

LIMITATIONS OF THE USE OF CHATGPT TECHNOLOGY FOR LEARNING TECHNICAL SUBJECTS IN ARCHITECTURE

María Jesús Morales-Conde¹, Paola Villoria-Sáez², Manuel Alejandro Pedreño-Rojas²,
& César Porrás-Amores²

¹*Departamento de Construcciones Arquitectónicas I, ETS Arquitectura, Universidad de Sevilla,
Av. Reina Mercedes 2, Seville 41013 (Spain)*

²*TEMA Research Group, ETS Edificación, Universidad Politécnica de Madrid,
Av. Juan de Herrera 6, Madrid 28040 (Spain)*

Abstract

The integration of digital technologies into education has long sparked debate among educators, often dividing opinion between those who embrace innovation and those who warn against its unintended consequences. The recent emergence of Artificial Intelligence (AI) marks a significant turning point in this ongoing transformation. Following the foundational principles introduced at the 1956 Dartmouth Conference, AI has developed into a set of powerful tools, among which ChatGPT—released by OpenAI in 2022—stands out for its capacity to generate natural language responses, simulate reasoning, and assist in problem-solving tasks across disciplines. This research evaluates the application of ChatGPT as a pedagogical support tool in the context of a technical subject within the *Bachelor's Degree in Fundamentals of Architecture* at the *University of Seville*. Conducted within the course “*Construcción 5: Rehabilitación*”, the study involved 32 students who used ChatGPT to analyze building damage based on photographic evidence and generate construction detail proposals for intervention. The activity was designed to assess AI's performance in three core learning objectives: (1) identifying typical pathologies in existing buildings; (2) formulating a diagnosis based on boundary and material conditions; and (3) proposing technical solutions through graphic and descriptive representation. Methodologically, the study was structured in two phases: first, students submitted building damage images and prompted ChatGPT for a diagnostic explanation; second, they requested the generation of constructive repair details. Student outputs were compared with AI-generated content and evaluated in terms of accuracy, graphical validity, and pedagogical value. The results show that while ChatGPT can support textual analysis and help students frame initial hypotheses, it lacks the precision and graphic reasoning required in construction-based assignments. Most notably, its inability to generate reliable technical drawings underscores its current limitations in architecture education. The findings affirm that, although generative AI offers valuable support for idea generation and autonomous learning, it cannot replace the expertise and judgment of educators in teaching technical subjects related to building rehabilitation.

Keywords: *ChatGPT, architectural education, technical learning limitations, building pathology, AI in construction.*

1. Introduction

Artificial Intelligence (AI) refers to the ability of computational systems—whether mobile devices, personal computers, or robotics platforms—to perform tasks that have traditionally required human intelligence. These tasks include understanding natural language, solving complex problems, learning from data, and making informed decisions. The conceptual foundations of AI were formally established in 1956 by John McCarthy during the Dartmouth Conference, where it was proposed that “every aspect of learning or any other feature of intelligence can, in principle, be so precisely described that a machine can be made to simulate it” (McCarthy et al., 2006). Since then, AI has evolved from theoretical models to real-world applications that are now embedded in everyday life and work. From medical diagnostics to financial forecasting, AI has redefined processes across multiple sectors. The field of education, in particular, has witnessed a dramatic transformation in the past decade, with AI being positioned as a catalyst for personalizing learning, automating feedback, and improving educational efficiency (European Commission, 2019).

Among the most prominent advancements in the field is ChatGPT (Chat Generative Pre-trained Transformer), a conversational AI model developed by OpenAI. First released in its Plus and GPT-4 versions in November 2022, ChatGPT rapidly gained global attention. By mid-2023, it had become a widely used tool in educational environments, thanks to its ability to generate written content, answer queries, summarize texts, and even suggest solutions to complex problems. Its interface, accessible via web browser and increasingly integrated into productivity platforms, has made it an easy point of entry into generative AI for students and educators alike.

However, the growing ubiquity of ChatGPT in education has sparked a range of debates. On the one hand, it promises to democratize access to information, support autonomous learning, and offer real-time assistance to learners. On the other, it raises serious concerns about academic integrity, critical thinking, and intellectual dependency. According to Rosser and Soler (2024), the immediacy with which students can generate any type of text—essays, analyses, summaries—may discourage the development of deeper cognitive skills. Chukwuere (2024) adds that overuse of AI tools risks fostering technological dependence and reducing essential interpersonal interactions in educational contexts. Ethical concerns also surround the integration of AI in education. The Council of Europe’s 2023 report on AI and Education stresses the need to evaluate AI systems through the lens of human rights, democracy, and the rule of law (Holmes et al., 2023). Questions of bias, transparency, and algorithmic accountability remain unresolved, especially in high-stakes academic environments. Furthermore, educators have voiced fears that AI could one day replace teaching roles or be used to automate certain educational functions, potentially leading to job displacement (Fowler, 2022). Despite these concerns, some scholars argue for a balanced and strategic use of AI. Girón Jiménez et al. (2024) highlight how tools like ChatGPT can support idea generation and scaffold autonomous learning when used within a well-structured pedagogical framework. They suggest that the key lies not in rejecting AI, but in guiding its application to enhance, rather than replace, traditional learning. In architectural education, these capabilities have both clear benefits and evident constraints. The technical nature of architectural learning involves not only linguistic and theoretical comprehension but also spatial reasoning, material logic, and graphic communication. For example, generating a diagnostic report for a pathological condition in a building might fall within ChatGPT’s scope. However, producing a reliable, detailed construction drawing based on that diagnosis remains far beyond its current graphical and contextual capabilities.

This study aims to contribute to that discussion by analyzing the practical results of integrating ChatGPT into a university-level technical assignment in architecture. It focuses on the students' ability to interact with the tool for the diagnosis of building pathologies and the generation of construction repair details, highlighting the strengths, weaknesses, and pedagogical implications of such an approach.

2. Objectives

The primary objective of this study is to critically assess the potential and limitations of using ChatGPT as an educational support tool in the learning of technical content within architectural education. The focus is placed on its role in assisting the understanding of building pathologies and the generation of construction detail drawings.

More specifically, the study seeks to:

1. **Evaluate the reliability of ChatGPT’s diagnostic capabilities** when analyzing structural pathologies based on photographic input and descriptive context provided by students.
2. **Assess the effectiveness of ChatGPT in generating construction detail drawings**, either through image-based outputs or detailed textual descriptions that can be interpreted graphically.
3. **Compare AI-generated content with student-developed outputs**, highlighting discrepancies, complementarities, and pedagogical implications.
4. **Document student engagement and interaction with the tool**, including the number of prompts required, the clarity of instructions, and the language used.
5. **Reflect on the broader implications of integrating generative AI tools into architectural education**, particularly in disciplines where visual-spatial literacy is critical.

3. Methodology

3.1. Educational context

The study was conducted during the 2025 spring semester at the *Escuela Técnica Superior de Arquitectura* of the *University of Seville*, within the subject “*Construcción 5: Rehabilitación*”, part of the Bachelor's Degree in Fundamentals of Architecture. This is a fifth-semester, compulsory subject, which focuses on structural diagnosis, rehabilitation strategies, and repair techniques in existing buildings. The participants consisted of 32 students, all in their fourth academic year. The subject is heavily technical and

includes both theoretical and practical components, such as the identification of real-world pathologies, analysis of causes, and the design of constructive interventions.

3.2. Activity design

Phase 1: Pathology diagnosis via ChatGPT

Students were asked to identify a building lesion—typically a crack, moisture damage, or material deterioration—either from their own surroundings or from curated examples provided by the instructors. Each student had to: capture and submit a photograph of the lesion; provide contextual information about the building’s typology, materials, structure, and environment.; input this visual and contextual data into ChatGPT (via GPT-4 or GPT-4 with Vision); request a diagnostic explanation from the AI, including possible causes and contributing factors; compare the AI’s diagnosis with their own analytical conclusions, informed by the course’s theoretical framework.

Phase 2: Construction detail proposal

Once the cause of the lesion was determined, students moved on to the repair phase. Here they were instructed to: ask ChatGPT to generate a technical detail drawing or detailed description of the constructive solution; interpret, critique, and/or complete the AI-generated drawing or textual description; draw their own solution using manual or CAD tools, integrating both course knowledge and any useful elements from the AI output.

3.3. Deliverables and evaluation

Each student submitted a single PDF report including:

- A screenshot or transcript of their interaction with ChatGPT.
- The AI-generated diagnosis and the student’s own analysis.
- The AI-generated drawing (if available) and the student’s detailed repair drawing.
- A reflective section discussing ChatGPT’s usefulness, reliability, and educational value.
- A completed survey on their interaction with the tool, covering aspects such as: language used for prompts (Spanish/English), number of iterations to achieve a useful result, time invested in the interaction, most effective phrases or strategies used, perceived difficulty of the task for the AI.

3.4. Data analysis

The collected data were evaluated along four dimensions:

1. **Diagnostic precision** – consistency and plausibility of AI-provided causes relative to technical expectations.
2. **Graphic generation quality** – clarity, usefulness, and constructiveness of the AI-generated detail drawings or descriptions.
3. **Student engagement and feedback** – satisfaction levels, critical reflections, and perceived learning benefits.
4. **Pedagogical coherence** – the alignment of AI use with the learning objectives of the course and the expected professional competencies.

4. Results and discussion

The implementation of ChatGPT in the context of a technical architecture course produced a range of outcomes, some promising and others revealing significant limitations of the tool. The results are organized into three main categories: diagnostic accuracy, quality of graphic output, and student perception and engagement.

4.1. Diagnostic accuracy: Reliable but dependent on context

Most students reported that ChatGPT provided accurate and plausible diagnoses when given a clearly described image and sufficient contextual information. In the example provided by one of the students, a photo was submitted showing a crack above a window lintel on a façade adjacent to a demolished neighboring building. After being fed detailed information about the building’s construction system—including load-bearing walls, foundation type, and historical context—ChatGPT correctly hypothesized that the crack was due to a loss of lateral confinement and foundation settlement—precisely the same conclusion reached by the student.

“The AI’s response matched the analysis taught in class. It even added structural criteria like flexural deformation and lack of reinforced lintels,” a student noted.

These cases highlight the model's ability to simulate critical reasoning, provided that it is guided with sufficiently rich and accurate input. In contrast, vague or minimal prompts led to generic or inconclusive answers, underscoring the importance of prompt engineering and technical vocabulary.

4.2. Graphical output: A major limitation

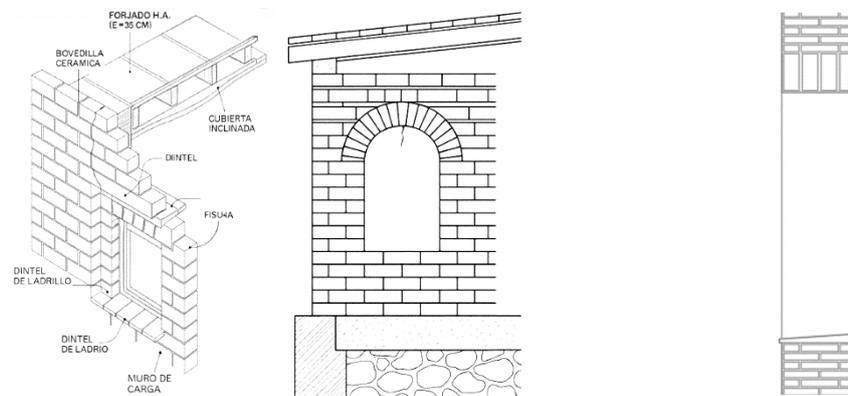
The second phase of the activity, which required ChatGPT to generate construction detail drawings, exposed the tool's most significant limitation. While some versions of GPT-4 can generate basic images (through plugins or external platforms), none of the graphical content produced was technically valid without substantial human intervention.

Students reported various issues:

- Diagrams were not to scale and lacked constructive coherence (e.g., inverted material layers, missing elements such as damp-proof courses or anchors).
- ChatGPT failed to correctly interpret requests for sections or axonometries.
- Labels were often incomplete, misplaced, or inconsistent with architectural conventions.
- In some cases, the tool returned decorative or conceptual illustrations rather than technical details.

In total, 91% of students indicated that ChatGPT was unsatisfactory or unusable for technical drawing, despite successfully generating textual descriptions of repair processes. These limitations are attributable to the model's current lack of spatial reasoning and graphic syntax.

Figure 1. Comparison between AI-generated (left) and student-generated (right) detail drawing for a façade crack repair.



4.3. Student interaction and critical reflections

The structured survey revealed the following quantitative trends:

- 85% of students agreed that ChatGPT was helpful for diagnosing pathologies, especially when fed detailed background data.
- 70% required more than 15 interactions (prompts) to refine ChatGPT's response to a usable form.
- Only 9% found the AI-generated drawings immediately usable.
- 100% used the tool in Spanish, with some experimenting in English to see if it improved results.
- 100% of students affirmed that ChatGPT is only useful as a complement, not as a substitute for their technical skills.

One of the most recurrent themes in student reflections was the importance of context building in their interactions with ChatGPT. Those who approached the AI with specific, layered, and sequenced prompts reported better results than those who used general instructions. This supports the idea that students using AI must first master the content themselves to know how to "instruct" the tool effectively. These findings align with previous academic literature. Girón Jiménez et al. (2024) advocated for the integration of AI within ethical and critical frameworks. Similarly, Chukwuere (2024) pointed to the dangers of over-reliance on AI and reduced peer interaction. In our study, we observed that those students who used ChatGPT as a partner, not a solution gained the most educationally from the experience. In conclusion, the results emphasize that the role of ChatGPT in architectural education must be complementary, scaffolded, and critically monitored. As the technology evolves, its capacity to integrate with architectural representation software (e.g., BIM, CAD) could potentially transform its usefulness. For now, however, human oversight remains essential, especially in visual and constructive aspects of the discipline.

5. Conclusions

The use of ChatGPT in the course “*Construcción 5: Rehabilitación*” allowed for a pedagogically rich experiment in integrating generative AI into technical education. The experience revealed a complex and nuanced picture of its potential and limitations.

On the one hand, ChatGPT proved to be an effective support tool for diagnosing construction pathologies, especially when used with structured, detailed input. The model’s textual capabilities enabled students to reflect critically on the causes of structural damage and compare their own hypotheses with automated reasoning. In this way, the tool fostered metacognitive engagement, supported early-stage decision-making, and even introduced alternative interpretations not initially considered by students. However, the most evident limitation was its incapacity to generate reliable construction detail drawings. Despite multiple iterations and clarifications, ChatGPT failed to meet the standards required in a technical architecture context. The lack of graphic precision, structural logic, and representational standards indicates that AI is not yet capable of replacing the graphical competencies that students must develop. This finding is consistent with broader critiques found in the literature (Chukwuere, 2024; Zapata-Ros, 2023).

This study confirms that ChatGPT can play a valuable, yet limited role in architectural education. Its incorporation into the classroom should be deliberate, guided, and critically mediated by educators. Used wisely, it can promote reflection, comparison, and idea generation—but always as a supplementary tool, never as a substitute for analytical or graphical rigor. Looking ahead, the continued evolution of AI—especially in its integration with BIM, CAD, or image-based reasoning—may enhance its utility in technical subjects. Until such developments occur, human oversight, architectural judgment, and representational skills remain irreplaceable pillars of architectural training.

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