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# **Teaching Case**

## **Harness the Power of Interactive Large Language Model in Teaching Using a Capstone Project in the Database Management Course**

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### **ABSTRACT**

This teaching case explores the integration of generative AI, specifically Large Language Models (LLMs) such as ChatGPT, into the pedagogy of a database management course. Database management is a critical field within Information Systems, requiring students to master a wide array of skills, from conceptual design to SQL programming and real-world problem-solving. However, traditional teaching methods often present database concepts in isolation, which can hinder students' ability to grasp the holistic nature of database design, development, and maintenance. Additionally, current pedagogical approaches tend to emphasize technical syntax over critical thinking and problem-solving. They provide limited feedback, especially in larger classes, which delays students' learning progress. This case addresses these challenges by incorporating a capstone project that leverages ChatGPT to facilitate interactive and adaptive learning. Through the project, students engage with practical tasks such as designing relational databases, generating SQL queries, and maintaining databases in response to dynamic business requirements. ChatGPT plays a central role in providing immediate feedback, helping students refine their understanding, and allowing them to explore more advanced database operations at their own pace. The AI tool also encourages students to actively participate in their learning, transforming them from passive recipients of information into critical thinkers who can apply their skills to real-world problems. A quantitative evaluation of final exam grades revealed significant performance improvements in graduate cohorts. While undergraduate cohorts showed a positive upward trend, further analysis with larger sample sizes is recommended. The case highlights the transformative potential of generative AI in education, showcasing how AI-driven tools can enhance student engagement, personalize learning, and ultimately improve educational outcomes in database management education. Furthermore, the principles demonstrated in this case can be extended to other Information Systems courses, such as systems analysis, programming, and data analytics, broadening the applicability of generative AI in Information Systems education.

**Keywords:** Database design & development, Generative AI in teaching, Adaptive learning, Active learning, Structured query language (SQL), Capstone course

### **1. CASE SUMMARY**

Database management is a cornerstone of Information Systems, serving as the critical interface between technological processes and management applications. In this digital era, databases do not merely store information in binary formats or assist in processing transactions; they encapsulate essential business insights, enabling organizations to summarize business activities and make informed decisions (Chen et al., 2012). Mastery of database concepts is therefore not only pivotal for information systems students but also serves as a gateway to advanced topics such as systems analysis and design, business analytics, and data mining.

Currently, several issues and deficiencies are evident in the way database management is taught at the university level. First, database concepts are often presented as isolated

components using a piecemeal approach that fails to offer students a holistic understanding of the entire database design, development, and maintenance cycle. As a result, students struggle to see how the various concepts they learn are interconnected and how these pieces work together in real-world database management (Musti, 2015). Second, while technical syntax is often emphasized, problem-solving and critical thinking skills receive less attention. Many students can master SQL syntax, but they have difficulty applying this knowledge to solve practical, real-world database challenges (Connolly & Begg, 2006). Additionally, traditional pedagogical methods create a passive learning environment where students primarily listen to lectures or complete static exercises without truly engaging with the material or receiving immediate feedback on their efforts. This lack of timely feedback, particularly in larger classes, hinders students' ability to correct

mistakes at the moment, thus delaying their understanding (Lumpkin et al., 2015). Lastly, traditional instruction tends to follow a one-size-fits-all approach, offering limited opportunities for personalized learning. This makes it difficult for students with varying levels of understanding to progress at their own pace, either feeling overwhelmed or held back by the rigid structure of the curriculum (Grant & Basye, 2014). These challenges highlight the need for a more interactive, feedback-driven, and adaptive approach to teaching database management. The limitations mentioned previously can be addressed by incorporating a capstone case with generative AI support.

This teaching case integrates the principles of adaptive learning, an educational approach that leverages technology to tailor the pace, learning path, and instructional content based on each learner's unique needs and performance (Plass & Pawar, 2020). This methodology employs interactive, data-driven tools to analyze learner responses and actively engage students with the material. A key feature of adaptive learning is scaffolding, where additional support is provided for more challenging tasks, ensuring that students receive the right level of assistance as they progress. The system tracks student progress and dynamically adjusts the content, offering more advanced challenges to those ready for them. Furthermore, adaptive learning relies heavily on feedback loops, providing immediate feedback to learners, which enhances knowledge retention and reinforces understanding throughout the learning process.

The emergence of generative AI and Large Language Models (LLMs), such as ChatGPT, has revolutionized traditional teaching methods by fostering interactive learning environments (Celik et al., 2022; Xie et al., 2019). This case study demonstrates the utilization of ChatGPT in an educational setting, emphasizing its role in enhancing student engagement through active learning. Interacting with ChatGPT transforms students from passive recipients of information to active participants in their learning processes, significantly enhancing educational effectiveness. Overall, ChatGPT enhances adaptive learning by creating a more interactive and responsive learning environment that allows students to learn at their own pace and in a way that best suits their individual needs.

Building on this foundation, recent studies have highlighted both the transformative potential and the challenges of using LLMs in education. Feuerriegel et al. (2024) emphasize the significant empirical improvements in student outcomes achieved through AI-driven tools, while Giannakos et al. (2024) discuss the importance of adaptive learning in addressing diverse learner needs. Moreover, ethical considerations, as outlined by Bender (2024), stress the importance of integrating generative AI responsibly, ensuring equitable access and minimizing risks. This evolving body of research underscores the dual opportunities and responsibilities inherent in leveraging LLMs like ChatGPT to modernize pedagogical strategies in Information Systems education.

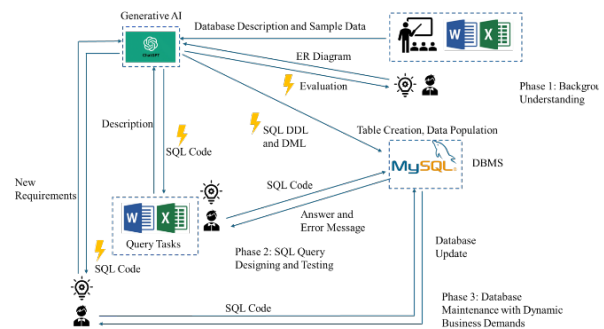
In this case study, ChatGPT plays a central role in helping students apply key database management concepts through hands-on exercises. Students engage with practical tasks such as designing relational databases, generating SQL commands, and manipulating data, but the learning extends beyond technical proficiency. By using ChatGPT, students not only master relational data modeling and SQL syntax for creating, modifying, and querying databases, but also develop a deeper understanding of the logic and structure behind database

operations. Through interactions with ChatGPT, they practice crafting complex SQL queries, such as those involving inner joins, GROUP BY clauses, aggregate functions, and subqueries, which push them to think critically and solve problems. This dynamic engagement allows students to see how various database components work together in real-world scenarios, thus gaining a more integrated and holistic understanding of database design and management. Additionally, ChatGPT provides immediate feedback that guides students in refining their work and encourages self-directed learning and problem-solving, which are essential skills for navigating the evolving landscape of database management.

This teaching case highlights the critical role of integrating generative AI into the education of complex IT subjects to equip students with the skills to address real-world business challenges through data-driven strategies. It provides valuable insights into the adaptive and active learning processes, showcasing the potential of AI to transform educational practices in the field of technology and management.

## 2. CASE BACKGROUND

We recommend that this teaching case be implemented as a capstone project for a database management course because it covers the full spectrum of the database development life cycle, from conceptual design to maintenance. It allows students to apply their cumulative learning from the course to demonstrate a comprehensive understanding of the subject. It also helps students tie together theoretical concepts and hands-on skills involved. Finally, the case introduces students to how generative AI tools can streamline tasks, provide guidance, and enhance problem-solving skills in real-world database management and development.



**Figure 1. Case Workflow**

In this project, students will assume responsibility for implementing a relational database system, formulating SQL queries for data analysis, and actively engaging in database maintenance to address dynamic business requirements. This case encompasses the major database development activities within the System Development Life Cycle (SDLC), including planning, analysis, design, implementation, and maintenance (Hoffer et al., 2016). The process consists of three major phases, as shown in Figure 1, which depicts the workflow and the interaction between the LLM and database management system (DBMS). Note that, in this case, the authors use MySQL as the DBMS (Oracle, 2024). However, the use of the LLM and

DBMS is loosely coupled. Any relational DBMS is suitable for this case study. Educators might also consider using Oracle Database, Microsoft SQL Server, or SQLite databases, including the Python SQLite3 module.

### 2.1 Phase 1: Background Understanding and Database Implementation

In the first phase, students review a business problem description and a sample dataset that includes table column names and several records. The primary learning objective is to facilitate student understanding of the business scenario, the necessity for a database, and the relevant entities and relationships.

### 2.2 Phase 2: SQL Query Design and Testing

In the second phase, students explore the database using SQL tools. This phase includes a series of well-crafted questions that serve as practical use cases for database applications. Additionally, students are motivated to formulate and answer their own questions using SQL, enhancing their hands-on experience with database manipulation.

### 2.3 Phase 3: Database Maintenance With Dynamic Business Demands

In the final phase, students address dynamic user requirements, including the introduction of new entities and relationships, and the insertion, deletion, and updating of data records. This phase also encourages students to apply their knowledge to simulate other business applications using the database, thus expanding their practical understanding of database systems.

## 3. CASE TEXT

### 3.1 Background Introduction

In response to the growing need for streamlined academic operations and enhanced decision-making capabilities, a hypothetical university has embarked on an initiative to develop a robust database management system. This system supports day-to-day academic and administrative processes, ensuring that students, faculty, and administrators can access and manage critical data effectively.

The database serves as a backbone for a variety of academic operations, from managing student information to tracking course enrollments and faculty qualifications. The system tracks each student through their academic journey. Every student is assigned a unique Student ID upon registration, which becomes the central key for linking personal and academic records. The system stores each student's name for easier identification.

Faculty members also play an integral role in the academic ecosystem. Each faculty member is assigned a unique Faculty ID as an identifier, along with their name. This ensures that the university can maintain a comprehensive record of each faculty member's qualifications and teaching assignments. Furthermore, faculty members are matched to courses based on verified qualifications. The system also stores the date they were qualified to teach each course.

Courses are a key component of this system. Each course offered by the university is assigned a Course ID and a corresponding Course Name, enabling clear identification of each academic offering. Courses may require prerequisites covering foundational topics. The system tracks these

prerequisite relationships to ensure students follow the correct academic path. Since one course can have multiple prerequisite courses, and a single course can serve as a prerequisite for multiple other courses, this forms a many-to-many relationship between courses. For example, a higher-level course may require several prerequisites, and these same prerequisites may apply to multiple advanced courses.

Courses are further subdivided into sections, allowing multiple offerings of the same course in different semesters or times, each led by a faculty member. Each Section has a unique Section Number and is linked to a particular Course ID and Faculty ID. The system records the semester for each section, helping track course offerings over time. The relationship between courses and sections is one-to-many; a single course can have multiple sections across different semesters, while each section corresponds to only one course.

Enrollment is the bridge between students and the courses they take. Each student can enroll in multiple sections, and each section may contain multiple students. This many-to-many relationship is captured in the Enrollment table, where a record is created for each student's enrollment in a specific course section. For every enrollment, the system records the Student ID, Section Number, and the Grade the student achieved in that section. This data is critical for maintaining academic records and generating performance reports.

Moreover, faculty members' qualifications are rigorously managed within the system. Each faculty member is linked to the courses they are eligible to teach through the Qualified relationship, which records their Faculty ID, Course ID, and the Date Qualified. This relationship ensures that only qualified faculty are assigned to teach specific courses, maintaining the university's high academic standards.

### 3.2 Phase 1: Background Understanding and Database Implementation

An Excel file containing a sample dataset is provided to support the learning process. However, the structure of the sample data is not normalized. In the logical design phase, students identify redundancies and dependencies within the dataset and apply normalization principles to organize the data into well-structured tables.

Students follow the SDLC stages, starting with conceptual and logical design, followed by the implementation phase using Data Definition Language (DDL) and Data Manipulation Language (DML). At the outset, students are instructed to develop the database structure by completing the entity-relationship diagram (ERD) and the relational data model. They are encouraged to upload their designs to ChatGPT to validate their answers.

Following are sample prompts for asking ChatGPT to support the conceptual design and logical design.

**Prompt 1:** *Please help me implement a relational database design. I will first describe the business case background. Then I will upload a sample dataset file. Please help me verify the correctness of my entity-relationship diagram. I am using Crow's Foot notation.*

**Prompt 2:** *The background is as follows: [copy-and-paste from case description].*

**Prompt 3:** *[Load the sample database Excel file].*

**Prompt 4:** *[Load the ER diagram designed by the student].*

Students can upload either hand-drawn or software-generated ER diagrams to ChatGPT for evaluation. Our testing, as shown in Appendix A, confirmed the correctness of the responses.

Following this, students are tasked with writing SQL DDL code to create database tables and define keys. This step encourages students to compare the code generated by ChatGPT with their own designs, furthering their understanding of database structuring. Students compare traditional database designs with those produced by ChatGPT, which helps to deepen their understanding of when and how AI tools provide value. Figure 2 depicts a typical response from ChatGPT, showcasing well-formatted code blocks accompanied by a “copy code” button. This feature allows rapid copying of commands, enhancing usability.

After generating SQL commands using ChatGPT, students are encouraged to further explore table creation through additional targeted questions using DDL. This exercise aims to deepen their understanding of database table structures. For example,

**[Optional] Prompt 5:** Please describe the data types in the table Student. Why do you choose INT for StudentID but VARCHAR(255) for StudentName?

**[Optional] Prompt 6:** What is the purpose of using VARCHAR(255) instead of CHAR(255)? Do you have any other options for this column? What are the advantages and disadvantages?

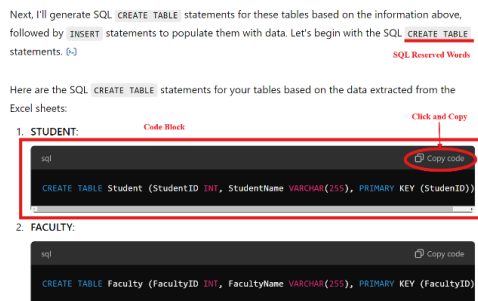


Figure 2. ChatGPT Response

In addition to the suggested prompts, instructors may encourage students to identify various potential query patterns and common use cases. Then students could ask ChatGPT to propose indexing strategies tailored to those patterns. This shows how AI tools can assist not only in code generation but also in database design optimization. At the same time, students gain a deeper understanding of how to enhance database efficiency in real-world scenarios.

Students are then guided to run these commands in MySQL Workbench to create tables. The next prompt will generate Data Manipulation Language (DML) to insert sample rows into the system.

**Prompt 7:** Please generate Data Manipulation Language to insert sample data records into the system.

### 3.3 Phase 2: SQL Query Designing and Testing

In Phase 2, instructors provide a series of questions designed to enhance students' SQL query formulation skills. These questions range from simple data retrieval from a single table to more complex tasks involving subqueries. For example, an

introductory question requires students to list all individuals enrolled in the “Network Security” course.

**[Question 1] Scenario:** You want to find out which students have enrolled in the course “Network Security.” The course name is not directly stored in the ENROLLMENT table, so you will need to use joins to retrieve this information.

**Task:** Write a SQL query to retrieve the names of all students who are enrolled in the “Network Security” course. Display both the student ID and the student name.

A more advanced challenge tasks students with identifying those whose grades surpass the average within their enrolled courses each semester. This necessitates a complex query that retrieves grades and calculates and compares them to course averages, thereby facilitating a deeper understanding of SQL's analytical capabilities.

**[Question 2] Scenario:** To promote a competitive academic environment, the university wants to identify students whose grades are higher than the average in each course they are enrolled in for a given semester.

**Task:** Write a SQL query to find students whose grades in any course are higher than the average grade of that course for the semester it was offered. Display the student ID, student name, course ID, student's grade, and the average course grade.

Students first develop their SQL code on their own, then utilize ChatGPT to review and critique it. For instance, in response to [Question 2], a student might initially construct an incorrect SQL command as illustrated next:

```
SELECT DISTINCT e.StudentID, s.StudentName,
sec.CourseID, e.Grade AS StudentGrade, AVG(e.Grade)
FROM ENROLLMENT e JOIN STUDENT s ON
e.StudentID = s.StudentID
JOIN SECTION sec ON e.SectionID = sec.SectionID
WHERE e.Grade > AVG(e.Grade);
```

Using the following prompt, ChatGPT explains why the query fails and suggests improvements tailored to the student's current level of understanding.

**Prompt 8:** I would like to use SQL to answer this question: [Question 2]. I have developed the code as follows: [SQL]. Please help me verify my answer.

Figure 3 illustrates the effectiveness of ChatGPT as a tool for educational purposes, highlighting its capacity to facilitate learning.

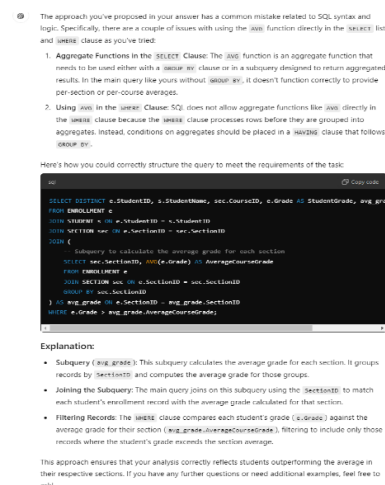


Figure 3. Interaction With ChatGPT



### 3.4 Phase 3: Database Maintenance with Dynamic Business Demands

In the final phase, students address dynamic business demands that require adjustments to the database. These include adding new entities and relationships, and the insertion, deletion, and updating of data records. This phase assesses students' ability to maintain and modify existing databases and encourages them to apply these skills to model additional business applications. These exercises give students practical experience in adapting databases to evolving business needs, underscoring the importance of flexibility and forward-thinking in database management. The following prompts will be used.

**Prompt 9:** *Can you add more records to the existing tables in the University database?*

**Prompt 10:** *The university requires to model the library system with the existing database. There is a new entity BOOK with attributes BookID, BookName, BookDiscipline, and Status. A book which is currently available in the library can be borrowed by students and faculty members. A person can borrow many books but a book can only be borrowed by one person at a time. We also want to record the borrowing history. Please help me add new tables and sample data records to the existing database.*

Student modify code adjustments to accommodate the new requirements. Additional explanations will be provided to enhance students' understanding of the nuances of database design. For instance, after Prompt 9, ChatGPT suggests the following considerations:

**PersonID Handling:** The design assumes PersonID in BORROWING references STUDENT. If faculty members can also borrow books, consider creating a unified person table or using a discriminator column to differentiate between students and faculty.

**Status Handling:** The status of the book could be more dynamically derived from whether there is an active (non-returned) record in BORROWING rather than storing it directly in BOOK. This approach minimizes redundancy and potential data inconsistencies.

The following optional prompt further illustrate the subtle differences in handling this problem.

**[Optional] Prompt 11:** *Faculty can also borrow books. Can you show me the process to create a unified person table?*

### 3.5 Group Discussion and Self-Reflection

The final stage involves group discussions and self-reflection to consolidate learning. While technical skills are vital, so is the ability to independently learn and apply these skills using advanced interactive tools like LLMs. Students are encouraged to engage in thoughtful discussions with their peers on the following topics:

**Discussion Question 1:** *How has interacting with ChatGPT enhanced your understanding of database concepts?*

**Discussion Question 2:** *Could you apply the methodologies learned here to a real-world scenario and develop a prototype database instance?*

These discussions deepen students' comprehension of the material and encourage them to reflect on the application of these technologies beyond the classroom setting. This process reinforces their learning and promotes critical thinking and practical application of their skills.

## 4. EVALUATION

To assess the effectiveness of the proposed teaching method, we conducted a structured evaluation of student performance using final exam grades. The final exams consisted of comprehensive database application questions, requiring students to demonstrate their skills in interpreting ER diagram and logical database designs, implementing databases to address dynamic business requirements, and designing effective SQL queries. Assessments considered the correctness, efficiency, flexibility, and adherence to best practices of the students' solutions, along with justifications provided for their assumptions and design choices. Data were collected from Master of Business Administration (MBA), Master of Science in Business Analytics (MSBA), and undergraduate database classes from Fall 2021 to Fall 2024. The evaluation focused on comparing student performance before and after the implementation of the capstone project, which integrates ChatGPT as a learning tool.

To evaluate the differences in performance between the "before" and "after" groups, we conducted independent one tailed t-tests. This test was selected because the groups were distinct, with no student overlap. The one-tailed version was used to test the hypothesis that students in the "after" group would perform better. The results are summarized in Table 1.

We found that for the MBA cohort ( $n = 62$  before,  $n = 18$  after), the mean score increased from 81.95 to 87.44 after implementing the new method. The improvement was statistically significant ( $t = 1.70$ ,  $p = 0.047$ ). For the MSBA cohort ( $n = 94$  before,  $n = 49$  after), the mean score improved from 82.06 to 85.27. This improvement was also statistically significant ( $t = 1.86$ ,  $p = 0.032$ ). For the undergraduate cohort ( $n = 255$  before,  $n = 58$  after), the mean score increased from 80.48 to 83.37. While the improvement was not statistically significant at the 0.05 level ( $t = 1.36$ ,  $p = 0.088$ ), the trend indicates potential benefits. The smaller sample size for the "after" group may have contributed to the lack of statistical significance.

The statistical analysis indicates that the integration of ChatGPT into the teaching method significantly enhances learning outcomes for graduate students, as evidenced by the MBA and MSBA cohorts. Although statistical significance was not achieved for the undergraduate cohort, the upward trend in performance highlights the potential benefits of the approach. These results underscore the importance of continued evaluation, particularly with larger sample sizes for undergraduate students.

By incorporating generative AI tools into database education, this teaching method provides students with immediate feedback and opportunities for adaptive learning. These findings support the effectiveness of the proposed approach and its potential for broader academic use.

Cohort	Group	Mean	Std Dev	Max	Min	n	T-Statistic	P-Value
MBA	Before	81.95	12.59	100	44	62	1.70	0.047
MBA	After	87.44	10.02	100	65	18		
MSBA	Before	82.06	10.24	100	60	94	1.86	0.032
MSBA	After	85.27	8.76	100	64	49		
Undergraduate	Before	80.48	12.50	100	34	255	1.36	0.088
Undergraduate	After	83.37	11.03	99	49	58		

**Table 1. Final Exam Performance Comparison Across Student Groups Before and After Implementing ChatGPT-Integrated Teaching Method**

## 5. CONCLUSION

In this teaching case, we demonstrated the significant advantages of incorporating interactive Large Language Models (LLMs) such as ChatGPT into database management education through a capstone project. This integration highlights the transformative potential of generative AI in modernizing educational methodologies and enhancing student engagement and learning outcomes.

Through practical exercises facilitated by ChatGPT, students were actively involved in understanding and applying complex database operations and SQL programming. Instead of applying a one-size-fits-all approach, ChatGPT can provide personalized assistance based on the specific needs of each student. For example, students can ask for clarification on certain concepts, receive tailored explanations, or explore more advanced topics at their own pace. This hands-on approach bolstered their technical skills and enhanced their problem-solving capabilities and critical thinking, which are essential for meeting real-world challenges in information systems. ChatGPT helps students focus more on thinking critically about how to approach database problems and developing solutions to account for unique circumstances. Throughout the project, ChatGPT offers real-time feedback that helps students stay engaged and reinforces learning in the moment. As a result, students become active and self-directed learners who are not just passively receiving information.

The evaluation of this teaching method provided empirical evidence supporting its effectiveness. Statistical analysis of final exam grades showed significant performance improvements for graduate students in both the MBA and MSBA cohorts. For the MBA cohort, mean scores increased from 81.95 to 87.44, and for the MSBA cohort, scores rose from 82.06 to 85.27, with both results achieving statistical significance. Although the undergraduate cohort's performance improvement from 80.48 to 83.37 was not statistically significant, the upward trend suggests potential benefits, particularly with larger sample sizes in future analyses. These findings underscore the value of generative AI tools in enhancing learning outcomes and addressing traditional challenges in database education. As database management is an applied science that emphasizes hands-on skills, it aligns well with competency-based education (CBE) principles, which provide structured methods to assess student mastery at various stages of learning (Voorhees, 2001). Scholtz et al. (2012) further highlight that competency-based frameworks bridge academic learning and industry demands, making them particularly suitable for applied disciplines like database management. Looking ahead, we aim to integrate CBE methods

into our evaluations, enabling more comprehensive assessments of student success throughout the teaching case.

These tools show the potential of AI to make the learning process more engaging and effective. The use of generative AI in educational settings, exemplified in this case study, underscores a shift towards more interactive and technology-driven pedagogical strategies. This approach prepares students to effectively tackle real-world business and data management problems and sets a precedent for the integration of advanced technological tools in IT education. Looking ahead, we plan to extend this approach to more advanced database topics such as concurrency control, triggers and PL/SQL, and Common Table Expressions (CTEs) and window functions in SQL. Furthermore, the principles demonstrated in this case—adaptive learning, real-time feedback, and personalized assistance—have the potential to be applied across a wide range of Information Systems and technical courses. For instance, generative AI could support students in creating UML diagrams in systems analysis and design courses, debugging code in programming courses, or generating advanced data queries and visualizations in data analytics courses. By exploring these broader applications, educators can further leverage generative AI to address common challenges in technical education and enhance student learning outcomes on a larger scale.

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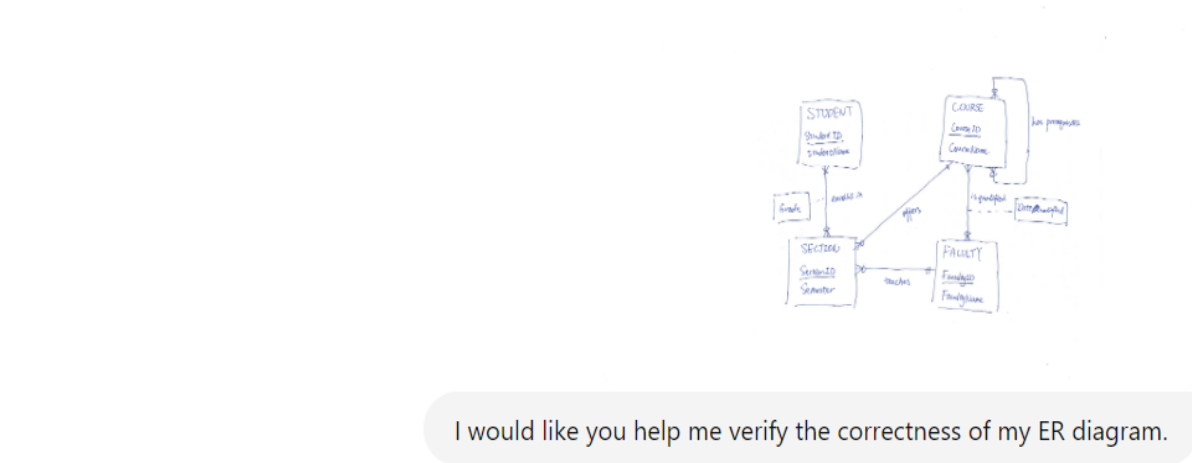




## APPENDICES

### Appendix A. ER Evaluation Screenshots

We uploaded a hand-drawn ER diagram to ChatGPT, and it generated the following responses.



Now that I have the image of your ER diagram, I can help verify its correctness based on your description and the data provided. Here's the analysis of each part of your ER diagram:

### 1. Students Entity

- **Attributes:** `StudentID` (Primary Key), `StudentName`.
- **Relationship:** Correctly shows the many-to-many relationship with **Sections** through the **Enrolls** In relationship (Crow's Foot notation is correctly used).

### 2. Faculty Entity

- **Attributes:** `FacultyID` (Primary Key), `FacultyName`.
- **Relationship:** Correctly shows a one-to-many relationship with **Sections**, indicating that each faculty member can teach multiple sections.

### 3. Courses Entity

- **Attributes:** `CourseID` (Primary Key), `CourseName`.
- **Relationships:**

- **Offers:** Correctly shows a one-to-many relationship with **Sections**, indicating that a course can have multiple sections.
- **Has Prerequisites:** Correctly shows a many-to-many relationship with other courses (this is correct since courses can have multiple prerequisites and serve as prerequisites for multiple other courses).

#### 4. Sections Entity

- **Attributes:** `SectionID` (Primary Key), `Semester`.
- **Relationships:**
  - **Enrolled By Students:** The many-to-many relationship with **Students** is correctly represented through the **Enrolls In** relationship.
  - **Taught By Faculty:** The one-to-many relationship with **Faculty** is correct, where each section is taught by one faculty member.

#### 5. Enrollment

- The **Grade** is represented as part of the **Enrolls In** relationship between **Students** and **Sections**, which is correct.

#### 6. Faculty Qualifications

- **Is Qualified For:** Correctly shows the relationship between **Faculty** and **Courses** with the additional attribute `DateQualified`.

#### Conclusion:

Your ER diagram appears to be correct. It follows the correct use of Crow's Foot notation, and the relationships between entities (students, faculty, courses, sections, and enrollments) are appropriately modeled. The many-to-many and one-to-many relationships are correctly depicted.

**Appendix B. Unnormalized Sample Data**

Student ID	Student Name	Section No	Semester	CourseID	Course Name	FacultyID	Faculty Name	Grade	Prerequisite CourseID	Prerequisite CourseName	Date Qualified
38214	Letersky	2714	II-2018	ISM 4212	Database	3467	Berndt	3.6			9/1/2015
54907	Altwater	2714	II-2018	ISM 4212	Database	3467	Berndt	4			9/1/2015
54907	Altwater	2715	II-2018	ISM 4930	Networking	3467	Berndt	3.6	ISM 3112	Syst Design	9/1/2016
54907	Altwater	2715	II-2018	ISM 4930	Networking	3467	Berndt	3.6	ISM 4212	Database	9/1/2016
66324	Aiken	2713	I-2018	ISM 3113	Syst Analysis	4756	Collins	2.8			9/1/2011

### **Appendix C. SQL Query Question Set**

**[Question 1]**

Scenario: As part of a report on student demographics, the university is interested in identifying students with ID numbers below a certain threshold. This information will be used to generate targeted reports based on student identification patterns.

Task: Write a SQL query that retrieves the IDs of all students whose ID is less than or equal to 60,000. Present the results in descending order based on the student ID.

**[Question 2]**

Scenario: The administration is conducting an audit on course offerings from the beginning of 2018. They need to identify the section that had the lowest section number during the "I-2018" semester to review its scheduling and allocation of resources.

Task: Write a SQL query that determines the smallest section number used in the semester "I-2018."

**[Question 3]**

Scenario: The university wants to assess the popularity of certain courses by analyzing the number of sections offered for them in a given semester. Specifically, they need to know how many sections were offered for the "Syst Analysis" course in the "I-2018" semester to evaluate student demand and faculty workload.

Task: Write a SQL query that calculates the total number of sections offered for the course "Syst Analysis" during the "I-2018" semester.

**[Question 4]**

Scenario: You want to find out which students have enrolled in the course "Network Security". The course name is not directly stored in the ENROLLMENT table, so you will need to use joins to retrieve this information.

Task: Write a SQL query to retrieve the names of all students who are enrolled in the "Network Security" course. Display both the student ID and the student name.

**[Question 5]**

Scenario: As part of the curriculum planning process, the university needs to verify which faculty members are qualified to teach certain courses. They want to ensure that only eligible faculty are assigned to teach "Syst Design" in the upcoming semester.

Task: Write a SQL query that retrieves the IDs and names of all faculty members who are qualified to teach "Syst Design."

**[Question 6]**

Scenario: The university is conducting a study on faculty influence and its impact on student engagement. Specifically, they are interested in identifying which students have taken courses with Professor Collins, as his teaching style is being evaluated for broader implementation.

Task: Write a SQL query that returns the IDs and names of students who have enrolled in at least one course taught by Professor "Collins."

**[Question 7]**

Scenario: The administration is evaluating the performance of faculty teaching the "Syst Analysis" course to determine the impact of instructors on student outcomes. The aim is to identify which professors consistently achieve high student performance, as measured by average grades.

Task: Write a SQL query that retrieves the names of professors who have taught "Syst Analysis" along with the average grade students received in their sections. Only include professors with an average grade of 3.2 or higher. Label the new column as "Avg\_Sys\_Analy\_Grade" and order the results by the average grade in descending order.

**[Question 8]**

Scenario: The university wants to streamline the process for students by identifying instances where an instructor teaches both a course and one of its prerequisites. This could be used to group these classes in future semesters to provide continuity for students taking related courses.

Task: Write a SQL query that identifies all cases where a course and at least one of its prerequisite courses are taught by the same instructor. Display the course name, prerequisite course name, and the instructor's name.

**[Question 9]**

Scenario: To promote a competitive academic environment, the university wants to identify students whose grades are higher than the average in each course they are enrolled in for a given semester.

Task: Write a SQL query to find students whose grades in any course are higher than the average grade of that course for the semester it was offered. Display the student ID, student name, course ID, student's grade, and the average course grade.

## Appendix D. Getting Started with AI Tools

This appendix provides a step-by-step guide to help instructors unfamiliar with generative AI tools, such as ChatGPT, effectively integrate them into their teaching. The guide includes setup instructions, example prompts, and practical tips for implementation in database management and other Information Systems (IS) courses.

### 1. Setting Up ChatGPT

Visit OpenAI's website (<https://openai.com/>) and sign up for an account. Select a suitable subscription plan if advanced features are required. The login page can also be accessed via this URL: <https://chatgpt.com/auth/login?sso>. After logging in, you will see ChatGPT's interface, which is accessible via a web browser. The following screenshot shows the user interface.



A few areas in the screenshot are highlighted and labeled with letters. The detailed explanations are as follows:

A. Model Selection: Before you start, you can choose different AI models from the model selection dropdown menu. This tutorial selects “ChatGPT 4o.”

B. Customized Models: You can choose different fine-tuned models. We use the vanilla “ChatGPT 4o” model. However, much more advanced and highly customized models are available for exploration.

C. Message Bar: Type your question or prompt in the message bar of the home page and hit the ENTER key on your keyboard. Now you can start to use ChatGPT interactively.

D. Attachment Icon: You can upload files through the attachment icon to provide additional context or datasets.

### 2. Example Prompts Used in the Teaching Case

The following are prompts we used in this teaching case. Note that ChatGPT is a generative model, which means that the AI will “generate” responses based on the input prompt through complex mathematical computations of probability. It cannot guarantee that the generated answer will always be the same.

Prompt 1: Please help me implement a relational database design. I will first describe the business case background. Then I will upload a sample dataset file. Please help me verify the correctness of my entity-relationship diagram. I am using Crow's Foot notation.

Prompt 2: The background is as follows: [copy-and-paste from case description].

Prompt 3: [Load the sample database Excel file].

Prompt 4: [Load the ER diagram designed by the student]

[Optional] Prompt 5: Please describe the data types in the table Student. Why do you choose INT for StudentID but VARCHAR(255) for StudentName?

[Optional] Prompt 6: What is the purpose of using VARCHAR(255) instead of CHAR(255)? Do you have any other options for this column? What are the advantages and disadvantages?

Prompt 7: Please generate Data Manipulation Language to insert sample data records into the system.

Prompt 8: I would like to use SQL to answer this question: [Question 2]. I have developed the code as follows: [SQL]. Please help me verify my answer.

Prompt 9: Can you add more records to the existing tables in the University database?

Prompt 10: The university requires to model the library system with the existing database. There is a new entity BOOK with attributes BookID, BookName, BookDiscipline, and Status. A book which is currently available in the library can be borrowed by students and faculty members. A person can borrow many books but a book can only be borrowed by one person at a time. We also want to record the borrowing history. Please help me add new tables and sample data records to the existing database.

[Optional] Prompt 11: Faculty can also borrow books. Can you show me the process to create a unified person table?



### **3. Practical Tips for Implementation**

3.1 Set Expectations for Students: Introduce ChatGPT as a supplementary tool rather than a replacement for learning. Emphasize that its purpose is to enhance understanding and critical thinking.

3.2 Provide Clear Prompts: Demonstrate how to write effective prompts to get accurate and relevant responses from ChatGPT. For example, be specific and contextually clear about the task or question.

3.3 Prepare for Limitations: Highlight potential limitations of ChatGPT, such as occasionally generating incorrect or incomplete responses. Teach students how to verify its outputs by cross-referencing other resources or applying critical thinking skills.

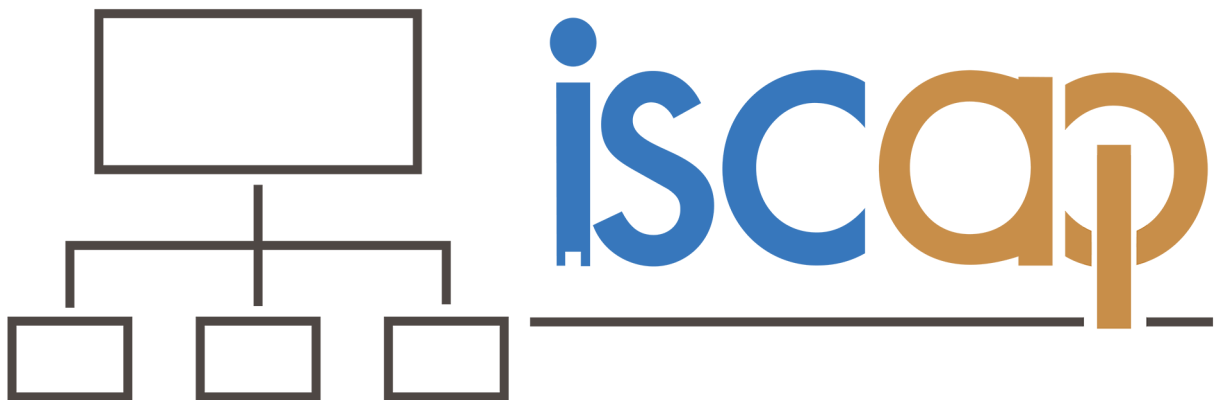
### **4. Additional Resources**

4.1 ChatGPT has comprehensive documentation to guide users. It can be accessed via this URL: <https://platform.openai.com/docs/overview>

4.2 YouTube (<https://www.youtube.com/>) has a rich source of video tutorials on using ChatGPT.

4.3 OpenAI's ChatGPT community (<https://community.openai.com/>) allows users to exchange experiences and best practices.

## INFORMATION SYSTEMS & COMPUTING ACADEMIC PROFESSIONALS



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