BUS 464 Final Project

Field Exercise as a Database Architect for an AI-Enhanced Educational Technology Startup - Quizlet

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1. Use Cases with AI:

Use Case No	**UC-1**
Name	AI Quiz Generation
User	Student
Pre-condition	- The student has an active Quizlet account. - Relevant study materials are available.
Post-condition	- The student receives a dynamically AI generated quiz. - Performance analytics are updated.
Main Scenario/Basic Path	1. The student logs into their Quizlet account. 2. The system analyses the student's past quiz performances, study habits, and proficiency levels. 3. The system's AI algorithms dynamically generate a quiz by selecting questions from the available study materials. ○ The difficulty level of questions is adjusted based on the student's historical performance. 4. The system presents the quiz to the student, providing a mix of question types (e.g., multiple choice, true/false, short answer). 5. The student answers the quiz questions. 6. The system provides instant feedback on correctness and offers explanations for incorrect answers. 7. The system updates the student's performance analytics, identifying strengths and weaknesses in specific topics or concepts. 8. Based on the quiz results, the system may recommend additional study materials or direct the student to specific areas for improvement.
Other	● The system ensures that questions are diverse, covering various aspects of the study materials. ● AI continuously adapts to the student's progress, refining the learning path for future quizzes.

Use Case No	UC-2
Name	Student Performance Dashboard
User	Student
Pre-condition	● The student has an active Quizlet account. ● The student has participated in AI quizzes or assessments
Post-condition	● The student gains insights into their own performance. ● Individual performance metrics are updated and visible in the student performance dashboard
Main Scenario/Basic Path	1. The student logs into their Quizlet account. 2. The student navigates to the Student Performance Dashboard within their account. 3. The system presents an overview of the student's performance, including aggregate scores, completion rates, and other relevant metrics. 4. The dashboard displays a history of AI genereated quizzes or assessments the student has completed, indicating scores and time spent on each. 5. The system highlights areas of strength and topics that may require improvement based on the student's performance in quizzes **6.** The system's AI algorithm provides study recommendations or links to additional resources tailored to the student's performance and identified areas of improvement. **7.** The student has the option to set personal learning goals directly from the dashboard, aligning with areas they wish to focus on or improve. **8.** The system provides positive feedback for achievements and recognizes progress, fostering a positive learning experience.

Other	The dashboard design is user-friendly, with a focus on providing actionable insights to enhance the student's learning journey.

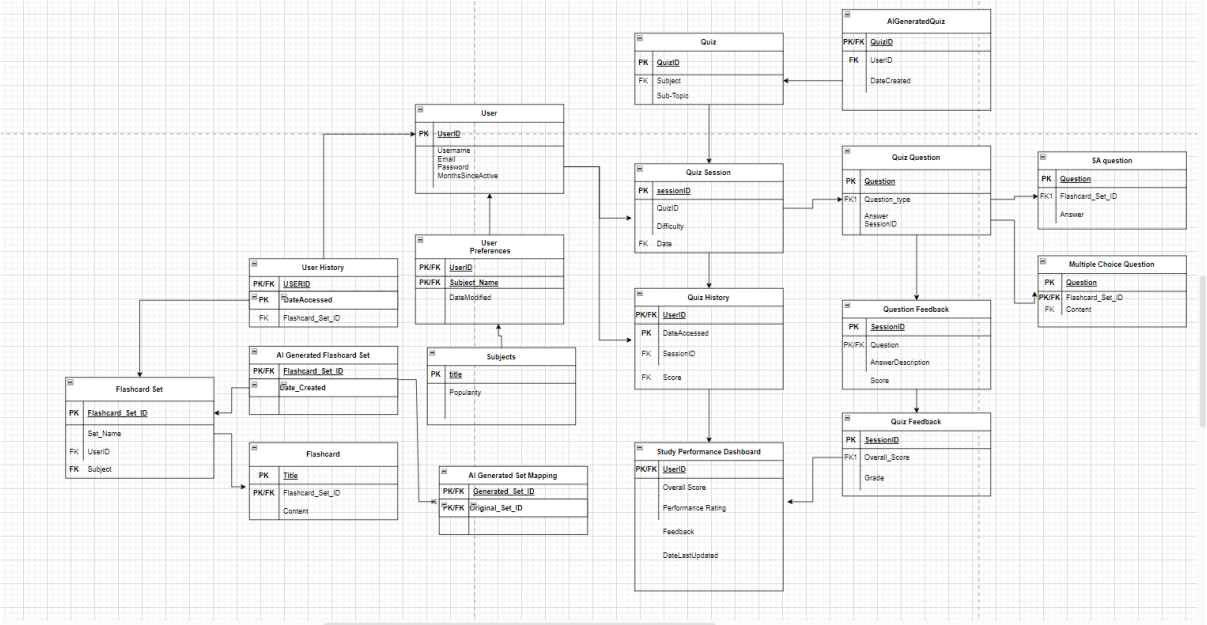
Use Case No	UC-3
Name	AI Generated Flashcard Recommendation
User	Student
Pre-condition	● The student has an active Quizlet account. ● The student has engaged with previous study materials or quizzes.
Post-condition	● The system recommends relevant flashcards to the student
Main Scenario/Basic Path	1. The Student logs into their Quizlet account. 2. The system analyzes the Student's past study sessions, quiz performances, and flashcard interactions. 3. Based on the analysis, the system identifies areas where the Student may have knowledge gaps or areas that need reinforcement. 4. The AI system generates a set of flashcards that specifically target the identified knowledge gaps. 5. The Student reviews and interacts with the recommended flashcards. 6. As the Student engages with the flashcards, the system provides real-time feedback on their progress and understanding. 7. The system updates the Student's study path, taking into account the newly acquired knowledge and adjusting future recommendations accordingly

Use Case No	UC-4

Name	Uploaded textbook ML
User	Student
Pre-condition	● The student has an active Quizlet account. ● The student possesses a digital textbook or study material for upload
Post-condition	● The uploaded textbook is processed by the ML model. ● Relevant flashcards or study materials are generated based on the student-uploaded content. ● The student gains access to the newly generated study materials. ● The student's learning path is updated to incorporate the content from their uploaded textbook.
Main Scenario/Basic Path	1. The student logs into their Quizlet account. 2. The student uploads a digital textbook or study material to the Quizlet platform. 3. The ML model processes the uploaded textbook, extracting key concepts, definitions, and questions. 4. Based on the ML processing, the system generates flashcards or study materials using the content provided by the student. 5. The student gains access to the newly generated flashcards or study materials. 6. The student engages with the new content, reviewing flashcards and studying the materials. 7. The system provides real-time feedback on the student's interaction, gauging understanding and proficiency. 8. The system updates the student's learning path is automatically updated to include the new content from their uploaded textbook.

Use Case No	UC-5
Name	Managerial KPI Dashboard
User	Quizlet Manager
Pre-condition	● The manager/administrator has an active account and appropriate permissions on the system. ● Relevant Key Performance Indicators (KPIs) data is available in the system.
Post-condition	● The manager gains a comprehensive view of organizational performance. ● Decision-making is informed by real-time and historical data presented in the KPI dashboard.
Main Scenario/Basic Path	1. The Manager/Administrator logs into the system using provided credentials. 2. The Manager/Administrator navigates to the Managerial KPI Dashboard section within their account. 3. The Manager/Administrator selects specific KPIs or customizes a set of metrics to monitor. 4. The System displays real-time data for the selected KPIs, providing an immediate snapshot of the organization's performance, and can provide AI recommendations on bandwidth performance 5. The Manager/Administrator analyzes historical data by toggling to view trends and patterns over time. 6. The Manager/Administrator conducts comparative analysis by comparing current KPIs against benchmarks, goals, or historical averages. 7. The Manager/Administrator applies filters and drills down into specific data points, departments, or projects for a more detailed analysis. 8. The System provides an option for the Manager/Administrator to download comprehensive reports summarizing the KPI data for offline analysis or presentation purposes.

2. ER-Diagram:



*To be less visually cluttered some entities were not connected such as subject table to flashcard Set table

3. Data Insertion:

Data Source	Data	Description and use
Kaggle https://www.kaggle.com/datasets/edx/course-study/	Subjects offered online at Harvard and MIT	The Subjects offered at Harvard and MIT are popular subjects. A count of each subject available is made and attributed to the popularity attribute in the quizlet database in the SubjectType table.
ChatGPT	All tables except Subjects	Data generation and some aid in table generation

4. SQL Queries:

UC-1: AI Quiz Generation

Function	**SQL QUERY**
Check login info (Username:: Robert pass: password)	SELECT * FROM user WHERE Username == “Robert” AND password == “password”;
Retrieve the frequency of each flashcard set in each user’s flashcard access history	SELECT count(*) FROM FlashcardHistory GROUP BY UserID, Flashcard_Set_ID;
Retrieve most frequently taken quiz for a certain user (UserID = 9999)	SELECT q.QuizID FROM SessionID s JOIN Quiz q ON s.SessionID = q.SessionID WHERE s.UserID = “9999” ORDER BY count(q.QuizID) DESC LIMIT 1;
Retrieve the list of flashcards pertaining to the subject Law in the user’s flashcard access history (UserID = 9999)	SELECT * FROM FlashcardSet WHERE Subject = “Law AND CreatedBy = “9999”;
Choose the most popular flashcard set from user’s flashcard set history for informing quiz generation (UserID = 9999)	SELECT Flashcard_Set_ID FROM FlashcardHistory WHERE UserID = 9999 GROUP BY UserID, Flashcard_Set_ID ORDER BY count(Flashcard_Set_ID);

UC-2: Student Performance Dashboard

Function	**SQL QUERY**
Retrieve list of quizzes UserID = 9999 has completed along with metrics like scores and time spent	SELECT qs.QuizID, qs.MinutesSpent, qf.Score, FROM QuizHistory qh JOIN QuizSession qs ON qh.SessionID = qs.SessionID JOIN QuizFeedback qf ON qs.SessionID = qf.SessionID WHERE qh.UserID = 9999 AND qs.IsCompleted = True;
Retrieve average quiz performance (score) of each user	SELECT Average(Score) FROM QuizFeedback GROUP BY UserID;
Retrieve average time spent on quizzes in each subject	SELECT Average(qs.MinutesSpent) FROM QuizSession qs JOIN SubjectType s ON qs.SubjectName = s.TypeName GROUP BY s.SubjectType

UC-3: Flashcard Recommendation

Function (Assume UserID = 9999)	**SQL QUERY**
Retrieves a user's lowest scored quiz in their quiz history and provides list of flashcard sets with the same subject as the quiz	SELECT * FROM FlashcardSet WHERE SubjectName IN (SELECT qs.SubjectName as SubjectName FROM QuizFeedback qf JOIN QuizSession qs ON qf.QuizID = qf.QuizID WHERE UserID = 9999 ORDER BY Score DESC LIMIT 1);
Retrieves a user's lowest scored quiz by average score in their quiz history and provides list of flashcard sets in the user's flashcard access history with the same subject as the quiz	SELECT * FROM FlashcardHistory fh JOIN FlashcardSet fs ON fh.Flashcard_Set_ID = fs.Flashcard_Set_ID WHERE fs.SubjectName IN (SELECT qs.SubjectName as SubjectName FROM QuizFeedback qf JOIN QuizSession qs ON qf.QuizID = qf.QuizID WHERE UserID = 9999 ORDER BY Score DESC LIMIT 1);
Choose top 5 most popular subjects for informing ai flashcard set recommendation	SELECT * FROM SubjectType ORDER BY Popularity DESC LIMIT 5;

5. Managerial Queries:

Function	**MANAGERIAL SQL QUERY**
User Engagement Query: ● Retrieve the number of active users in the last month	SELECT Count(*) FROM User WHERE MonthsSinceActive = 0;
Average AI Quiz Performance for students ● Retrieve the average AI-GENERATED quiz performance ● Can compared to non-ai quizzes	SELECT Average(qf.Score) FROM AIGeneratedQuiz ai JOIN QuizFeedback qf ON ai.QuizID = qf.QuizID;
AI - Flashcard Usage Query ● Retrieve the most commonly used flashcards	SELECT Flashcard_Set_ID, Count(*) as FlashcardUsageCount FROM FlashcardHistory GROUP BY Flashcard_Set_ID ORDER BY Count(*) DESC LIMIT 10;
AI-Generated Subject Popularity Query ● Retrieve the most commonly AI-generated subjects	SELECT s.TypeName FROM SubjectType s JOIN Quiz q ON s.TypeName = q.SubjectName JOIN AIGeneratedQuiz ai ON q.QuizID = ai.QuizID GROUP BY s.TypeName ORDER BY Count(*) DESC;
Time-of-Day Engagement Query: ● Retrieve the most popular times ● Optimise content delivery by	SELECT HourTime, Count(*) as numLogins FROM LoginTimes GROUP BY HourTime

identifying peak times of user engagement.	ORDER BY Count(*) DESC LIMIT 3;
Average Time Spent on Platform Query ● Retrieve the average number of minutes spent on the platform ● Compare Before and after AI implementation	SELECT Average(MinutesSpent) FROM LoginTimes;
User Demographics Query ● Retrieve the count of users from different demographic	SELECT COUNT(UserID) FROM User GROUP BY AgeGroup;
AI-Quiz Session Completion Time Query	SELECT Average(qs.MinutesSpent) FROM AIGeneratedQuiz ai JOIN QuizSession qs ON ai.QuizID = qs.QuizID WHERE IsCompleted = True;
% of people who fill out AI quiz feedback ● Retrieve the % and count of users who fill out feedback forms	SELECT count(*) FROM QuizSession qs JOIN AIGeneratedQuiz ai ON qs.QuizID = ai.QuizID WHERE qs.isFeedback = true;
% of positive feedback versus negative feedback on AI featrures	SELECT Count(*)/(SELECT COUNT(*) FROM QuizFeedback) as ratio FROM QuizFeedback WHERE FeedbackType = “Positive”;

6. Reflection on AI Integration

Why Quizlet?

Integrating AI into Quizlet, we chose the edtech giant due to our familiarity and widespread usage. Both Austin and Willson have both used Quizlet throughout their undergraduate career, and we wanted to explore how AI could elevate Quizlet's core competencies. We first conducted an initial analysis of Quizlet's existing AI capabilities, and we brainstormed areas for AI improvement.

Use Cases

UC-1, "AI Quiz Generation," was selected as the main use case due to its benefits in leveraging artificial intelligence to enhance one of Quizlet’s current existing features. By analysing past quiz performances, study habits, and proficiency levels, the system tailors quizzes to each student's unique learning profile. The adjustment of question difficulty based on historical performance ensures an optimal level of challenge. The continuous adaptation of AI to the student's progress, along with the potential for recommending additional study materials will greatly benefit a student’s learning path.

We also included use cases 2 -5 to showcase how AI can also benefit Quizlet, providing insights via performance dashboards, tailoring flashcard recommendations, incorporating user-uploaded content, and empowering managerial decision-making with comprehensive KPI dashboards.

Challenges in AI

For UC-1, The accuracy of the system's analysis of past quiz performances, study habits, and proficiency levels is essential and can be misinterpreted by AI. Ensuring the precision of these AI interpretations is crucial for tailoring the learning experience effectively.

Other challenges that Quizlet would face include maintaining adaptability to diverse learning styles, and safeguarding user privacy while implementing AI to enhance features like dynamic quiz generation and personalised learning paths.

ERD

During the ERD diagram creation, we leveraged ChatGPT to draft a preliminary skeleton. While not flawless, it provided a foundation. After that, we completed the rest of it manually to ensure it was accurate and complete.

Data Inputs

Data inputs were garnered from Kaggle, a popular platform for datasets. ChatGPT was also used in formulating data inputs, contributing significantly to our robust dataset.

Constructing the Database

When creating the SQL database, our ERD was used as a foundational blueprint. We began by translating the entity-relationship model into a structured set of SQL queries. The process involved creating tables and establishing primary and foreign key relationships as outlined in the ERD. We then also ensured that our SQL Queries and Managerial Queries aligned with our database.