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The impact of ChatGPT in databases courses

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***Abstract*— This paper examines the impact of artificial intelligence (AI) in education, with a specific focus on its application in database courses. Utilizing ChatGPT, a language model developed by OpenAI, we analyze how AI can be used to enhance the teaching and learning of database design and management. The study explores two use cases of ChatGPT: as an assessment tool for students and as a tool for devising exercises. Results indicate that ChatGPT has the potential to improve the efficiency of education, personalize learning and improve decision-making. The use of this kind of tools makes important to focus the students evaluation on the student's ability to explain their work, both in writing and in an oral setting, to demonstrate their understanding of the material.**

Keywords—databases, course assessment, ChatGPT

I. Introduction

Recent advancements in Artificial Intelligence (AI) have led to its integration in various aspects of our daily lives, including education. AI in education aims to enhance human capabilities, promote collaboration between humans and machines, and support human rights and sustainable development.

Some examples of AI in education include: virtual learning assistants, such as IBM's Watson Tutor, which can provide personalized feedback and guidance to students [1], adaptive learning platforms, like Knewton, which use AI algorithms to adapt the learning experience to the individual needs of each student [2], intelligent tutoring systems, like ALEKS, which uses AI to assess students' knowledge and provide personalized instruction [3], AI for Automated Essay Scoring (AES), which uses AI to score student essays [4], Recommending or providing personalised contents, which use AI to recommend or provide contents tailored to the needs of each student [5], Performance evaluation and assistance based on AI (StuDiAsE) for engineering learners, which use AI to evaluate and assist engineering learners in their performance [6], and predictive analytics, which uses AI to analyse data about students and predict their performance, allowing educators to intervene early when students are at risk of falling behind [7]. ChatGPT is an example of these advances in AI[1]. It is an AI-powered language model developed by OpenAI, which is trained on a large corpus of text (570GB updated till 2021) and can generate texts in different languages with high accuracy [8]. It can provide information and explain it in a realistic and effective manner.

In this article, we aim to analyse how the use of AI impacts the database subject in computer science and multimedia degrees with special focus on the learning and assessment processes of students

II. Databases subject

The primary objective of the database course is to provide students with a comprehensive understanding of database concepts and technologies. This includes the process developing databases through designing conceptual models and implementing them using SQL language.

The course is designed to foster active learning, where students take a leading role in their own education. The teaching methodology is interactive and participatory, with lectures supplemented by hands-on exercises and activities in class, as well as guided projects led by the course instructors. The course also includes continuous evaluation exercises, where students are given the opportunity to practice their skills. These assessments are designed to evaluate the students' ability to design conceptual and relational models, create SQL queries, and explain their work. The professors review and evaluate the quality of the conceptual models (drawings) and SQL queries (code) as well as the explanations provided by the students to describe their work.

With the aim of studying the impact of the use of ChatGPT by the students, we have used ChatGPT for two use cases: to carry out the assessments as students and to devise exercises as the one we currently have in the course.

III. Use cases and results

We have used ChatGPT in three use cases: the first two to solve real continuous assessments and the last one to devise SQL exercises.

A. Conceptual and relational model exercise

To design the conceptual model, we utilized the capabilities of ChatGPT by inputting the requirements into the interface. The output provided by the model was a list of entities with their

[1] https://openai.com/blog/chatgpt/

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respective attributes. We then asked for relationships between the entities, and ChatGPT provided explanations on the type of relationships and their cardinalities. Then, we queried for primary keys and ChatGPT provided suggestions for suitable primary keys for the entities. Lastly, we ask ChatGPT to transform the conceptual model into a relational model. The answer was a list of tables and columns with primary and foreign key suggestions. In order to evaluate the output of ChatGPT, we focused on the quality of the conceptual and relational models. We acknowledged that ChatGPT is not able to provide a graphic diagram, thus we evaluated the textual answer of ChatGPT as if it were a diagram.

The conceptual model was graded with a score of 4,5 out of 10 and the relational model was graded with a score of 3. The main errors identified in the output of ChatGPT were related to not generalizing entities, errors in relationship cardinalities, and attributes not being included in the correct entities or relations. These are common errors made by students as well.

B. *SQL queries exercise*

This kind of exercises students has to solve around 10 questions on the same relational model. In this case, we prompt ChatGPT with the textual requirements: relational model in schema mode and the query (e.g., *Select the users with most comments. In case of a tie, sort by the username*). We conducted tests with two levels of difficulty to evaluate the performance of ChatGPT in answering SQL queries. For the basic SQL queries, ChatGPT's answers were almost perfect, and the queries ran successfully giving the expected results. However, for the more difficult exercise, the answers were not so good. We had to provide multiple corrections to ChatGPT in order to arrive at partially correct answers. Those corrections required strong SQL knowledge.

The basic exercise was graded with an 8 out of 10 and the advanced exercise with a 2.5 out of 10. The main errors identified in the output of ChatGPT were related to a poor interpretation of the relational model and the statement, particularly when the statement was ambiguous or confusing. This kind of statements are intended to challenge students with requirements that may be encountered in real-world scenarios.

C. *Devising SQL exercises*

In this use case, we employed ChatGPT to generate SQL query-based exercises based on a relational model provided by us. The output provided by ChatGPT was a statement and a SQL query, which with some minor manual modifications, ran successfully on our database. We were also able to prompt ChatGPT to generate additional queries, providing different exercises for the students. However, a limitation of this approach is the design of the exercises. Sometimes, a specific type of query is needed (e.g., the use of LEFT JOINs with the right table columns equal to null) and it can be challenging to ask ChatGPT to generate such queries. To overcome this limitation, we provided examples of the specific types of queries we needed and trained ChatGPT to generate new exercises. In this way, we were able to create a diverse set of exercises that are suitable for the students.

CONCLUSIONS

The use of ChatGPT as a tool to assist students in their learning process has the potential to be highly beneficial. The tool can be used to generate summaries, abstracts, and provide suggestions for grammar and sentence structure to help students communicate their knowledge effectively.

However, it is important to note that ChatGPT is not a magic solution that will help students cheat. In order to fully benefit from the tool, students need to have a solid understanding of the course material and be able to critically evaluate the answers provided by ChatGPT. The tool should be viewed as a way to enhance the students' learning experience by providing them with an efficient and effective tool to improve their communication and writing. The use of ChatGPT will not replace the need for students to master the course material but will help them to communicate and apply their knowledge in a more effective way.

We recognize that ChatGPT can be a useful tool for searching and organizing information, but it should be used with caution and scrutiny as we cannot ensure the quality of the source information it queries, and it does not disclose its sources.

This kind of tools might turn the evaluation processes to focus on the student's ability to explain their work, both in writing and in an oral setting, regardless of whether or not they used ChatGPT to assist them in their work. The emphasis should be on how well the student can explain their thought process, the logic behind their code, and their understanding of the problem-solving approach taken. This approach to evaluation will ensure that students are not simply relying on the output of ChatGPT and will encourage them to take an active role in their own learning process.

REFERENCES

[1] D. A. Ferrucci. 2012. Introduction to "This is Watson". IBM J. Res. Dev. 56, 3 (May 2012), 235–249. https://doi.org/10.1147/JRD.2012.2184356.

[2] Thomas A. Conklin, 2016: Knewton (An adaptive learning platform available at https://www.knewton.com/). AMLE, 15, 635–639, https://doi.org/10.5465/amle.2016.0206.

[3] Harati, H., Sujo-Montes, L.E., Tu, C., Armfield, S.W., & Yen, C. (2021). Assessment and Learning in Knowledge Spaces (ALEKS) Adaptive System Impact on Students' Perception and Self-Regulated Learning Skills. Education Sciences.

[4] Perin, D., & Lauterbach, M. (2018). Assessing text-based writing of low-skilled college students. International Journal of Artificial Intelligence in Education, 28(1), 56–78. https://doi.org/10.1007/s40593-016-0122-z.

[5] Kose, U., & Arslan, A. (2016). Intelligent e-Learning system for improving students' academic achievements in computer programming courses. International Journal of Engineering Education, 32(1, A), 185–198

[6] Samarakou, M., Fylladitakis, E. D., Früh, W. G., Hatziapostolou, A., & Gelegenis, J. J. (2015). An advanced eLearning environment developed for engineering learners. International Journal of Emerging Technologies in Learning, 10(3), 22–33. https://doi.org/10.3991/ijet.v10i3.4484.

[7] Anjeela Jokhan, Bibhya Sharma & Shaveen Singh (2019) Early warning system as a predictor for student performance in higher education blended courses, Studies in Higher Education, 44:11, 1900-1911, DOI: 10.1080/03075079.2018.1466872.

[8] Brown, T. B., Mann, B., Ryder, N., … Amodei, D. (2020). Language Models are Few-Shot Learners. doi:10.48550/ARXIV.2005.14165