

ChatGPT's Performance on the Fundamentals of Engineering (FE) Exam: A Spotlight on Flaws in Engineering Education

Collins Chike Kwasi-Effah

Department of Mechanical Engineering, Faculty of Engineering, University of Benin, Edo State, Nigeria

Introduction

In recent years, the rise of artificial intelligence (AI) tools like ChatGPT has generated significant interest in how these systems perform in traditionally human-dominated domains. Specifically, ChatGPT's use in educational settings has sparked discussions about the role of AI in various professional fields. Several studies have tested ChatGPT on professional exams, including the Fundamentals of Engineering (FE) exam, which is a key milestone for aspiring engineers in the United States. This report explores how ChatGPT's performance on the FE exam highlights potential gaps in engineering education, particularly concerning the emphasis on formulaic assessments and memorization-based learning.

Case Study: Fundamentals of Engineering (FE) Exam Performance

Several studies, including those by the American Society for Engineering Education (ASEE), have evaluated ChatGPT's ability to tackle questions from the FE exam, which assesses the fundamental competencies of engineers across disciplines like mechanical, civil, and environmental engineering. The studies have shown that ChatGPT (specifically versions GPT-3.5 and GPT-4) achieved moderate success on these exams, with scores ranging from 63% to 76% correct answers depending on the version used [1-3].

For instance, in one study, GPT-4 performed well on multiple-choice questions in the FE exam that required formula-based calculations and factual recall. However, when it came to more complex problems requiring a deep understanding of engineering principles, ChatGPT struggled. The AI model confidently produced incorrect answers on questions involving advanced problem-solving, design considerations, or real-world application of engineering concepts [1-2].

Over-reliance on Formulaic Assessments

The results of ChatGPT's performance point to a broader issue in engineering education: the over-reliance on formulaic question types and memorization-based assessments. Engineering students are often assessed on their ability to recall and apply standard formulas to solve structured problems, which AI models like ChatGPT can handle effectively. However, real-world engineering practice demands much more than simple recall—it requires the ability to address nuanced, open-ended problems, often under conditions of uncertainty.

As ChatGPT demonstrated, AI can perform well when questions are limited to clear-cut numerical problems or predefined methods, but it struggles with the critical thinking, creativity, and complex decision-making that are central to the practice of engineering. This highlights a key flaw in the current assessment methods used in many engineering programs, where rote learning and standardized testing are still prevalent.

Implications for Engineering Education

The ability of ChatGPT to pass portions of the FE exam should prompt educators and institutions to reconsider how they assess fundamental engineering skills. Current exams like the FE focus heavily on

quantitative analysis and the ability to perform calculations using established methodologies. However, future engineers need more than just technical knowledge—they must also possess strong problem-solving skills, ethical judgment, and the ability to adapt to complex, unstructured situations, all areas where AI tools fall short [2-4].

By highlighting these shortcomings, ChatGPT's performance on the FE exam serves as a call to action for educators. There is a growing need to shift the focus of engineering education from traditional, memorization-heavy assessment methods toward more experiential learning, project-based evaluations, and case studies that mimic the complexities of real-world engineering challenges. These types of assessments encourage students to apply theoretical knowledge in practical settings, fostering deeper understanding and innovation.

Conclusion

The findings from studies on ChatGPT's performance on the FE exam expose significant flaws in the current structure of engineering education, where passing standardized tests is often seen as a benchmark of competence. However, as AI continues to advance, these assessments may become less reliable indicators of a student's ability to succeed in real-world engineering. This raises important questions about the future of engineering education and how best to equip the next generation of engineers with the skills they truly need.

By rethinking assessment methods to prioritize critical thinking, creativity, and real-world application over rote memorization, educational institutions can ensure that engineers are not only technically proficient but also equipped to tackle the complex and evolving challenges of the profession.

References:

- [1] ASEE Annual Conference. (2024). Traditional Engineering Assessments Challenged by ChatGPT: An Evaluation of its Performance on a Fundamental Competencies Exam. American Society for Engineering Education. Retrieved from [https://nemo.asee.org/public/conferences/344/papers/43635/view\(ASEE\)](https://nemo.asee.org/public/conferences/344/papers/43635/view(ASEE)).
- [2] Frenkel, M., & Emara, H. (2023). ChatGPT & Mechanical Engineering: Examining performance on the FE Mechanical Engineering and Undergraduate Exams. arXiv. Retrieved from [https://arxiv.org/abs/2309.15866\(ar5iv\)](https://arxiv.org/abs/2309.15866(ar5iv)).
- [3] Pursnani, V., & Sermet, Y. (2023). Performance of ChatGPT on the US Fundamentals of Engineering Exam: Comprehensive Assessment of Proficiency and Potential Implications for Professional Environmental Engineering Practice. arXiv. Retrieved from [https://arxiv.org/abs/2304.12198\(ar5iv\)](https://arxiv.org/abs/2304.12198(ar5iv)).
- [4] Collins Chike Kwasi-Effah. (2024). An Introduction to Artificial Intelligence in Mechanical Engineering. *NIPES - Journal of Science and Technology Research*. <https://doi.org/10.5281/zenodo.11864622>