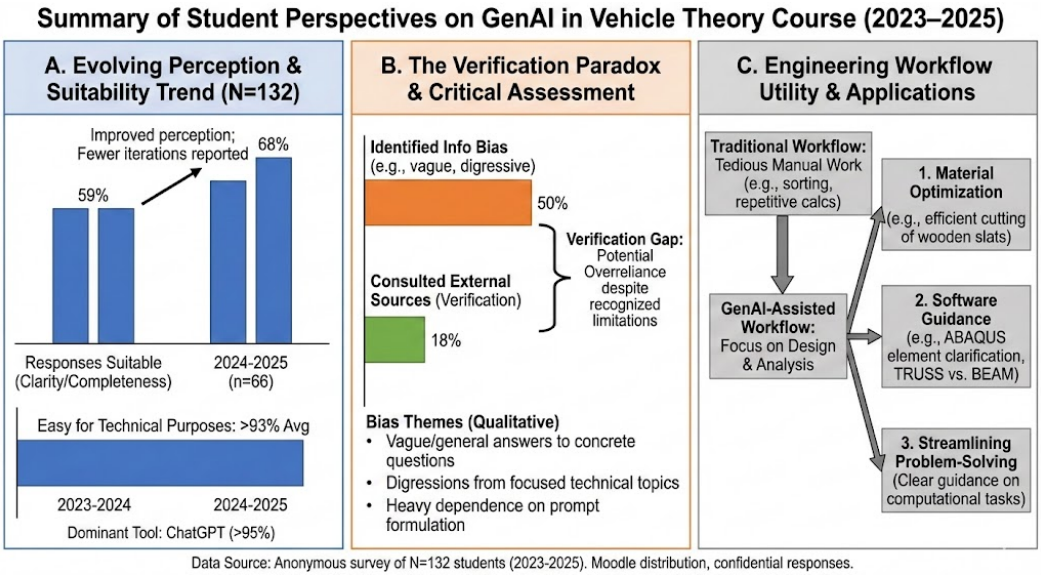

Figure 3. A summary of the student's perspective on GenAI for the Vehicle Theory course.

6. Discussion

The project experience indicates that GenAI tools, particularly ChatGPT, were widely recognized and used by students during the Vehicle Theory course. Most students reported prior exposure to GenAI, and a majority utilized these tools for academic or technical purposes. ChatGPT was the most commonly used tool, reflecting its accessibility and ease of use for engineering-related questions. Students generally found GenAI responses clear and comprehensive, and the number of iterations required to obtain satisfactory answers decreased between the 2023–2024 and 2024–2025 courses, suggesting that students quickly adapted to formulating effective prompts. While this comparison involves two distinct student years, the fundamental technical requirements and design constraints for the chassis remained identical across both years. Therefore, the observed reduction in design iterations is interpreted as a positive indicator of engineering efficiency. This demonstrates that students utilized GenAI as an effective "co-pilot" to troubleshoot finite element analysis modeling errors and reach optimized solutions more rapidly.

One of the central objectives of introducing GenAI was to support a flipped classroom approach, where students summarize previous lessons at the beginning of each session. This approach aimed to reduce absenteeism while encouraging active participation and knowledge consolidation. Survey results suggest that GenAI can partially fulfill this role, as students reported that the tools were useful for understanding theoretical concepts, completing exercises, and supporting the Vehicle Theory chassis project. Responses indicate that AI helped students navigate computational and technical challenges independently, providing structured guidance that complements classroom instruction.

However, several limitations emerged. While students reported high confidence in GenAI responses, only 18% consulted other sources to verify accuracy, despite 50% identifying information bias. This points to a risk of overreliance on AI and underscores the importance of verification to maintain academic rigor. This "verification gap" suggests a significant GenAI literacy challenge: while students are cognitively aware of potential bias, the perceived efficiency of the tool may disincentivize traditional cross-referencing. Furthermore,

students may over-rely on their own ability to self-correct technical errors, underestimating the subtle nature of AI hallucinations. Additionally, the quality of AI-generated responses depended heavily on prompt clarity. Poorly focused questions often resulted in general or tangential answers, which may limit the tool's effectiveness in fully replacing direct instruction. Tasks requiring creativity or context-dependent problem-solving were still better supported by human guidance.

If the project were conducted again, several improvements could enhance both learning outcomes and evaluation of GenAI tools. Providing structured guidance on effective prompt formulation could reduce iterations and improve answer relevance. Integrating mandatory verification exercises, where students cross-check AI outputs against authoritative sources, would mitigate overreliance and reinforce critical thinking. A systematic assessment of AI support across different project stages, including technical and creative tasks, would offer a more complete understanding of the tool's strengths and limitations.

Overall, GenAI tools showed considerable potential for enhancing learning in the Vehicle Theory course and supporting the flipped classroom model. When combined with guided instruction, iterative prompting, and verification, GenAI can facilitate independent learning, improve engagement, and reduce absenteeism, while maintaining academic rigor.

The discussion is summarized in Figure 4.

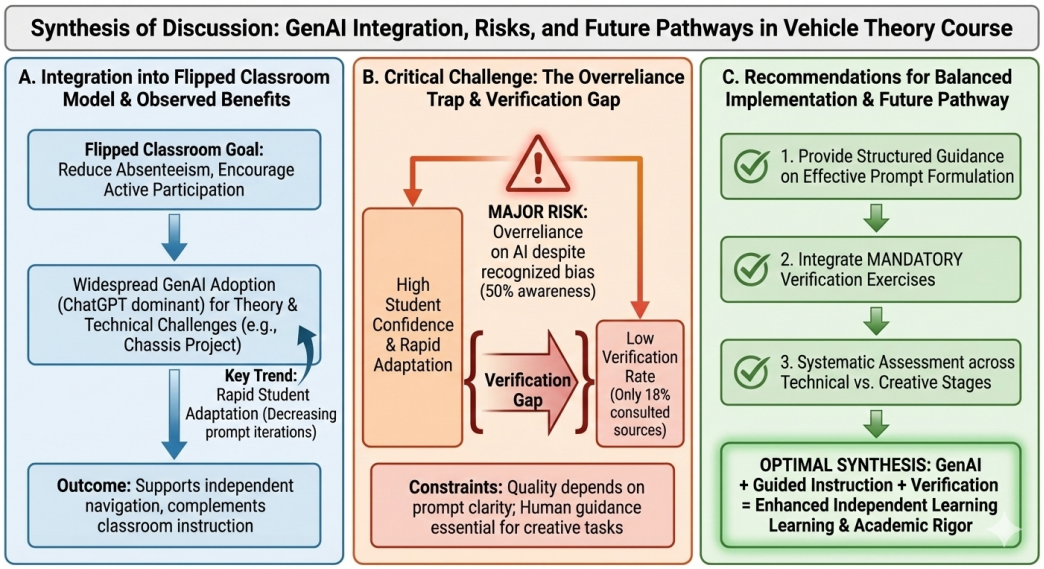

Figure 4. Discussion summary.

7. Conclusions

This paper has presented the outcomes of a two-year innovative teaching project conducted in the Vehicle Theory course, part of the fourth-year Mechanical Engineering degree at the Universidad Carlos III de Madrid. The project focused on the integration of GenAI with the dual objectives of promoting ethical academic usage and encouraging student attendance through active learning strategies, including a flipped classroom approach.

The results indicate a high degree of student satisfaction and engagement. Students reported that GenAI tools provided valuable support for project work, offering optimization strategies, initial guidance, and resources to create clearer, more visual, and attractive presentations. While GenAI currently does not provide fully developed practical applications of theoretical concepts, students recognized its potential to generate innovative ideas when combined with appropriate knowledge and guidance.

Moreover, the implementation of GenAI and active learning strategies led to observable improvements in attendance and academic performance, as reflected in enhanced

evaluation scores. Specifically, a 23% increase in average attendance was achieved compared to the previous year, which did not incorporate the flipped classroom approach. Students highlighted a desire for more practical activities and active participation to make in-person attendance more rewarding, suggesting avenues for future course development.

For future work, the integration of interactive chatbots specifically designed for Vehicle Theory could enhance learning outcomes further. These chatbots could provide real-time guidance, contextual explanations, and step-by-step problem-solving support, effectively complementing both classroom and independent learning. Tailoring chatbots to the course content would allow for more targeted responses than general-purpose GenAI tools, while also reinforcing critical thinking and verification practices.

Overall, the project demonstrates that GenAI can serve as a powerful complementary tool in engineering education. When used ethically and strategically, it supports independent learning, stimulates creativity, and contributes to better student engagement and learning outcomes, while highlighting the continued value of structured, hands-on participation in the classroom.

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Abbreviations

The following abbreviations are used in this manuscript:

AI	Artificial intelligence
GenAI	Generative artificial intelligence

Appendix A

Survey questions

1. Were you aware of any GenAI tools, such as ChatGPT, before studying Vehicle Theory? (Yes/No)
2. Have you used a GenAI tool, such as ChatGPT, prior to studying Vehicle Theory? (Yes/No)
3. Have you used GenAI tools for any academic or technical purposes before studying Vehicle Theory? (Yes/No)

4. Which GenAIs have you used as an assistant during Vehicle Theory? (ChatGPT/Bing/Bard/Others)
5. Are GenAI tools easy to use when looking for answers to technical questions or doubts at the university level? (Yes/No)
6. Are GenAI tools useful for finding answers to technical questions or doubts at the university level? (Yes/No)
7. On a scale from 0 (not useful) to 10 (very useful), please rate the usefulness of GenAI tools. (0–10 Likert scale)
8. Are GenAI answers to technical questions clear and complete? (Yes/No)
9. How many iterations were required to obtain an answer that was deemed accurate? (1/2–3/4 or more)
10. Did you consult non-GenAI sources to verify the accuracy of the GenAI answers? (Yes/No)
11. If you consulted additional sources to verify the accuracy of the GenAI answers, could this task be conducted with ease? (Yes/No)
12. Have you observed any information bias in GenAI? For example, does GenAI overexplain certain aspects to compensate for lack of knowledge in other fields? (Yes/No)
13. Please rate the accuracy of the GenAI answers on a scale of 0 (not accurate) to 10 (very accurate). (0–10 Likert scale)
14. Would you like to provide some feedback on the accuracy of the answers? (Open-ended question)
15. Do you think that GenAI tools can replace search sources such as books, research articles or libraries? (Yes/No)
16. Do you believe that GenAI can replace lectures or books to study the Vehicle Theory course? (Yes/No)
17. To which questions related to Vehicle Theory can GenAI answer properly? (Theoretical concepts | Application examples | Equations and formulas | Exercises)
18. Please evaluate the support provided by GenAI in the Vehicle Theory chassis project. Use a scale from 0 (not useful at all) to 10 (extremely useful) to rate the following aspects:
    - Basic information (0–10 Likert scale)
    - Problem formulation (0–10 Likert scale)
    - Chassis selection (0–10 Likert scale)
    - Torsional stiffness (0–10 Likert scale)
    - Chassis design (0–10 Likert scale)
    - Chassis optimization (0–10 Likert scale)
    - Finite element modelling (0–10 Likert scale)
    - Balsa wood processing (0–10 Likert scale)
    - Bibliographic research (0–10 Likert scale)

References

Bercaru, V., & Popescu, N. (2025). Exploring sign language dataset augmentation with generative artificial intelligence videos: A case study using adobe firefly-generated american sign language data. *Information*, *16*(9), 799. [CrossRef]

Cordero, J., Torres-Zambrano, J., & Cordero-Castillo, A. (2024). Integration of generative artificial intelligence in higher education: Best practices. *Education Sciences*, *15*(1), 32. [CrossRef]

Đerić, E., Frank, D., & Milković, M. (2025a). Trust in generative AI tools: A comparative study of higher education students, teachers, and researchers. *Information*, *16*(7), 622. [CrossRef]

Đerić, E., Frank, D., & Vuković, D. (2025b). Exploring the ethical implications of using generative AI tools in higher education. *Informatics*, *12*, 36. [CrossRef]

Francis, N. J., Jones, S., & Smith, D. P. (2025). Generative AI in higher education: Balancing innovation and integrity. *British Journal of Biomedical Science*, *81*, 14048. [CrossRef]

Franco, J. V. P., Naranjo-Zolotov, M., Vai, C., & Pazmino-Sarango, M. (2025, June 12–18). *Exploring psychological and technological drivers of student absenteeism in the era of artificial intelligence*. European Conference on Information Systems (ECIS) 2025, Amman, Jordan.

Fulsher, A., Pagkratidou, M., & Kendeou, P. (2025). GenAI and misinformation in education: A systematic scoping review of opportunities and challenges. *AI & Society*, 1–13. [CrossRef]

Garcia-Pozuelo, D., Olatunbosun, O., Yunta, J., Yang, X., & Diaz, V. (2017). A novel strain-based method to estimate tire conditions using fuzzy logic for intelligent tires. *Sensors*, *17*(2), 350. [CrossRef] [PubMed]

Grassini, S. (2023). Shaping the future of education: Exploring the potential and consequences of AI and ChatGPT in educational settings. *Education Sciences*, *13*(7), 692. [CrossRef]

Huang, Y., Zhang, K., & Li, S. (2025). How postgraduates navigate GenAI's dual pathways between research creativity and academic plagiarism: Research engagement and self-regulated learning matter. *Studies in Higher Education*, 1–22. [CrossRef]

Huynh, L., & McNamara, D. S. (2025). GenAI-powered text personalization: Natural language processing validation of adaptation capabilities. *Applied Sciences*, *15*(12), 6791. [CrossRef]

Imran, M., & Almusharraf, N. (2024). Google Gemini as a next generation AI educational tool: A review of emerging educational technology. *Smart Learning Environments*, *11*(1), 22. [CrossRef]

Kamruzzaman, M., Salinas, J. S., Kolla, H., Sale, K. L., Balakrishnan, U., & Poorey, K. (2025). GenAI-based digital twins aided data augmentation increases accuracy in real-time cokurtosis-based anomaly detection of wearable data. *Sensors*, *25*(17), 5586. [CrossRef]

Kovari, A. (2025). Ethical use of ChatGPT in education—Best practices to combat AI-induced plagiarism. *Frontiers in Education*, *9*, 1465703. [CrossRef]

Llerena-Izquierdo, J., Mendez-Reyes, J., Ayala-Carabajo, R., & Andrade-Martinez, C. (2024). Innovations in introductory programming education: The role of ai with google colab and gemini. *Education Sciences*, *14*(12), 1330. [CrossRef]

Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences*, *13*(4), 410. [CrossRef]

Martínez-Peláez, R., Mena, L. J., Toral-Cruz, H., Ochoa-Brust, A., Potes, A. G., Flores, V., Ostos, R., Pacheco, J. C. R., Félix, R. A., & Félix, V. G. (2025). Can large language models foster critical thinking, teamwork, and problem-solving skills in higher education?: A literature review. *Systems*, *13*(11), 1013. [CrossRef]

Meléndez-Useros, M., Jiménez-Salas, M., Viadero-Monasterio, F., & Boada, B. L. (2023). Tire slip H∞ control for optimal braking depending on road condition. *Sensors*, *23*(3), 1417. [CrossRef]

Naznin, K., Al Mahmud, A., Nguyen, M. T., & Chua, C. (2025). ChatGPT integration in higher education for personalized learning, academic writing, and coding tasks: A systematic review. *Computers*, *14*(2), 53. [CrossRef]

Rai, S., Abubakar, A. A., Shetty, R., Bijur, G., Shetty, N. K., & Kumar, A. P. (2025). Diagnosis of sarcoidosis through supervised ensemble method and GenAI-based data augmentation: An intelligent diagnostic tool. *Applied Sciences*, *15*(22), 12213. [CrossRef]

Rajamani, R. (2006). *Vehicle dynamics and control*. Springer.

Ribeirinha, T., Santos, R., & Correia, M. (2025). Exploring the educational acceptance and use of artificial intelligence tools: Perceptions among portuguese university students. *Trends in Higher Education*, *4*(4), 77. [CrossRef]

Swacha, J., & Gracel, M. (2025). Supporting serious game development with generative artificial intelligence: Mapping solutions to lifecycle stages. *Applied Sciences*, *15*(21), 11606. [CrossRef]

Thampanichwat, C., Wongvorachan, T., Sirisakdi, L., Chunhajinda, P., Bunyarittikit, S., & Wongmahasiri, R. (2025). Mindful architecture from text-to-image AI perspectives: A case study of DALL-E, Midjourney, and Stable Diffusion. *Buildings*, *15*(6), 972. [CrossRef]

Tillmanns, T., Salomão Filho, A., Rudra, S., Weber, P., Dawitz, J., Wiersma, E., Dudenaite, D., & Reynolds, S. (2025). Mapping tomorrow's teaching and learning spaces: A systematic review on GenAI in higher education. *Trends in Higher Education*, *4*(1), 2. [CrossRef]

Viadero-Monasterio, F., Boada, B., Boada, M., & Díaz, V. (2022). H∞ dynamic output feedback control for a networked control active suspension system under actuator faults. *Mechanical Systems and Signal Processing*, *162*, 108050. [CrossRef]

Viadero-Monasterio, F., Nguyen, A.-T., Lauber, J., Boada, M. J. L., & Boada, B. L. (2023). Event-triggered robust path tracking control considering roll stability under network-induced delays for autonomous vehicles. *IEEE Transactions on Intelligent Transportation Systems*, *24*(12), 14743–14756. [CrossRef]

Wang, K., & Guo, Z. (2025). Can learners' use of GenAI enhance learning engagement?—A meta-analysis. *Education Sciences*, *15*(12), 1578. [CrossRef]

Wei, L., Yu, Y., Qin, Y., & Zhang, S. (2025). From tools to creators: A review on the development and application of artificial intelligence music generation. *Information*, *16*(8), 656. [CrossRef]

Yavich, R., & Davidovitch, N. (2024). Plagiarism among higher education students. *Education Sciences*, *14*(8), 908. [CrossRef]

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