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WEB PROGRAMMING ASSIGNMENT

Project

MCQ TEST ONLINE

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1 Introduction

In the current digital era, education systems worldwide are increasingly integrating technology to enhance teaching and learning experiences. Multiple-choice Question (MCQ) tests, a staple of educational assessment for decades, are undergoing a transformation through online platforms, becoming more versatile and user-friendly.

This project is aimed at leveraging these technological advancements to design and develop a comprehensive website that not only facilitates the creation and management of MCQ tests but also enriches the overall testing process with innovative features and functionalities.

This introduction explores the concept of online MCQ tests, articulates the goals of the project, and delineates the scope within which the project will be executed.

1.1 What is a Multiple-choice Question Test Online?

A Multiple-choice Question (MCQ) Test Online is a sophisticated digital tool that revolutionizes the way educational assessments are conducted. This tool enables educators to administer assessments and allows students to take exams through any internet-connected device, be it a computer, tablet, or smartphone. The core of each MCQ is a question or statement, known as a query, followed by a set of possible answers—typically four, marked as A, B, C, and D. Out of these options, only one is the correct answer, challenging students to use their knowledge and reasoning to select the right one.

The adoption of MCQ tests in a digital format offers a plethora of functionalities that traditional paper-based tests simply cannot match. One of the most significant advantages is the inclusion of interactive content, which can engage students in a more dynamic learning process. For example, questions can include interactive diagrams, audio clips, or videos that make the material more accessible and engaging.

Moreover, these online tests support multimedia integration, allowing for a richer presentation of test materials. This can be particularly beneficial in subjects like science and geography, where visual aids are crucial for understanding complex concepts. Another critical feature of online MCQ tests is the provision of instant feedback. Upon completion of the test, students can immediately learn about their performance, understand the correct answers, and identify areas where they made mistakes. This immediate feedback is invaluable for learning as it helps students quickly assimilate corrections and reinforces learning through timely reinforcement.

The platform that hosts these MCQ tests enhances user engagement by making the test-taking experience more interactive and less monotonous compared to traditional methods. It also facilitates remote testing, which is an essential feature in today's global education landscape, allowing students from different geographical locations to take the same test under similar conditions. This is particularly useful for distance learning programs and for institutions that offer online courses to international students.

Additionally, online MCQ tests ensure uniformity in the administration of tests. Every student receives the same questions in the same order, and the environment is standardized, reducing the likelihood of discrepancies that can occur in paper-based tests. The digital format also enables the quick compilation and analysis of results. Educational institutions can collect and analyze

data from these tests efficiently, allowing them to assess not only individual student performance but also to draw insights about the effectiveness of their teaching methods and curriculum.

Overall, the transition from paper-based to online MCQ tests represents a significant advancement in educational technology. It not only simplifies the logistical aspects of test administration but also enhances the learning experience for students by making assessments more engaging and informative. Through these innovations, online MCQ tests are setting a new standard in educational assessment, one that aligns with the needs of modern educators and students in a digitally connected world.

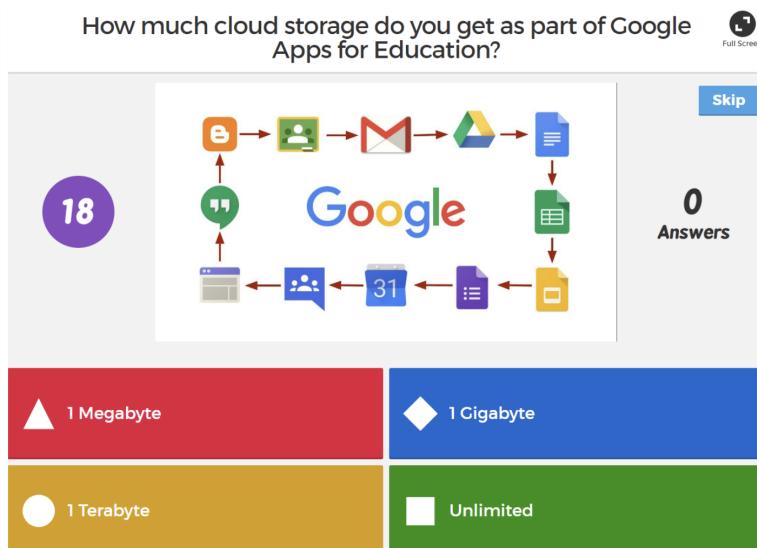


Figure 1. MCQ test online overview.

1.2 Topic Goal

The overarching goal of this project is to develop a dynamic and intuitive website that serves multiple stakeholders in the educational process, including teachers, students, and guests. This website will:

- Enable teachers to effortlessly craft and customize courses and their associated tests, integrating diverse types of questions and multimedia resources to enhance the educational content.
- Offer students a seamless and interactive test-taking experience, with features such as timed tests, instant grading, and personalized feedback to aid in their learning progression.
- Provide guests with the ability to explore the educational offerings of the platform, which can serve both promotional and instructional purposes.

1.3 Project Scope

The project scope is defined by several critical dimensions, each contributing to the comprehensive nature of the proposed platform:



- **Design and Development:** The website will be engineered using state-of-the-art web development technologies and frameworks to ensure robust performance, high availability, and scalability. It will feature a clean, engaging user interface that adheres to the latest web design trends and usability standards.
- **User Roles and Functionalities:**
 - **Teachers:** This role will have capabilities such as creating and managing courses, adding customizable questions with varying difficulty levels, attaching images or videos to questions, assembling tests, and exporting these tests into well-formatted PDF documents.
 - **Students:** They will have access to a dashboard where they can choose courses, take tests, receive immediate feedback, review their answers, and track their progress over time.
 - **Guests:** Guests can navigate through the site to view course previews and sample questions, which can help in making informed decisions about enrollment or usage.
- **Technical Requirements:** Emphasis will be placed on building a secure, reliable, and accessible platform. This involves implementing rigorous data protection measures, ensuring the site is accessible to users with disabilities, and optimizing the website for various devices and network conditions.
- **Accessibility and Usability:** The design will prioritize accessibility, ensuring that all users, regardless of physical ability or technical skill, can effectively interact with the platform. This includes adherence to WCAG (Web Content Accessibility Guidelines) and designing a responsive layout that adapts to different screen sizes and orientations.

This project seeks to redefine the standard for online educational tools by creating a comprehensive, scalable, and user-friendly multiple-choice question test platform that significantly enhances both teaching efficiency and student learning outcomes.



2 Requirements

2.1 Functional

- **USER ACCOUNT MANAGEMENT:**

- **Registration:** Users (teachers, students, guests) can register on the platform by providing necessary details such as name, email address, and password.
- **Login/Logout:** Users can log in to and log out from the platform using their credentials.
- **Profile Management:** Users can view and edit their profiles, including password changes.

- **COURSE MANAGEMENT** (Teacher Role):

- **Create Courses:** Teachers can create new courses by specifying course details such as course name, description, and relevant images or videos.
- **Edit Courses:** Teachers can modify course details or delete courses as needed.
- **Course Visibility:** Teachers can set courses to be public or private.

- **QUESTION AND TEST MANAGEMET** (Teacher Role):

- **Add Questions:** Teachers can add multiple-choice questions to courses, specifying the question text, options (A, B, C, D), the correct answer, and an optional image or video.
- **Edit/Delete Questions:** Teachers can modify or remove questions from courses.
- **Assemble Tests:** Teachers can compile questions into tests, specifying the order of questions and the total number of questions.
- **Export Tests:** Teachers can export tests to PDF format, ensuring that no single question spans multiple pages.

- **TEST TAKING** (Student Role):

- **Select Courses and Tests:** Students can browse available courses and select tests to undertake.
- **Answer Questions:** During a test, students select answers for multiple-choice questions.
- **Submit Tests:** Students can submit their answers for grading.
- **View Results:** After submission, students can view their test scores and review incorrect answers.

- **GUEST ACCESS:**

- **Course Previews:** Guests can view previews of available courses and sample questions.

- **DASHBOARD AND REPORTING:**

- **Teacher Dashboard:** Teachers can view summaries of courses created, tests assembled, and student performance.
- **Student Dashboard:** Students can track their test histories, scores, and progress over time.



2.2 Non-functional

- **USABILITY:**

- **Intuitive Design:** The platform should have an easy-to-navigate, user-friendly interface that is intuitive even for users who are not tech-savvy.
- **Accessibility:** The platform must comply with WCAG (Web Content Accessibility Guidelines) to ensure that users with disabilities can use the system effectively.

- **PERFORMANCE:**

- **Response Time:** The system should respond to user inputs (e.g., button clicks, page navigation) within 2 seconds under normal load conditions.
- **Scalability:** The system must handle up to 10,000 users simultaneously without performance degradation.

- **RELIABILITY AND AVAILABILITY:**

- **Uptime:** The platform should be available 99.9
- **Data Backup:** Automated daily backups of all data to prevent data loss.

- **SECURITY:**

- **Data Encryption:** All user data transmitted over the network should be encrypted using TLS (Transport Layer Security).
- **Authentication:** The system should support secure password standards and session management to prevent unauthorized access.
- **Data Privacy:** Compliance with relevant data protection regulations (e.g., GDPR, CCPA) to ensure user data is handled securely.

- **MAINTAINABILITY:**

- **Modularity:** The system should be built in a modular way to facilitate easy updates and maintenance.
- **Documentation:** Comprehensive system documentation should be provided to assist with future maintenance and upgrades.

These functional and non-functional requirements are designed to ensure that the platform is robust, user-friendly, and secure, catering to both the technical and practical needs of its users.



3 Use Case Details

3.1 Usecase 1: Create a course

Bảng 1: Use-case create a course

Use-case id:	1
Name:	Create a course.
Actor:	Teacher.
Description:	Teachers can create a new course by providing course details such as name, description, and any relevant resources.
Preconditions:	The teacher is logged into the system.
Postconditions:	A new course is successfully created and added to the platform.
Normal flow:	<ol style="list-style-type: none">1. Teacher logs into the system.2. Teacher navigates to the course creation page.3. Teacher enters course details including name, description, and resources.4. Teacher saves the course.5. System confirms successful creation of the course.
Alternative flow:	None.
Exception flow:	None.

3.2 Usecase 2: Manage course content

Bảng 2: Use-case manage course content

Use-case id:	2
Name:	Manage course content.
Actor:	Teacher.
Description:	Teachers can add, edit, or delete multiple-choice questions within a course, specifying question details and options.
Preconditions:	The teacher is logged into the system and has access to the desired course.
Postconditions:	Course content is updated with new, edited, or removed questions.
Normal flow:	<ol style="list-style-type: none">1. Teacher selects a course to manage.2. Teacher navigates to the course content management page.3. Teacher adds new questions or edits/deletes existing questions.4. Teacher saves changes.5. System confirms successful update of course content.
Alternative flow:	None.
Exception flow:	None.



3.3 Use Case 3: Take a test

Bảng 3: Use-case take a test

Use-case id:	3
Name:	Take a test.
Actor:	Student.
Description:	Students can access and complete multiple-choice tests within enrolled courses.
Preconditions:	The student is logged into the system and enrolled in at least one course with available tests.
Postconditions:	Test is completed, and results are displayed to the student.
Normal flow:	<ol style="list-style-type: none">1. Student logs into the system.2. Student navigates to the course containing the desired test.3. Student selects and starts the test.4. Student answers multiple-choice questions.5. Student submits the completed test.6. System displays test results and feedback to the student.
Alternative flow:	None.
Exception flow:	None.

3.4 Use Case 4: View Course Previews

Bảng 4: Use-case view course previews

Use-case id:	4
Name:	View course previews.
Actor:	Guest.
Description:	Guests can preview available courses, viewing sample questions and course descriptions.
Preconditions:	None.
Postconditions:	None.
Normal flow:	<ol style="list-style-type: none">1. Guest accesses the platform without logging in.2. Guest navigates to the list of available courses.3. Guest selects a course to view details and sample questions.
Alternative flow:	None.
Exception flow:	None.



3.5 Use Case 5: Edit course details

Bảng 5: Use-case edit course details

Use-case id:	5
Name:	Edit course details.
Actor:	Teacher.
Description:	Teachers can modify course details such as name, description, and resources for an existing course.
Preconditions:	The teacher is logged into the system and has access to the course to be edited.
Postconditions:	Course details are updated with the new information provided by the teacher.
Normal flow:	<ol style="list-style-type: none">1. Teacher logs into the system.2. Teacher navigates to the course management page.3. Teacher selects the course to be edited.4. Teacher modifies course details (e.g., name, description, resources).5. Teacher saves changes.6. System confirms successful update of course details.
Alternative flow:	None.
Exception flow:	None.

3.6 Use Case 6: Review test results

Bảng 6: Use-case review the test results

Use-case id:	6
Name:	Review the test results.
Actor:	Student.
Description:	Students can review their test results and see correct/incorrect answers for each question.
Preconditions:	The student is logged into the system and has completed at least one test.
Postconditions:	Student gains insights into performance and areas for improvement based on test results.
Normal flow:	<ol style="list-style-type: none">1. Student logs into the system.2. Student navigates to the test results page.3. Student selects a completed test to review.4. System displays test results with correct and incorrect answers highlighted.
Alternative flow:	None.
Exception flow:	None.



3.7 Use Case 7: Export test results

Bảng 7: Use-case export test results

Use-case id:	7
Name:	Export test results.
Actor:	Teacher.
Description:	Teachers can export test results for a specific course or test session into a downloadable format (e.g., PDF).
Preconditions:	The teacher is logged into the system and has access to the test results.
Postconditions:	Test results are exported and ready for download by the teacher.
Normal flow:	<ol style="list-style-type: none">1. Teacher logs into the system.2. Teacher navigates to the test results management page.3. Teacher selects the desired course or test session.4. Teacher initiates the export process and selects the desired file format.5. System generates and provides the download link for the exported test results.
Alternative flow:	None.
Exception flow:	None.

These use cases outline key interactions and functionalities of the online MCQ test platform, illustrating how different actors (teachers, students, guests) interact with the system to accomplish specific tasks.

Each use case includes detailed descriptions of preconditions, postconditions, and the normal flow of events, providing a comprehensive understanding of the system's behavior and expected outcomes for each scenario.

3.8 Use-case diagram

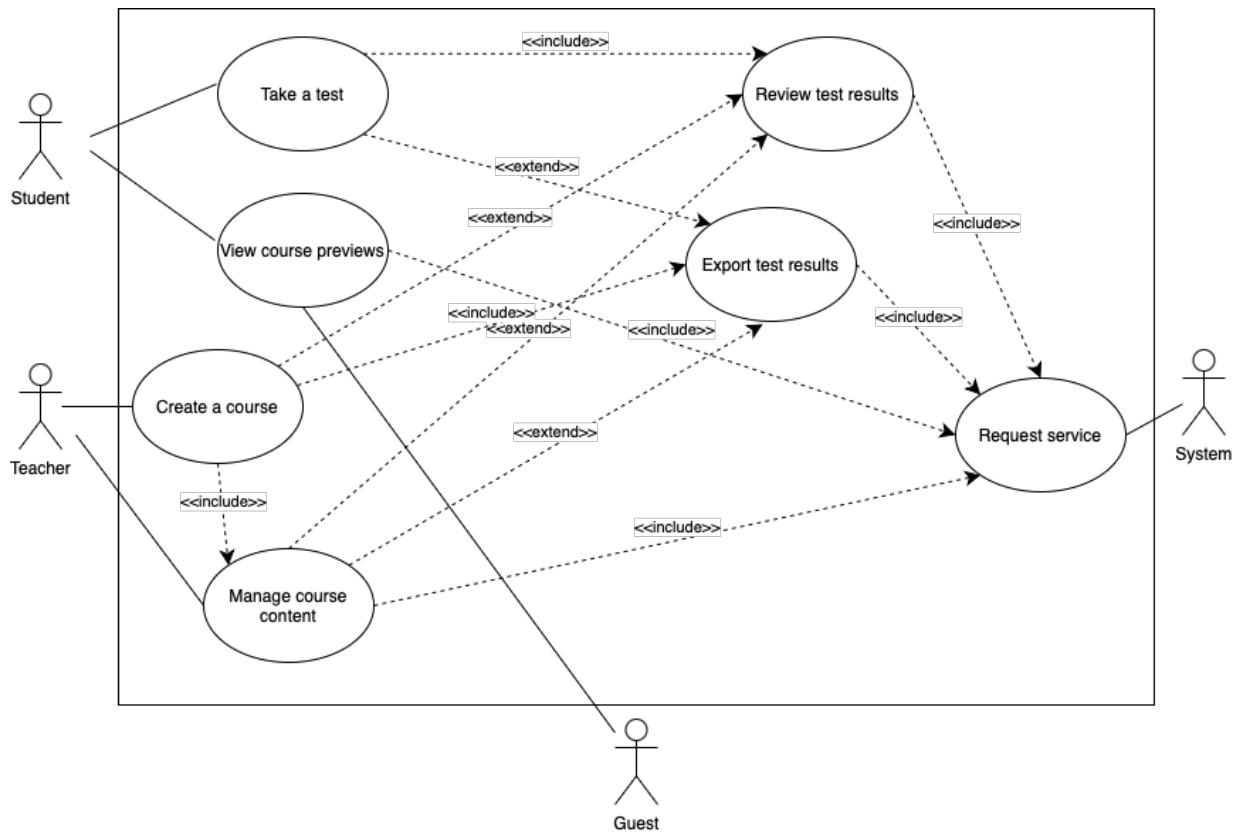


Figure 2. Use-case diagram of the system.

Diagram description:

- **Take a Test:**
 - Includes the ability to "Review Test Results."
 - Extends to "Export Test Results," meaning exporting results is an optional feature based on taking a test.
- **Review Test Results:**
 - Includes the functionality to "Export Test Results."
- **View Course Previews:**
 - This is a standalone use case.
- **Create a Course:**
 - Includes "Manage Course Content," indicating managing content is a necessary part of creating a course.



- **Manage Course Content:**

- This is depicted as an integral part of creating a course.

- **Export Test Results:**

- Tied to both "Review Test Results" and "Take a Test" as an included option.

- **Request Service:**

- This appears as a separate, independent use case, possibly representing an additional service or support feature outside the primary functionality of course and test management.

4 Technical Diagram

4.1 Overall architecture diagram

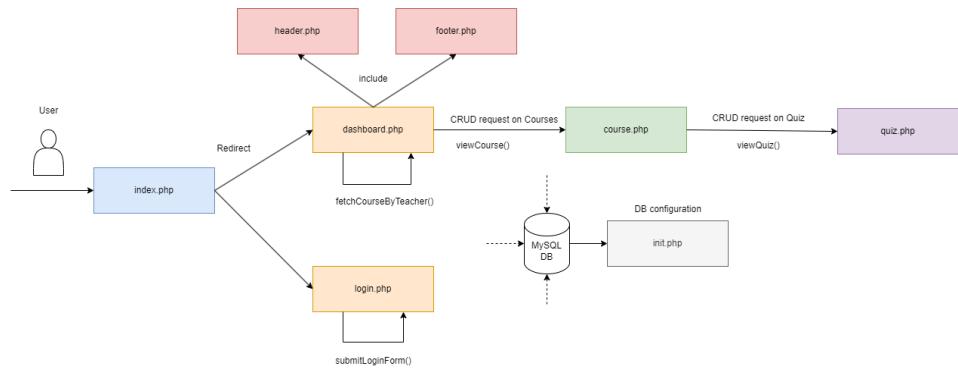


Figure 3. Architecture Diagram.

4.2 E2E student sequence diagram

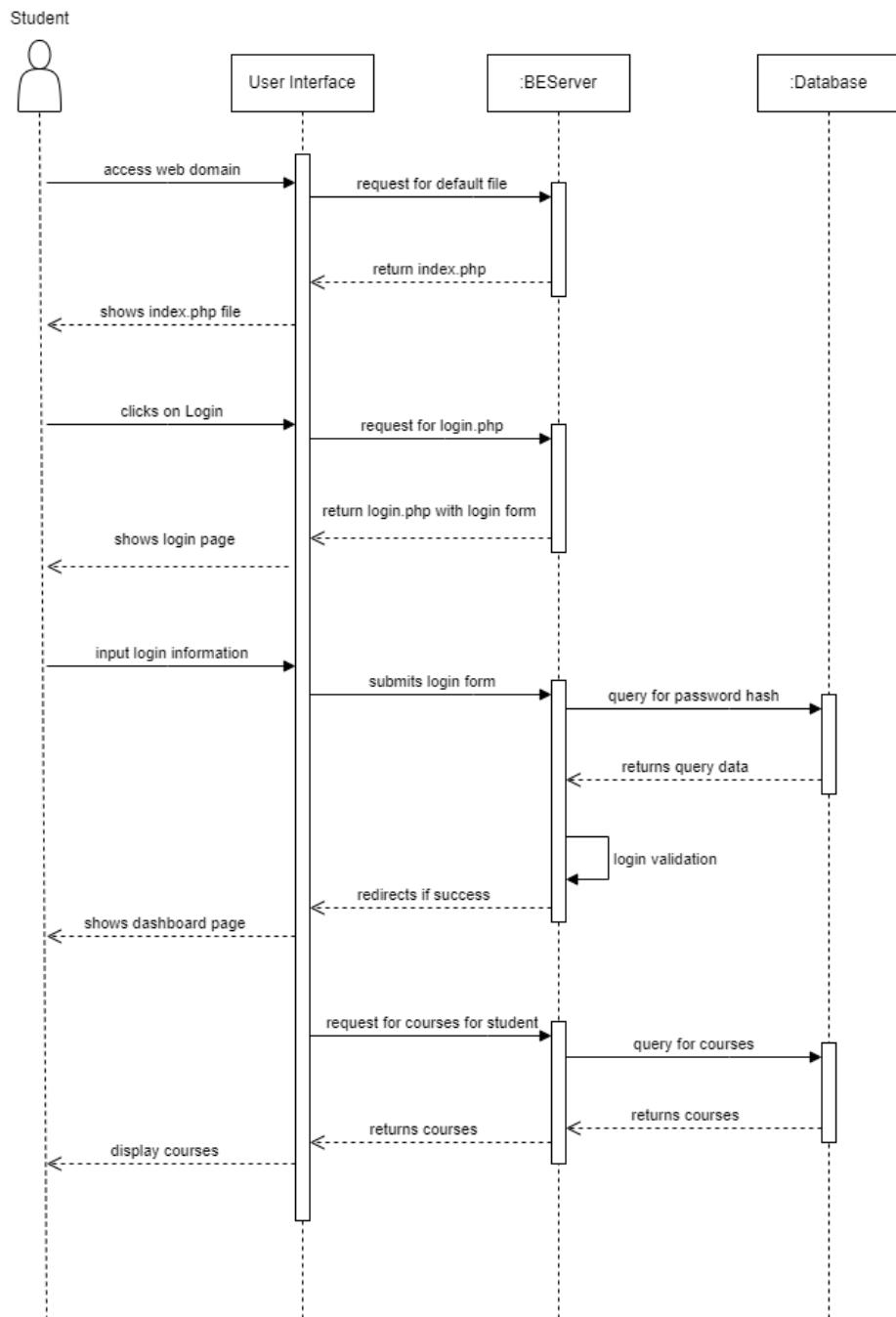


Figure 4. Sequence Diagram part 1.

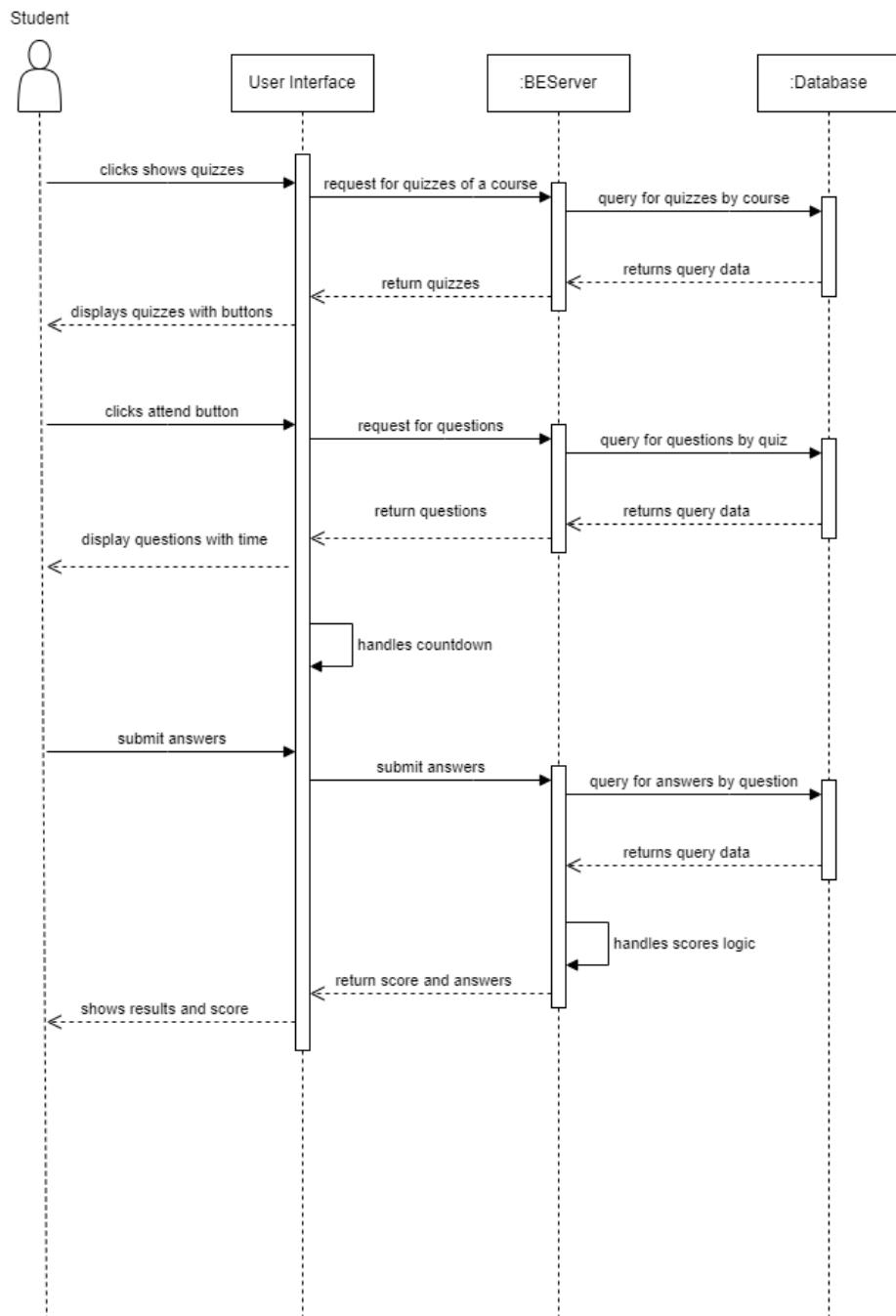


Figure 5. Sequence D2agram part 2.

5 Database

5.1 EDR and Relational Schema

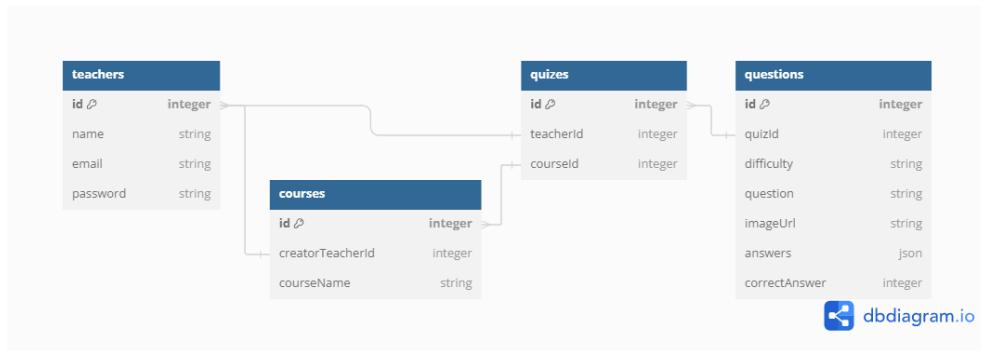


Figure 6. EDR diagram

```
1 Table teachers {  
2   id integer [primary key]  
3   name string  
4   email string  
5   password string  
6 }  
7  
8 Table courses {  
9   id integer [primary key]  
10  creatorTeacherId integer  
11  courseName string  
12 }  
13  
14 Table quizzes {  
15   id integer [primary key]  
16   teacherId integer  
17   courseId integer  
18 }  
19  
20 Table questions {  
21   id integer [primary key]  
22   quizId integer  
23   difficulty string // easy, medium, hard  
24   question string  
25   imageUrl string [null]  
26   answers json // array of answers  
27   correctAnswer integer  
28 }
```



6 System Design And Description

6.1 Login Interface

In the login section, the user needs to enter account name and password that has been provided by HCMUT before. After login, there will be a notification and the user will be directed to the dashboard.

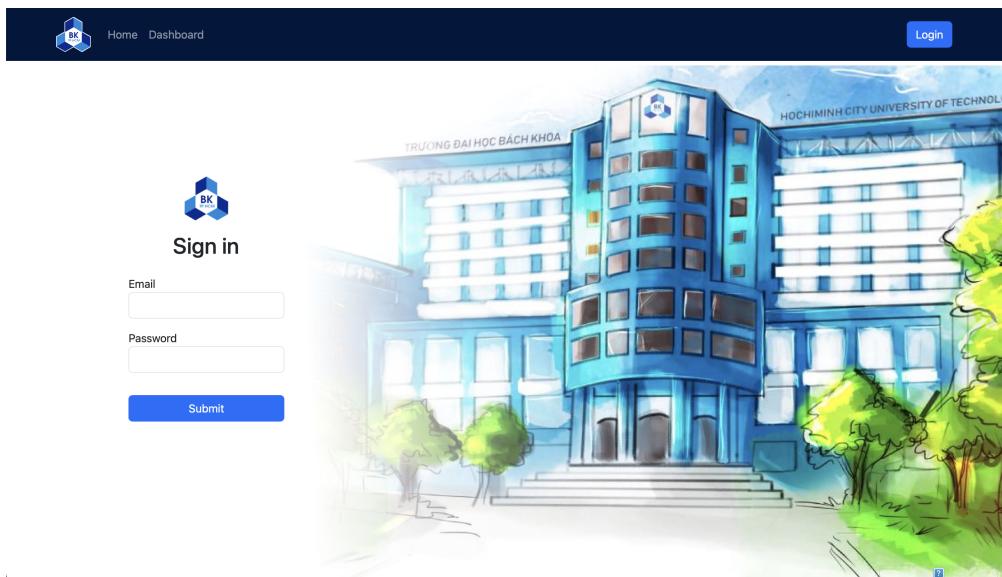


Figure 7. Login interface.

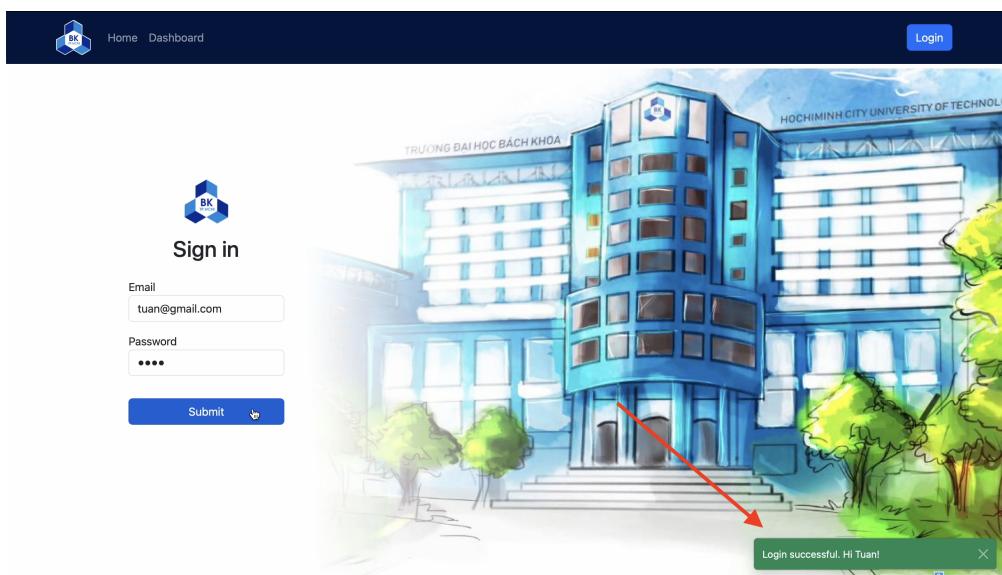


Figure 8. Login Success.



6.2 Instructor interface

The dashboard displays various courses along with images and the names of the instructor. Additionally, instructor is able to create new courses by clicking the 'Create' button located in the upper right corner or edit the content of existing courses.

The screenshot shows the instructor's dashboard with four course cards:

- History** by you (edit, delete)
- English** by Danh (edit, delete)
- Science** by Hung (edit, delete)
- Math** by Khanh (edit, delete)

A blue 'Create' button is located in the top right corner of the dashboard area.

Figure 9. The instructor's dashboard interface.

The screenshot shows the instructor's dashboard with a modal dialog box open over the course cards. The dialog box contains fields for 'Course name' and 'Course cover image', with placeholder text 'Course name' and 'Course cover image' respectively. At the bottom of the dialog are 'Close' and 'Submit' buttons.

Figure 10. After clicking "Create" button.



Instructor can add a new question to a specific course and manage all questions. Plus, instructor is capable arrange the difficulty level, add images, and select the correct answer from four multiple-choice questions publishing.

The screenshot shows a list of quizzes under a course. Each quiz card includes the quiz title, 'by you' authorship, and edit/delete icons. A blue '+' button is at the bottom left.

- 1. History Quiz
- 2. Chinese History Quiz
- 3. World History Quiz
- 4. Review Quiz

+

Figure 11. Quizzes within a course.

The screenshot shows the editing interface for the first quiz. It displays two questions with their details and answer options. The first question is about the capital of France, and the second is about the largest country in the world. Each question has a difficulty level selector (Easy, Medium, Hard) and a trash icon.

Question 1 Easy Medium Hard

What is the capital of France?

Paris
 London
 Berlin
 Rome

Question 2 Easy Medium Hard

What is the largest country in the world?

Figure 12. Questions editing interface.



Instructors may have the capability to export tests to PDF to accommodate students who cannot participate in online assessments.

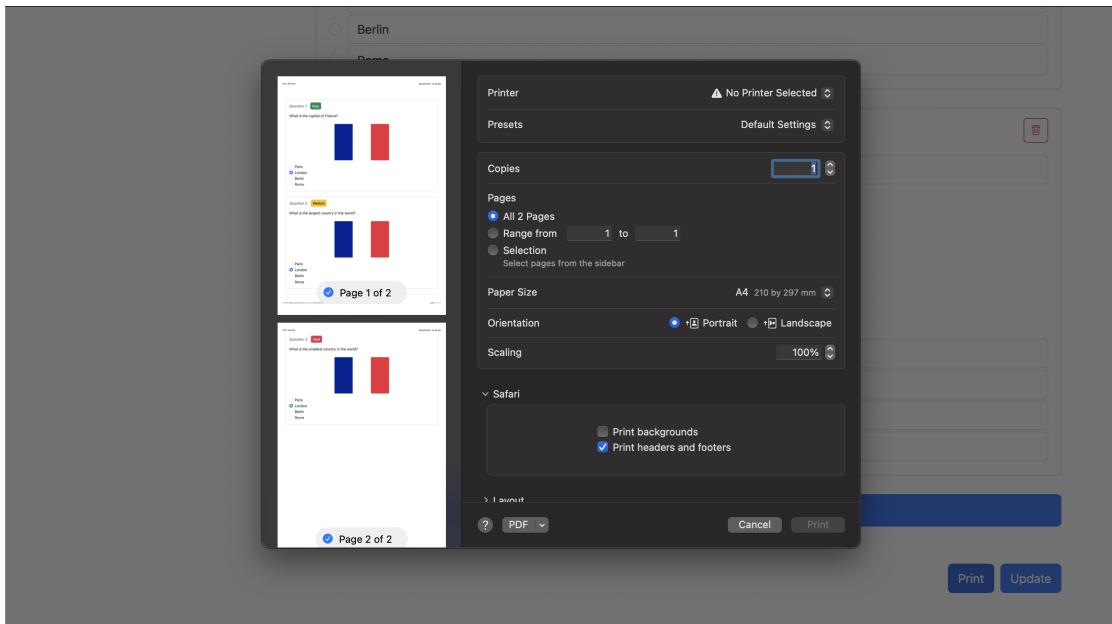


Figure 13. Printing the test.



6.3 Student interface

It is not necessary for student to login, by clicking on "Dashboard" they can select a course and choose a test to do.

The screenshot shows a dark-themed dashboard with a navigation bar at the top featuring the university logo, "Home", "Dashboard", and a "Login" button. Below the navigation bar are four course cards, each with a "No Image" placeholder, the course name, and the author's name. The courses listed are Math (by Khanh), History (by Tuan), English (by Danh), and Science (by Hung).

Figure 14. Student's dashboard interface.

The screenshot shows a dark-themed assignment interface with a navigation bar at the top. On the left, there is a vertical list of quiz cards labeled 1. Science Quiz, 2. Quiz #1, 3. Quiz #2, and 4. Quiz #3, all attributed to "by Hung". On the right, a detailed view of Quiz #1 is shown. It includes the question "What is the chemical symbol for the element gold?", a list of four options (Au, Ag, Fe, Hg) with the first one selected, and a "Question 1" button with a "Easy" rating.

Figure 15. Student assignment interface.



Students are reminded to confirm before submitting their assignments and are able to see their score and wrong answers.

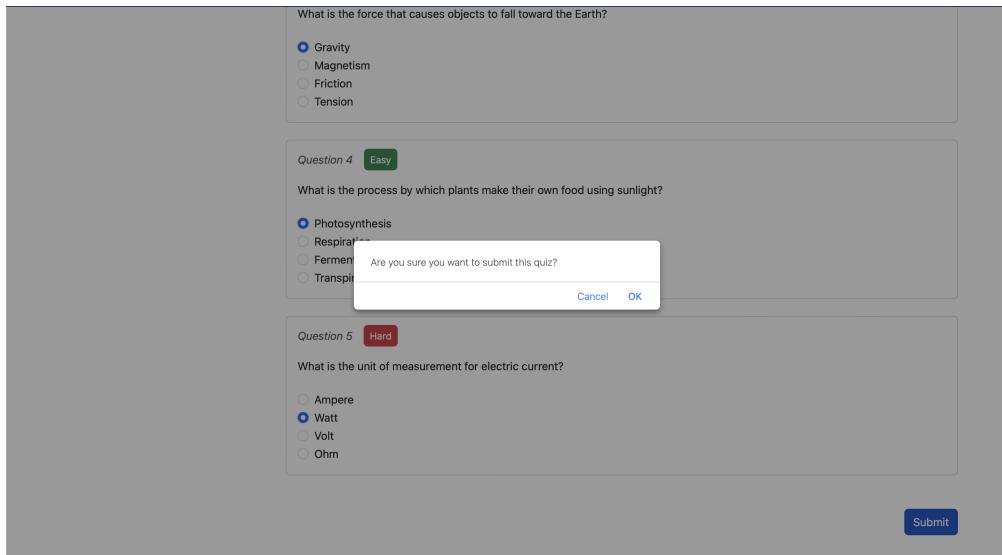


Figure 16. Submission confirmation notification.

The screenshot shows a dashboard with a navigation bar for "Home" and "Dashboard" and a "Login" button. Below, four quizzes are listed: "1. Science Quiz" by Hung, "2. Quiz #1" by Hung (selected), "3. Quiz #2" by Hung, and "4. Quiz #3" by Hung. Each quiz has a list of questions and their answers. For "2. Quiz #1": Question 1 [Easy] asks for the symbol of gold, with Au (selected) and Ag marked with a red X. Question 2 [Medium] asks for the largest organ in the body, with Heart (selected) and Liver marked with a green checkmark. For "3. Quiz #2": Question 2 [Medium] asks for the largest organ in the body, with Liver (selected) and Heart marked with a red X. For "4. Quiz #3": Question 3 [Easy] asks for the force causing objects to fall, with Gravity (selected) and Magnetism marked with a green checkmark. A "Print" button is visible at the bottom right.

Figure 17. Assignment correction.



Magnetism ✓
 Friction
 Tension

Question 4 Easy ×

What is the process by which plants make their own food using sunlight?

Photosynthesis ✅
 Respiration ✓
 Fermentation
 Transpiration

Question 5 Hard ✓

What is the unit of measurement for electric current?

Ampere
 Watt ✅
 Volt
 Ohm

You got 1 out of 5 questions correct.

Figure 18. Score after finishing a test.

6.4 Guest Interface



Figure 19. Guest interface.



7 Distribution And Conclusion

7.1 Distribution

No.	Fullname	Student ID	Distribution	Percentage
1	Lương Quang Khánh	2053115	Full-stack, Material Research, Leader	100%
2	Lưu Quang Hưng	2153408	Front-end, Material Research, Report	100%
3	Nguyễn Anh Tuân	1953070	Front-end, Material Research, Report	100%
4	Nguyễn Đức Danh	2052904	UX/UI design, Front-end, Material Research	100%

7.2 Results Achieved

As a result, after the project, thanks to the instructions of Ph.D Nguyen Duc Thai made it possible for us to implement the project successfully and achieved several key milestones and outcomes:

- Development of a Comprehensive Website:** A robust and user-friendly website has been developed to facilitate the creation, management, and execution of multiple-choice question tests online.
- Integration of Essential Features:** The platform incorporates essential functionalities such as course creation, test management and student engagement tools.
- User Role Implementation:** Differentiated user roles (Teachers, Students, Guests) have been implemented with specific capabilities tailored to their needs.
- Secure and Accessible Platform:** Emphasis has been placed on security and accessibility, ensuring that the platform adheres to data protection standards and is usable for all users.

7.3 Limitations

Despite the achievements, the project also encountered certain limitations:

- Complexity of Multimedia Integration:** Implementing advanced multimedia features (e.g., video questions) posed challenges due to compatibility issues and bandwidth requirements.
- Scalability Concerns:** While the current version supports moderate usage, scalability for a large number of concurrent users remains a consideration for future enhancements.
- User Training Needs:** Some users may require additional training to fully leverage the platform's capabilities, especially in managing course content and test results.
- Interface:** The interface of the application is not diverse. We also realize that our UI designs are not really eye-catching either but we have tried to make it really easy to use to be user-friendly.



7.4 Development Plans

Looking ahead, the project roadmap includes the following development plans:

- **Enhanced Multimedia Support:** Implementing optimizations for multimedia content to improve compatibility and performance.
- **Scalability Improvements:** Upgrading server infrastructure and optimizing code for better scalability under increased load.
- **User Interface Refinements:** Conducting user feedback sessions to refine the user interface and streamline user interactions.
- **Advanced Reporting and Analytics:** Introducing advanced reporting features to provide deeper insights into test results and user performance.
- **Improve User Interface:** We will make attempts to bring better UI/UX for the users.

These development plans aim to address current limitations and further enhance the platform's capabilities to meet evolving educational needs.



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