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Teaching Database Knowledge Through AI Prompt Engineering

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Hook

In database design courses, AI can serve as a tutor, collaborator, and coding assistant. As generative AI becomes integral to the workplace, students must learn to design prompts and evaluate AI output, transforming from passive learners into active developers of intelligent systems.

Abstract

Database knowledge is essential for students of information systems and analytics, and increasingly, they must interact with generative AI to support their projects and succeed in the workforce. The interaction with AI will help them learn a subject, understand a business problem, develop system logic, or generate the necessary code or output. However, AI's responses to prompts may not be consistent, complete, or accurate, so it is essential to understand the importance of training AI to meet specific needs or to provide improved prompts through prompt engineering. This assignment aims to demonstrate the importance of understanding and recognizing database terms to enhance and train their AI, and to help students develop an equally well-trained model as they work on course projects. Additionally, by discussing differences and interacting with other students, the students will also build a learning community.

Keywords: Critical Thinking, Database, Generative AI in teaching, Prompt Engineering

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1. INTRODUCTION

Databases are the memory of an organization storing its data, and SQL is still recognized as one of the most important technical skills for anyone performing analysis (Cummings, Matthews, & Janicki, 2025). This case is designed to support the suggested approach of utilizing AI in teaching Database (Zhang, 2025). One of the suggested uses for generative AI is to aid system design. In this case, we utilize generative AI to help determine entities and attributes for a database that would store data for cross-country races using text prompts. The responses should then be analyzed to see if the proper entity relationship diagram (ERD) type and detail are supplied.

2. CASE SUMMARY

The students will interact with generative AI to improve prompts related to creating an ERD to store cross-country meet results. The use of generative AI enables instructors to "flip the classroom" by allowing students to explore topics and experiment outside of class, thereby providing more time for higher-level learning within the class or during video calls with students (Algarni, 2025; Kasneci et al., 2023). The students need to evaluate their individual AI responses within groups and/or on discussion boards to determine if the responses are accurate and consistent. The idea is to utilize generative AI as a powerful tool to enhance the classroom, which has been found to improve classroom effectiveness across all age groups (Algarni, 2025).

3. ENTITY RELATIONSHIP MODELING

ERDs serve as a visual representation of the database's data structure. ERDs diagram the entities, which are the main concepts that become tables within databases, and the attributes that describe these entities, representing the fields within a table, and their relationships, which represent how the entities are related. ERDs can have a range of complexities, ranging from conceptual models to logical models to physical models (Figure 1).

Conceptual models typically provide a high-level representation of entities and their relationships, and optionally, they may also record high-level attributes. Logical ERDs will include attributes, including key attributes, that will eventually enable connections between the tables. Logical ERDs are also typically normalized, a process that organizes a relational database to reduce the number of potential anomalies and improve data integrity. This transition represents a need to advance in understanding database design and its related concepts.

Additional steps are taken as ERDs are converted into physical models, which are then ready to be implemented within the database. These may include reducing composite attributes to their simple forms, removing derived attributes, adding fields that require storage, denormalizing data, and determining the final data types to be stored. This transition again represents a step that requires additional knowledge of database design and terminology.

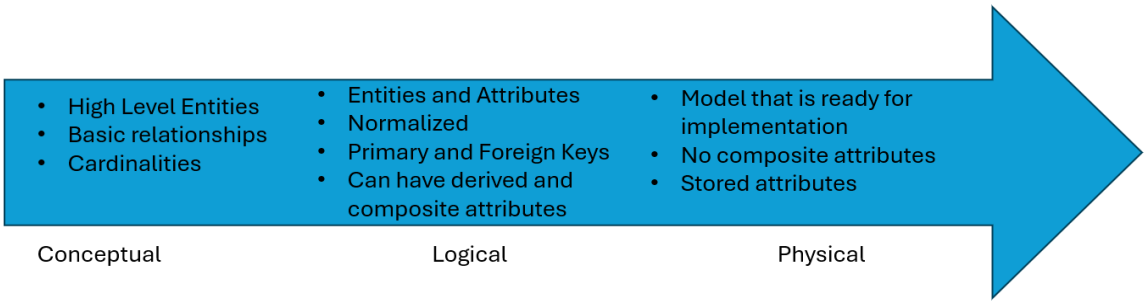

Figure 1. ERDs Differences: Conceptual to Physical

The different models are designed for communication across an organization, where conceptual ERDs are intended for interaction with business personnel who have limited database knowledge. In contrast, logical and physical ERDs are intended for more technical personnel. The changes in the models provide a learning opportunity in database design and concepts that can be applied to developing skills in creating different AI agents or enhancing AI prompt engineering skills.

4. PROMPT ENGINEERING

Information systems education should incorporate AI into our courses, including allowing students to utilize AI in projects to enhance their learning (Zhang, 2025). Prompt engineering is the process of designing and generating a prompt to get the desired results from AI. There are several different models to follow when engineering prompts with new models, such as 0 Shot or few-shot prompting, which means that only a few examples are needed for many problems (Wei et al., 2022).

However, with problems like developing ERDs, the response may vary significantly. For example, someone with technology expertise who has interacted with generative AI may receive very different results than an individual new to databases or generative AI. Therefore, a single prompt without detailed instructions is likely to yield inconsistent or incomplete results (Zhang et al., 2023). Therefore, prompt chaining to create improved prompts may be necessary.

In prompt chaining, the process is broken down into smaller phases, allowing for a three-step implementation: an initial draft is created, critiqued, and then refined. Prompt chaining also helps to support context awareness of your Generative AI (Seo et al., 2025).

5. CASE SETUP

The case presents a novel approach allowing the students to interact with AI and with each other in the classroom. In this way, it promotes the use of novel technology and helps build a learning community within the course. In this case, the students will work to create a physical ERD to record the results of cross-country meets. Specific examples of results websites may be provided to facilitate understanding, such as https://ga.milesplit.com/results/ or https://al.milesplit.com/results/. This assignment is designed to promote the use of AI as a tool for scaffolding within a semester-long project, specifically supporting the development of the initial ERD. By utilizing a prompt chain specifically designed for this part of the assignment, students can enhance their technical knowledge while focusing on a narrow topic. The overall project would be challenging to develop as a single conversation for a novice user.

Prompt 1: I need to create an entity-relationship diagram (ERD) for storing results from cross-country meets, allowing us to look up details by meet, team, and runner. What would my entities be?

> Discussion Question 1.1 - Discuss in your group whether the initial response was consistent for every member.
>
> Discussion Question 1.2 - What type of ERD did AI describe for you? If it is conceptual, logical, or physical. Provide your reasoning for the response.

Prompt 2: Can you design a physical ERD for a cross-country race results database with entities like Runner, Team, and Meet? Include relationships using primary and foreign keys. Avoid storing derived data, such as age. Instead, store the Date of Birth and break down any composite attributes, such as name, into simple attributes like first name and last name.

> Discussion Question 2.1 - Discuss in your group the consistency of the AI response following this prompt.
>
> Discussion Question 2.2 - What were the main changes that were seen from prompt 1?
>
> Discussion Question 2.3 - Discuss in your group the importance of these added terms. What do they enable the system to do?
>
> Discussion Question 2.4 - What are any terms or concepts that AI struggled with?

Prompt 3: I need to create a database to store results from a swim meet. What would my entities be?

> Discussion Question 3.1 - Discuss in your group the consistency of the AI response following this prompt.
>
> Discussion Question 3.2 - What type of ERD did AI describe for you? If it is conceptual, logical, or physical. Provide your reasoning

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for the response.

Discussion Question 3.3 - To what extent has the model been generalized? In other words, given that your project will require a physical ERD, the default response will become more physical, and how?

Prompt 4: Please, provide me with the SQL to create the tables for the Cross-Country Database.

Discussion Question 4.1 - Did AI provide SQL? Assuming that it is correct, make a case for whether it is more important to understand conceptual ideas or technical details while using AI.

Discussion Question 4.2 - Assuming that you can document a problem and AI can generate the code, to what extent should a technology course focus on terminology?

Follow-on Prompt: As a student learning about database design, the purpose of this exercise was not just to obtain an answer, but to better understand the entities, attributes, and relationships that should be included in a well-structured ERD. My goal is to learn both the concepts and the terminology so that I can apply them in future database projects. Consider the prompts and responses from this chat when I continue this project.

6. CONCLUSIONS

This case offers a straightforward yet practical connection to the application of AI and database design. Students found the case to be very useful in understanding how ERDs can help different users depending on their perspective. They also understood how to utilize AI to aid them in scaffolding and creating additional examples, thereby enhancing their understanding of complex concepts. The case attempts to demonstrate the importance of understanding theory and terminology in working with generative AI. By having the students practice using chained prompts to train their AI, they are also creating an AI assistant that will be more equitable in supporting them for their semester projects.

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