

Design and Prototyping Project

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1 OVERVIEW

Students need an efficient way to study individually before tests and exams. While quizzes exist everywhere on the internet, there should be a way for them to freely create their own quizzes based on the content they learn in their courses. This will help them identify and measure their strengths and weaknesses, and stimulate their cognition everyday. Furthermore, teachers also need a platform where they can provide students with practice quizzes to help them improve their learning.

The target users are mainly students who go to high school, university and college. Since this app is focused on helping students study and tracking their progress, it needs to be easily accessible from anywhere. Students can have very different circumstances from being international students, e-learning to in-person attendees. Therefore a web application is the perfect interface for our target users who would need to use this from many different locations on many different devices. The target users also include teachers or tutors who want to provide quizzes and review material for students.

As mentioned earlier, a web application will be the ideal interface to use. We will be using HTML, CSS, JavaScript, SQL. HTML will be used for the basic structure, while CSS will be used for the styling and design. JavaScript and SQL will be used to manage the back-end to implement the functionality of the system.

The project is being designed and built to easily accommodate growth and expansion. We can start by creating a low fidelity prototype and then gradually continue adding/removing features that align with our objective. Our project has a clearly defined goal of focusing on essential features such as self quiz creation, registration and study note management. This will help with ensuring that the features are within the allotted time and that the changes can be made without making or breaking the system.

1.1 Target Users

- Source: Katie Myers. 2020. 5 Ways Online Learning Is Crucial In Education. Retrieved October 16, 2023 from <https://elearningindustry.com/how-online-educational-resources-are-useful>
Online resources are advantageous for many reasons, such as its improved accessibility, the instant feedback to the work students do, and how it can help improve students' weaknesses in certain parts of a given lesson's content. Furthermore, teachers save time helping out students individually and focus on other important tasks, and students in turn don't fall behind on the course content.
- Source: College Lake County. 2023. Benefits of Online Learning. Retrieved from <https://www.clcillinois.edu/programs-and-classes/online/onlineforyou/benefits>
Online resources can help students improve their technical skills. They can easily access them no matter their location, meaning that they can either study at the comfort of their own home or if they are out of town.
- Source: TestReach. 2022. The Benefits of Online Assessment. Retrieved October 16, 2023 from <https://www.testreach.com/benefits-of-online-assessment-testreach.html>
Digital online assessments (for our case, we can compare them with quizzes used for studying for assessments) are more environmentally friendly thanks to less paper printing.
- Source: Guru TechnoLabs. 2018. Education Apps: Advantages, Ideas & Features. (June 2023). Retrieved October 16, 2023 from <https://www.gurutechnolabs.com/advantages-ideas-and-features-of-education-apps/>

Studying, an activity that is considered to be “boring” among students, will be more interesting if done through interactive activities. Educational applications are receiving positive responses from users nowadays because of how much more interesting studying has become.


- Source: Kinga Edwards. 2021. Quiz Maker for Teachers: Benefits and Good Practices. Retrieved October 16, 2023 from <https://youengage.me/blog/quiz-maker-for-teachers-benefits-and-good-practices/>

Instead of reading the course book, quizzes can help students not only to remember the content of a given class, but to also engage themselves in learning the material interactively.

2 PERSONA'S

2.1 Teacher Persona

Jennifer Kingston



Gratifications

- Values personal life, balancing with her profession.
- Providing guidance to students.
- Creating interactive activities to help students learn course content.

Frustrations

- Not well versed in new technology.
- Not the best at making presentation slides.
- Lack of online resources to use for her course content activities as she makes her own.
- Using paper for course activities like quizzes.

Goals

- Staying active within the university's educational dashboard.
- Providing students with more activities to do on their own.
- To feel guided when creating certain activities using online resources.
- Being more eco-friendly with her course content.

Biography

Jennifer has been a professor teaching psychology at Carleton University for 7 years. She values her profession just as much as her personal life and spending time with her family. She has always been an old-school student, which has negatively impacted her computer skills. Jennifer tries her best to provide students with resources to help them study the course material as much as possible, but she only gives her students either PDF files online or quizzes on paper for them to do on their own time. She is also aware that only a certain proportion of students will use her resources to study despite her encouragement. Thus, she tries various websites for her courses each semester to find the perfect application for both the education of her students and for her own productivity.


Background


- 37, Female
- Professor at Carleton University
- Studied at the University of Ottawa
- Enthusiastic, confident
- Married, has 2 children


Fig. 1. Teacher Persona


2.2 Student Persona 1


Razi Judge



 Economics


 E-learning/Online

 20 years old

 Ottawa, Ontario

Gratifications

- Engaging content, such as video lectures, interactive exercises, and discussion forums
- Investing in the stock market and making money
- E-learning given flexibility to balance school and goals



Frustrations

- Sleep schedule
- Waiting hours to get a response from an online forum/discussions
- Motivation to study

Goals

- Finding an internship
- Attempting to become more physically fit
- Read 1 book every month

Biography

He belongs to a family of four, sharing his home with both his parents and a younger sister. Both his parents are accountants and he hopes to one day strive to be just like them. His university is located an hour away from his residence, prompting to opt for remote learning.

Fig. 2. E-Learning Student

2.3 Student Persona 2

Angela Battista

Background:

- Age: 24
- Female
- University of Toronto Student
- 4th year in Bachelor of Engineering – Mechanical
- Part-time Walmart Employee Toronto, ON

Goals:

- Work as a lead engineer at Nasa.
- Wants to work from home.
- Buy a new car.
- Pay off her tuition loan.

Motivations:

- Easy accessibility to lecture material outside of lecture time to keep a flexible schedule.
- Enjoys building her network via event at her university.
- Values having leisure stress free time to herself.

Frustrations:

- Not having enough time to adequately prepare between exams and deliverables.
- Lack of supporting sample tests or solutions to verify her knowledge.
- Being unable to balance work/social life with school.
- Expenses of textbooks and other online resources

Biography:

Angela is a 4th year mechanical engineering student studying at the university of Toronto. She lives in a shared rent apartment with two other students. Due to high expenses of living in Toronto she works a part – time job. She has a hard time managing her time and struggles to keep up with her workload. She is paper-free and used her tablet to take notes. She often skips classes to work on assignments for her other classes. She loves playing video games and enjoys spending her time in a quiet environment which often clashes with her workload. She also loves hanging out with her friends and like to visit new restaurants with them. She is excited to graduate and is currently looking for a job for after her graduation.



Fig. 3. In - Person Student

3 SCENARIOS

3.1 Student Scenario

William Smith is a college student with an extremely hectic schedule, taking 5 courses while juggling a part time job with little to no time for hobbies. He wants to succeed in school however the lack of motivation to study holds him back. This is where our self made study website comes in to save the day. William discovered this website by a recommendation from one of his friends to help do well in school. Intrigued, he creates an account and navigates to the “Create Quiz” section. With a few simple clicks, he generates a quiz using the platform’s user-friendly interface. The questions are drawn from a question bank he’s been building all semester, which saves him a significant amount of time. The next day, he goes back onto the system and creates another self made quiz. However, this time its different; sometimes when he starts answering the questions he may get questions from the previous days. If he answers them correctly the system wouldn’t stop recommending questions, it would just delay the time that the question repeats for a few more days and months. As he continues taking quizzes and answering them and repeating the questions that he got wrong, will help reinforce his concept.

3.2 Teacher Scenario

Professor Joshua Ridgeway has been teaching historical English literature at university for 7 years. He has noticed the decline in using paper among his students and wants to update his method of teaching to be more accessible to students. He used to provide students with worksheets on the school provided website to help them review for the course. He realized this made it hard for him to provide the same resources the following year, as he would re-upload all of the resources. He recently came across the self-test website. He browses it and realizes that he can upload ungraded practice worksheets here, with the sample solutions that the student can use to verify their own answers. And this website would hold the uploaded worksheets for as long as the website is active, solving his shared content issue. He tested creating a quiz himself, and found it relatively simple to use compared to the interface of the school provided dashboard. He quickly makes an account for himself as a teacher. He creates a practice quiz for the first upcoming test of the semester, and uploads the solution locked behind completing the quiz. He sees that he can post three types of questions: multiple choice, long answer, and short answer. He finishes the test, uploads it, and makes it available to be publicly viewed. The next day during the lecture, he shares the link to the students and informs them that this website is great for creating quizzes to test yourself or attempting the quizzes that he has provided.

4 INITIAL PROTOTYPES: DESIGN 1: FRIENDLY INTERFACE

4.1 Design Rationale:

Based on what we have learned and researched in the previous step, we realized that students often do not want to study because the action of studying seems not enjoyable. So, we wanted to make a design that is aesthetically pleasing to the eye with a simple interface and appearance while also providing users with useful and helpful features to make things work. This will encourage users to identify their strengths and weaknesses in an interactive way and in a virtual environment they feel most comfortable and well versed in. Furthermore, for teachers, creating quizzes might be difficult if they do not have enough experience using web applications. To combat this, this design will focus on providing support for users with instructions on what needs to be done when creating a quiz on the page.

4.2 Design Approach:

Evidently, our application will have access to multiple features that users should feel comfortable using. Here is a list of how we approached the implementation of these features in our design:

- A visual and interactive characteristic in this design is the presentation of menu bar icons, which will be placed at the top of the interface. These icons will be available at all times regardless of which page the user is currently on. The goal for this is to provide easy access to features, such as creating a quiz, viewing the user's account, and more. The downside for this feature is that there will be a limit to the number of features the user can choose from this menu. Therefore, it will be important to place these icons on the menu bar properly.
- When a user is doing a quiz, we want the page to have a feeling of a real test at school where all the questions can be seen. Thus, we have replicated that by allowing every question to be visible. Once the user answers all the questions and clicks on a button at the end of the page labeled "Done", they instantly get their score back for all questions.
- Creating a quiz on our web application should be an easy process, even for teachers who do not have great experience using computer devices. So, we wanted to make a quiz creation page with an interface with simple explanations on what to do, specifically the addition of a checklist that acts as a to-do list for what needs to be done for the quiz to be put out.
- If there are a range of quizzes available to do, then users should be able to search for quizzes that other users have created based on what they are studying. Plus, since we want to keep the aesthetically pleasing aspect of the design, we want the search page to be very easy to interact with. Therefore, the search page will have a set of large buttons with big labels and pictures that displays to the user a possible category to query.
- To use this application, users will need an account on the platform. Once they are logged in, they should be capable of viewing their account information in case they want to review and/or modify their information. For this design, the user's account page will be divided in two sections of the page: one that will display links labeled with sections of information important to the user; their personal information, their created quizzes, and their liked quizzes, and one that will display the specific information related to the links mentioned previously. This allows the user's information to be clearly presented and to carefully use the space without overwhelming the user's eyes.

4.3 Anticipated Advantages

Based on the requirements we have gathered in previous steps, we believe that this design is a strong possible candidate for the basis of our product's design as we anticipate many advantages:

- Users that are students will be able to enjoy studying for their tests and exams in an environment they are comfortable interacting with.
- Users that are teachers will be encouraged to use the web application to provide students with practice tests and maybe even short quizzes based on the lesson material.
- A quiz creation process that users can do efficiently.

4.4 Design 1: Low Fidelity

(1) Login Page

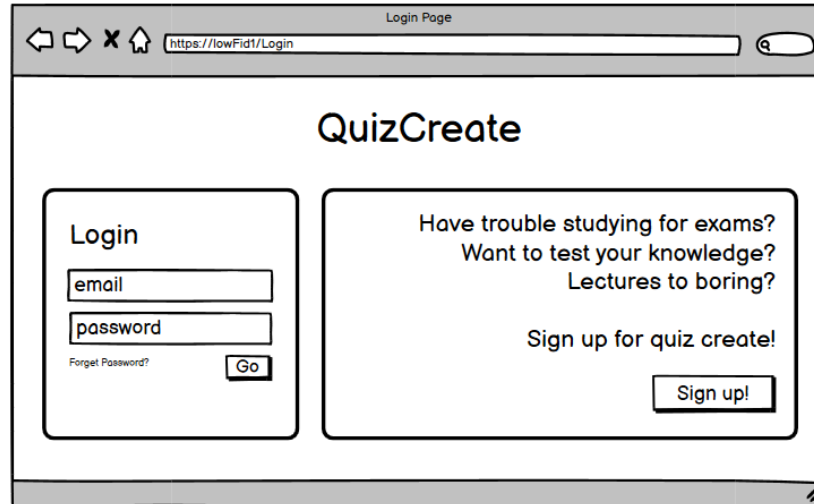


Fig. 4. Login Page

(2) Search Page - Also the landing page

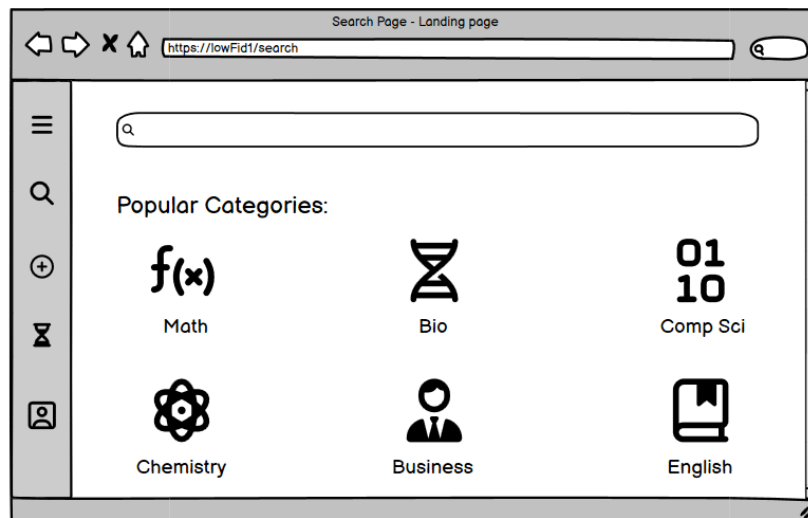


Fig. 5. Search Page

(3) Menu Bar

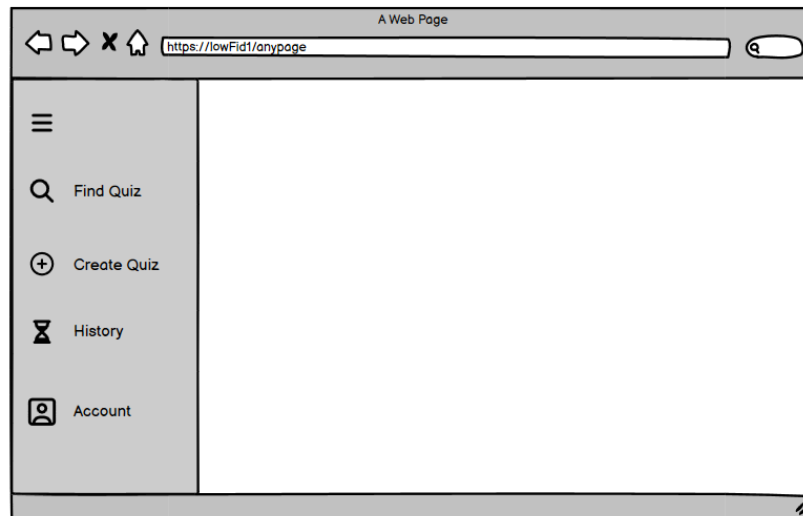


Fig. 6. Menu Bar

(4) Account Page

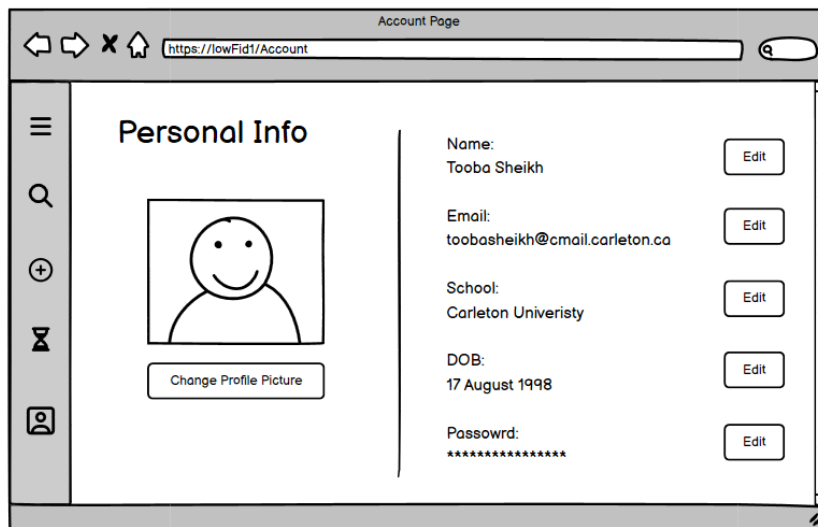


Fig. 7. Account Page

(5) History - Saved Quizzes, Created Quizzes, Score

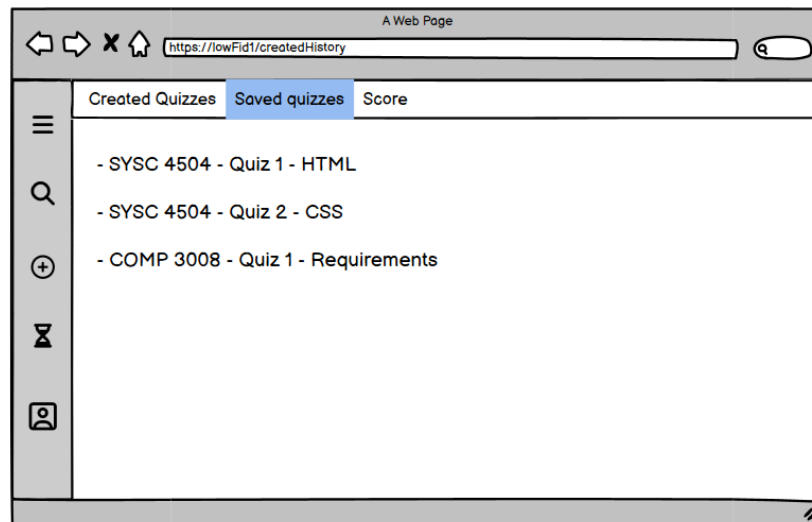


Fig. 8. Saved Quizzes

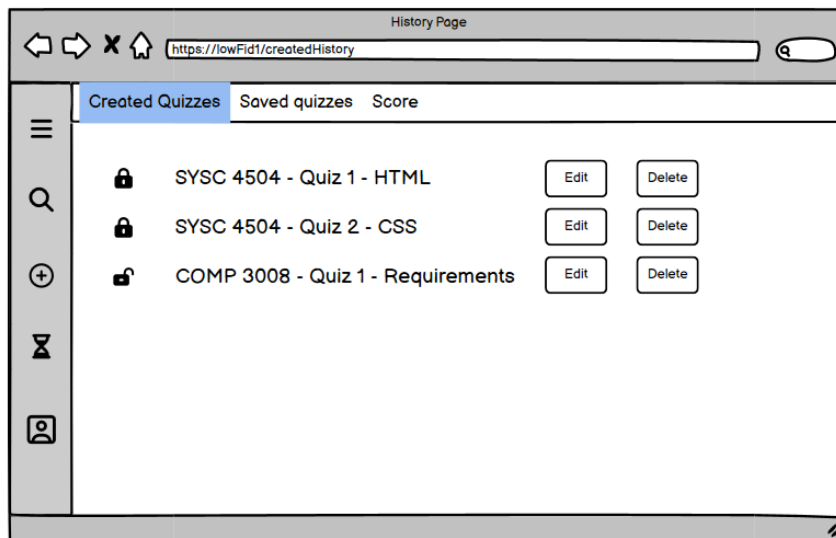


Fig. 9. Created Quiz Page

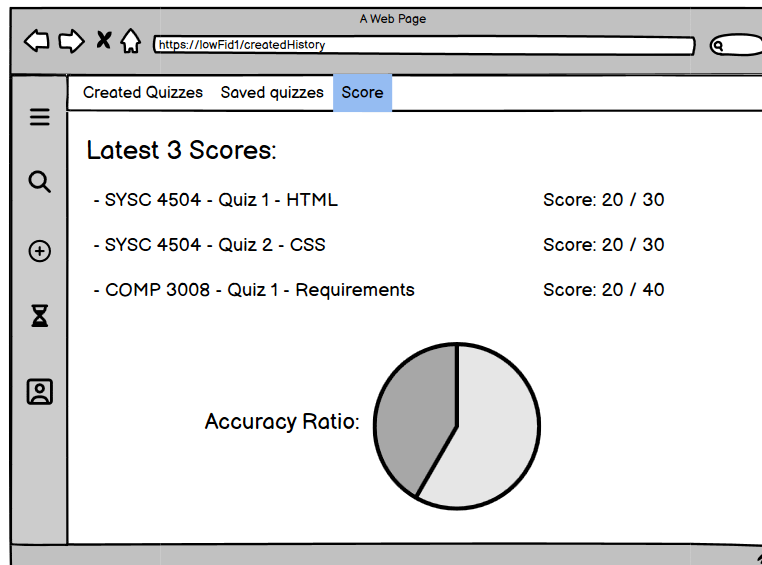


Fig. 10. Score Page

(6) Take Quiz - Multiple Choice, Long Answer, Short Answer

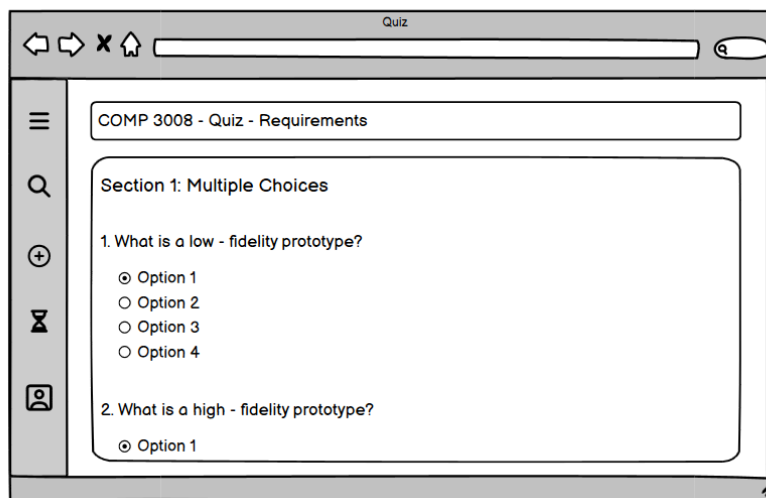


Fig. 11. Multiple Choice

The screenshot shows a web browser window titled "Quiz". On the left is a sidebar with icons for a menu, search, add, timer, and user profile. The main content area is titled "Section 2: Short Answers" and contains three questions, each with a text input field:

1. What is a low - fidelity prototype?
2. What is a high - fidelity prototype?
3. What to graduate?

Fig. 12. Short Answers

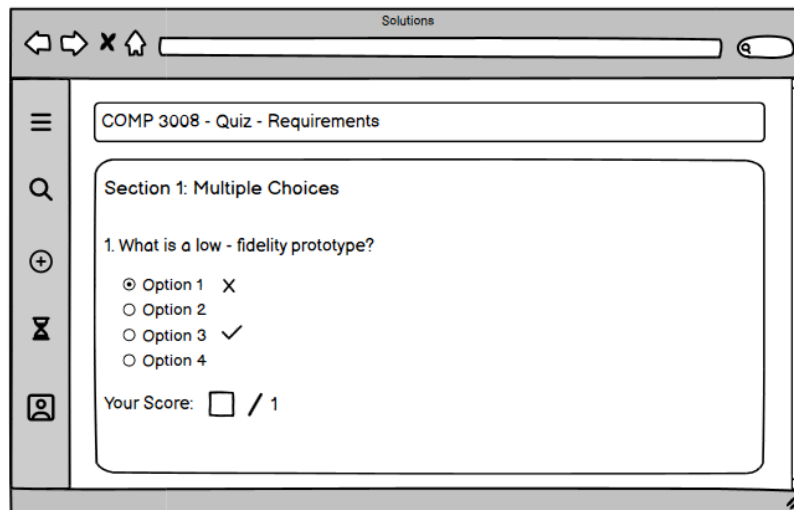
The screenshot shows a web browser window titled "Quiz". On the left is a sidebar with icons for a menu, search, add, timer, and user profile. The main content area is titled "Section 3: Long Answers" and contains one question with a large text area for the answer:

1. What is a low - fidelity prototype?

At the bottom right of the main content area are two buttons: "Done" and "Save".

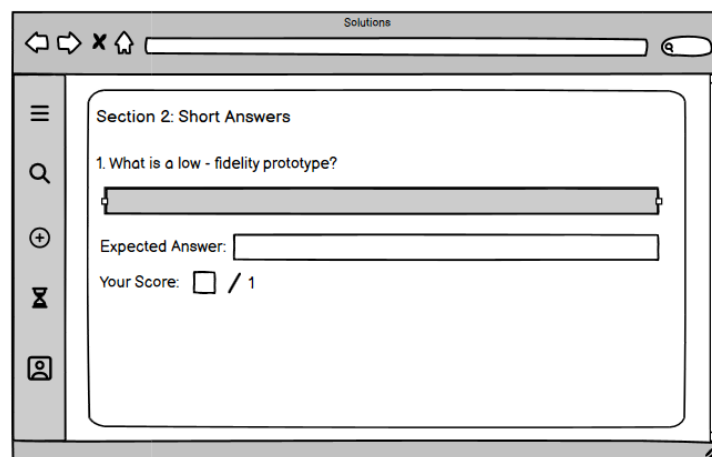
Fig. 13. Long Answers

(7) Solutions and Scoring page



The screenshot shows a web browser window titled "Solutions". The address bar contains "COMP 3008 - Quiz - Requirements". The left sidebar has icons for a menu, search, add, timer, and user profile. The main content area is titled "Section 1: Multiple Choices" and contains the question "1. What is a low - fidelity prototype?". Below the question are four radio button options: "Option 1" (selected with an 'X'), "Option 2", "Option 3" (marked with a checkmark), and "Option 4". At the bottom, it says "Your Score: ☐ / 1".

Fig. 14. Multiple Choice - Solutions Page



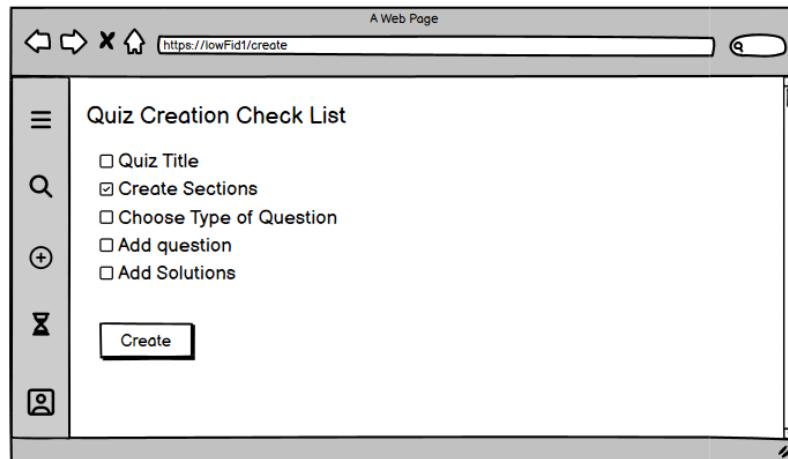
The screenshot shows a web browser window titled "Solutions". The address bar contains "COMP 3008 - Quiz - Requirements". The left sidebar has icons for a menu, search, add, timer, and user profile. The main content area is titled "Section 2: Short Answers" and contains the question "1. What is a low - fidelity prototype?". Below the question is a text input field. Underneath the input field is the text "Expected Answer:" followed by another text input field. At the bottom, it says "Your Score: ☐ / 1".

Fig. 15. Short Answers - Solutions Page

The image is a wireframe of a web application interface titled "Solutions". It is divided into a sidebar on the left and a main content area. The sidebar contains five icons: a hamburger menu, a magnifying glass, a plus sign, a timer, and a user profile. The main content area is titled "Section 3: Long Answers" and contains a question: "1. What is a low - fidelity prototype?". Below the question is a large rectangular text input field. Underneath this field is the text "Expected Answer:" followed by another rectangular text input field. At the bottom of the main content area, there is a score display: "Your Score: ☐ / 1". In the bottom right corner of the page, there are two buttons labeled "Done" and "Save".

Fig. 16. Long Answers - Solutions Page

(8) Create Quiz



A Web Page

https://lowfid1/create

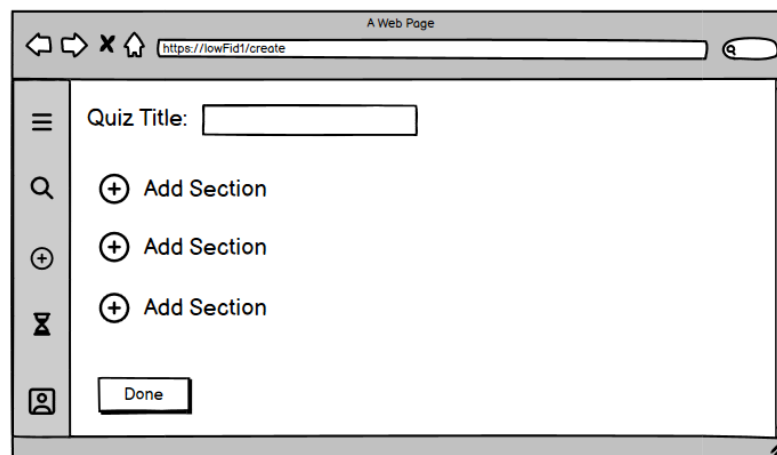
Quiz Creation Check List

- ☐ Quiz Title
- ☒ Create Sections
- ☐ Choose Type of Question
- ☐ Add question
- ☐ Add Solutions

Create

The image shows a web browser window titled 'A Web Page' with the address bar displaying 'https://lowfid1/create'. On the left is a sidebar with icons for menu, search, add, timer, and user. The main content area is titled 'Quiz Creation Check List' and contains a list of five items: 'Quiz Title', 'Create Sections' (checked), 'Choose Type of Question', 'Add question', and 'Add Solutions'. A 'Create' button is located at the bottom of the list.

Fig. 17. Quiz Creation Start Page



A Web Page

https://lowfid1/create

Quiz Title:

+ Add Section

+ Add Section

+ Add Section

Done

The image shows the same web browser window as Fig. 17. The 'Quiz Title' checkbox is now a text input field. The 'Create Sections' checkbox is now a button with a plus sign. Below it are two more '+ Add Section' buttons. The 'Add question' and 'Add Solutions' checkboxes are no longer visible. A 'Done' button is now at the bottom of the main content area.

Fig. 18. Add Sections Page

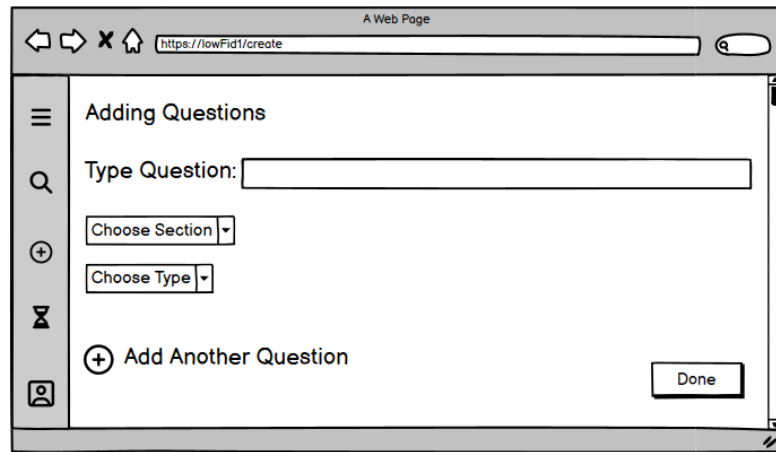


Fig. 19. Add Questions Page

5 INITIAL PROTOTYPES: DESIGN 2: GAMING INTERFACE

5.1 Design Rationale

As mentioned in our design rationale for our first design, students have a hard time being interested in studying as they find it boring. We wanted to make a design that tackles this problem in a different way, with more emphasis on the needs of a student. The goal for this design is to make the application feel like a game, adding elements like gamification achievements and score tracking, while also laying out the interface elements differently compared to our previous design.

5.2 Design Approach

Here is a list of how we approached the implementation of these features in our video-game-influenced design:

- Users should be allowed to use various features regardless of what page they are currently on. The menu bar will contain links to these pages/features displayed in dropdown lists to allow features to be grouped together (example: searching and creating quizzes as one group, account information, created quizzes, and saved quizzes in another group).
- When a user is doing a quiz, each question will be displayed one question at a time. This way, they will be less likely to deviate their attention to other questions simultaneously and possibly help them direct their focus on the given question. After each question is answered, they will get an indication if they got it correctly or not. This way, the user might push himself further to answer the upcoming questions more carefully. The downside to this approach is that the experience will not be as similar as possible to a real-life test or exam.
- When creating a quiz, a user can choose, for each question, one of two types of answers: written answer or a multiple choice. The page will give access to the user the amount of points the question is worth, the time limit to add competitiveness, and the type of questions the quiz will provide. The user can also write hints alongside each question to guide the user if they are stuck. This approach is important to encourage consistency within every created quiz by making sure the competitive elements are present

- The login and registration pages will be relatively simple. The login page will ask for a username and password along with two buttons labeled “Login” and “Register.” If the user clicks on “Register” though, they will be directed to a page that will ask them for an email as well. The approach with this feature is to make an account in a recognizable layout for users.
- The layout of the home page should aim to inform the user of the features of the application. However, we want the user to be capable of searching for quizzes as soon as they enter the website so that they can start studying as soon as possible. Thus, the home page will contain elements used to query quizzes, such as a search bar to query a school and a course from the chosen school. If they are already logged in, they can access their created and saved/liked quizzes as well.

5.3 Design Advantages

We believe this design can also be advantageous for our users: The application will change the way users perceive tests and exams, which will in turn relieve them from stress. Users will not feel like using our application will be a chore, but more so as doing something that is more fun to do. Users will feel like they have achieved stuff, and will set personal goals which will encourage them to use the application more often.

5.4 Design 2: Low Fidelity

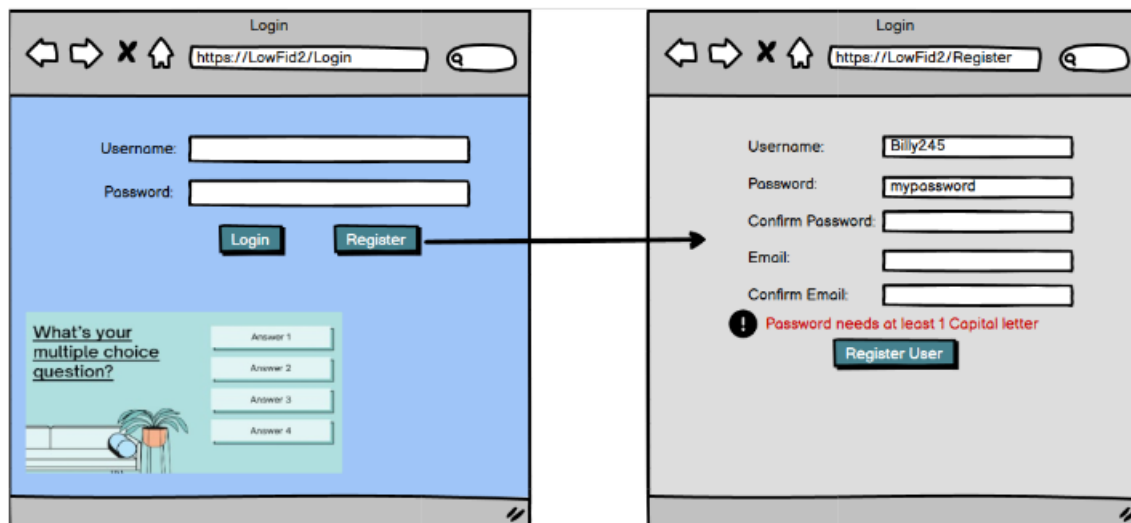


Fig. 20. Login and Registration Page

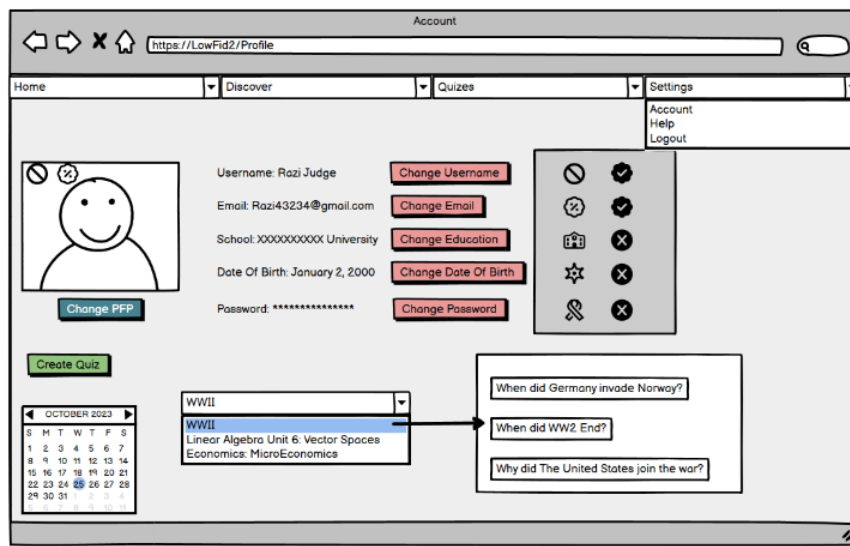


Fig. 21. Account Page

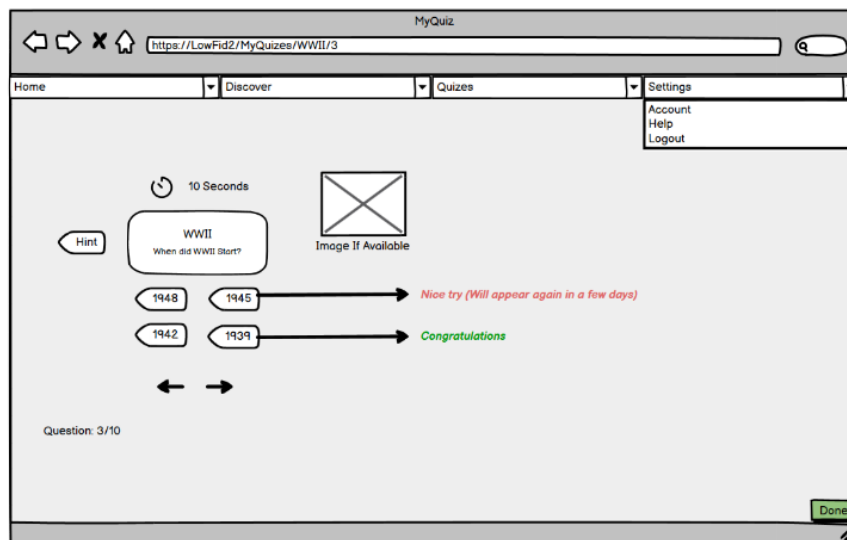
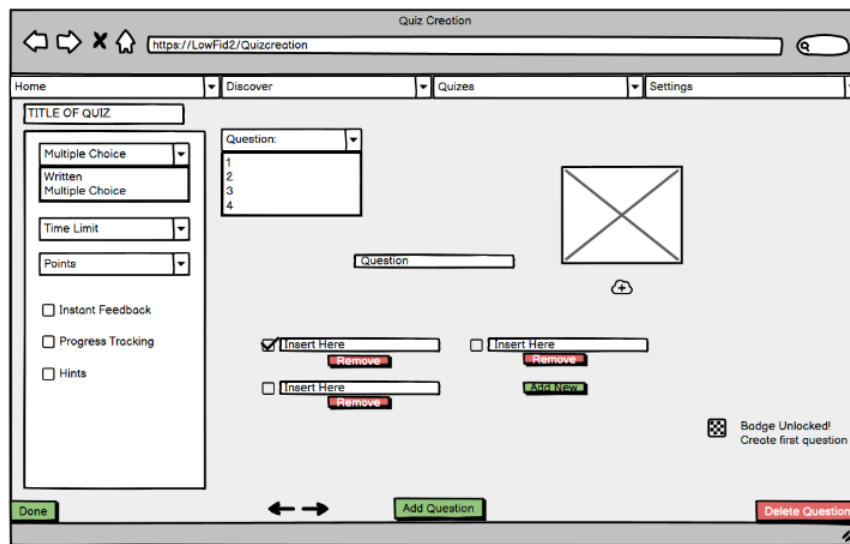
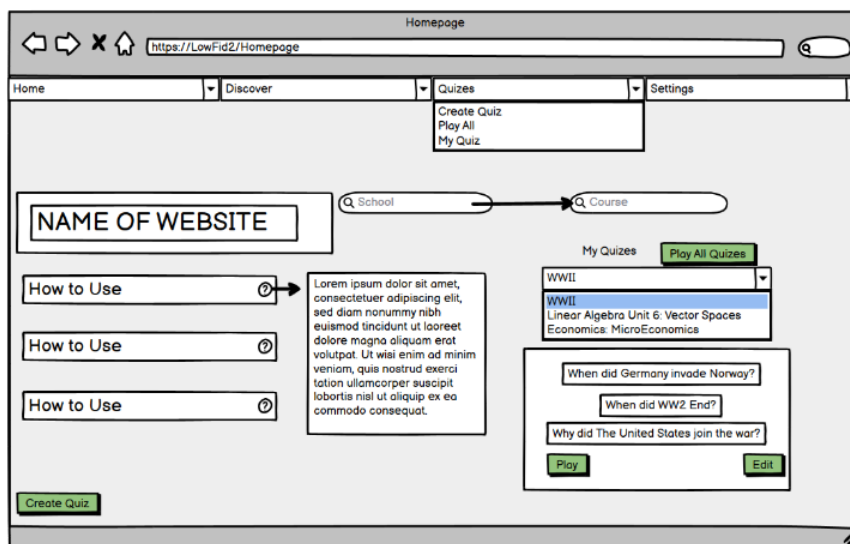


Fig. 22. Quiz Page



The 'Quiz Creation' page features a top navigation bar with 'Home', 'Discover', 'Quizzes', and 'Settings'. The main area is divided into a left sidebar and a central workspace. The sidebar contains a 'TITLE OF QUIZ' input, a question type selector (Multiple Choice, Written, Multiple Choice), a 'Time Limit' dropdown, a 'Points' dropdown, and checkboxes for 'Instant Feedback', 'Progress Tracking', and 'Hints'. The central workspace includes a 'Question' input, a list of question numbers (1, 2, 3, 4), a 'Question' label, a large 'X' icon, and two 'Insert Here' buttons with 'Remove' links. A 'Done' button is at the bottom left, and 'Add Question' and 'Delete Question' buttons are at the bottom right. A badge on the right says 'Badge Unlocked! Create first question'.

Fig. 23. Create Quiz Page



The 'Homepage' features a top navigation bar with 'Home', 'Discover', 'Quizzes', and 'Settings'. The 'Quizzes' dropdown menu is open, showing 'Create Quiz', 'Play All', and 'My Quiz'. The main area includes a 'NAME OF WEBSITE' input, a search bar with 'School' and 'Course' filters, and a 'Create Quiz' button. On the left, there are three 'How to Use' sections with placeholder text. On the right, there is a 'My Quizzes' section with a 'Play All Quizzes' button and a list of quizzes: 'WWII', 'Linear Algebra Unit 6: Vector Spaces', and 'Economics: MicroEconomics'. Below this, there are three quiz questions: 'When did Germany invade Norway?', 'When did WW2 End?', and 'Why did The United States join the war?'. Each question has a 'Play' button and an 'Edit' button.

Fig. 24. Search Page

6 PROTOTYPE EVALUATION

6.1 Cognitive Walkthrough: Design 1

Design 1 was created with more visuals over texts and an uncluttered interface to guide the user to be able to use the system intuitively. There were five main scenarios that a user would experience in this system. The roles were assigned as follows:

- Tooba : Persona's advocate
- Mirage: Prototype operator
- Garrison: Results recorder

There are five main scenarios in design 1.

- (1) Scenario 1 - User logs in:
 - Step 1: Type email and password
 - Step 2: Press Login

Scenario one is a very simple log in to the system to access the website scenario. As web systems are very common today, the user would have inherent knowledge on how to login. Due to the presence of the text boxes with the enter password and email prompt, the correct actions are definitely visible to the user. The login button accomplishes the same thing, with the button right underneath the text boxes and the labeled "login". Therefore, this scenario passes the cognitive walkthrough. One issue noticed is that the registration page was not included in the design, which will result in vague design decisions while building the system.

- (2) Scenario 2 - User searches for a quiz using the search bar:
 - Step 1: Type input into the search bar
 - Step 2: Press Enter or click search.

Scenario two requires the user searching for a quiz. The search feature is again a very common feature on web systems which make it easy for the user to know what to do. This scenario mostly passes the cognitive walkthrough. One issue with design was the non-existence of a search button. The user might not know that they need to hit enter to go to the next step, therefore a button labeled search would make it easier for the user.

- (3) Scenario 3 - User searches for a quiz using the categories icon:
 - Step 1: Click on the category.

The user will know conceptually how to accomplish the task as the user will see multiple icons under the popular quizzes label. The user might not know that the correct action is available, because the icons were not designed with any feedback to the user on mouse hover. The user will be able to associate response with the action correctly because the user will be redirected to a different page. The design should include the hover react to indicate the presence of clickable icons to make the system more intuitive to the user.

- (4) Scenario 4 - User completes a quiz:

- Step 1: Choose a multiple-choice answer.
- Step 2: User types of an answer.
- Step 3: User finishes the quiz.

This scenario passes the cognitive walkthrough. Due to the quiz layout designed to mimic real exams and tests provided in class, the quiz is intuitive to take. The multiple choices are provided with radio buttons and there are text boxes available with long answers questions. The only change would be to relabel the “done” button at the end to “Finish Quiz” for more clarity.

(5) Scenario 5 - User creates a quiz:

- Step 1: Click the create button.
- Step 2: Add quiz title.
- Step 3: Add section.
- Step 4: Click Done.
- Step 5: Type question.
- Step 6: Choose section and type.
- Step 7: Provide solution/feedback.
- Step 8: Click done.

The results of doing the walkthrough were varied for this scenario. The quiz creation feature takes the user through multiple pages, which resulted in confusion. Step 1, Step 7, and Step 8 passed the cognitive walkthrough due to the simplicity of just pressing done or providing a solution for the created quiz. The issues started with Step 2: adding the quiz title. The user would know what and where to do it, but there was no feedback given to the user if the title was valid. This results in issues as one user should not be able to create two quizzes with the same name. As for Step 4, 5 and 6, while the design elements were simple and the user would know how to use them, the overall creation of the questions was confusing. These steps would be re-organized to allow the user to have a more simple set of steps to follow to create the quiz. One small note of change is to change the button in step 4 to “next” instead of “done” to provide more clarity.

Overall, the basic functions of the system were usable and easy to learn. The system was designed in a way that the user would not have to learn a lot to be able to use the system. However, there were massive issues in the creation of the quiz feature. This feature would be usable because of its simple design but learning to create a quiz would be very confusing due to how each step was laid out. This design key characteristics caters to the teacher persona because it allows the user to feel supported during the quiz creation process. For our students’ persona this will be able to prepare them for quizzes more efficiently due to the quizzes having a similar format to in-class quizzes. The results of this walkthrough made it clear that some re-organizing of the features would make this pretty usable.

6.2 Cognitive Walkthrough: Design 2

Design 2 demonstrates a mixed performance in terms of learnability and usability. While certain steps are clear and supportive of both aspects, there are areas where the design can be improved to enhance user understanding and experience, such as making actions more evident and distinguishing between required and optional fields more

effectively. A lot of buttons, interface are designed for a younger audience who are more familiar with gaming friendly interfaces.

- User Register/Login:

In the process of user login, clicking "Register User" is clear as it helps users determine their account status. It also supports usability and feedback by redirecting users to a different page. Answering all the required information is common for many websites hence registering for another one would be very familiar. For this design there's a friendly error reminding the user of any mistakes or requirements needed to register. This provides clear communication and likely comprehends what's needed. However, one problem with this situation is that errors only show one at a time, if the user creates multiple errors they will have to continuously read and modify their information. Clicking "Register User" after answering all the information is also clear for both aspects, leading to a redirection back to the login page.

- User Creates a Quiz:

In this process, the step of clicking the "Quizzes" dropdown menu is somewhat confusing for learnability, as it hides behind a drop down arrow key. This results in first time users learning the website field and finding what options are available and using some common sense to find what they need. However, the redirection to the "Create page" is somewhat clear and supportive of usability. There are multiple ways to create the quiz, one from the dropdown and another from accessing it from the home page labeled as "Create Quiz". Offering multiple pathways to access a feature gives users a sense of control and flexibility. They can choose the method that suits them best, which improves satisfaction. However, introducing multiple access points can make the interface more complex. The step to select the question type, number of points, and timer is mostly clear in terms of learnability, but it could improve usability by making it clear which fields are required and which are optional (timer, number of points). Also using a dropdown for creating these options will prevent errors and spend much less time trying to fill each field.

- User Takes a Quiz:

Selecting a multiple-choice/word problem answer is clear for both learnability and usability. There will be boxes for the user to fill in to help create options. The presence of a right arrow key to redirect to different questions next to a "Done" button might confuse users, negatively impacting learnability since they may not know to distinguish between what the 2 button does. Despite this, the usability is good, as it redirects users to the next page for feedback. We decided to limit the user to creating 1 question at a time to ensure that every question gets proper format and works properly. or users who prefer to create multiple questions in one go, this limitation can disrupt their workflow and slow them down. It may not align with their preferred working style.

- User Searches for a Quiz:

In the search process, clicking the "Home" dropdown menu and selecting "Search" impacts learnability negatively as it might confuse users. However, the redirection to the "Quiz search" section supports usability well. Typing the school name and pressing enter then typing the course name may seem a bit of a nuisance since it requires 2 steps. However the benefit provides options to search the query more effectively. We also made a drop down menu to search for each quiz which is sorted by most recent activity.

- Misc:

We also added color coding for buttons. When users see the color green, it signals that they are engaging in a positive and creative action. This can include creating new content, adding items, or performing actions

that contribute to their experience on the platform. While the red button is anything critical that creates a permanent change such as changing account information, deleting questions, exiting and leaving. This is a cultural norm that should be familiar with most people in the west and can guess what each button will do.

6.3 Final iteration

After carefully reviewing both designs, we have decided to use our first design, The Visual-Friendly Interface, to proceed in our project.

When we compared the two designs together, we realized that creating an application should be, first and foremost, pleasing to the eye while keeping everything as simple as possible. This was particularly prominent in the first design, especially for the search page and creating a quiz. Although we predicted that it might engage students to study like it's a game, we are trading away the simplistic visual style by adding more features that focus on the aspect of gamification.

Another point that we came across is that our second design, A Replication of a Video Game, will not be ideal for teachers, especially the proportion of this group of potential users that are not familiar with using applications. We have evaluated our quiz creation page layout for both approaches and deduced that the first design's steps were easier to follow; the steps for creating a quiz were clearly implied (although we have made some small modifications to enhance this aspect) and the result for each action were also comprehensible. Furthermore, even though it carefully took advantage of the layout's space to exhibit all the possible features and options of the quiz creation in one page, it looked more complicated and crammed compared to the dynamic layout of the first design. In summary, simplicity will fit in best as our key characteristic for our product, thus we will proceed for The Visual-Friendly Interface.

6.4 Improvements to the design

The first improvement we want to implement to The Visual-Friendly Interface design is the addition of a registration page. The absence of the latter function will result in a vague requirement when the actual product is built. Therefore, we will take the page layout from the second design and transfer it over to our selected one.

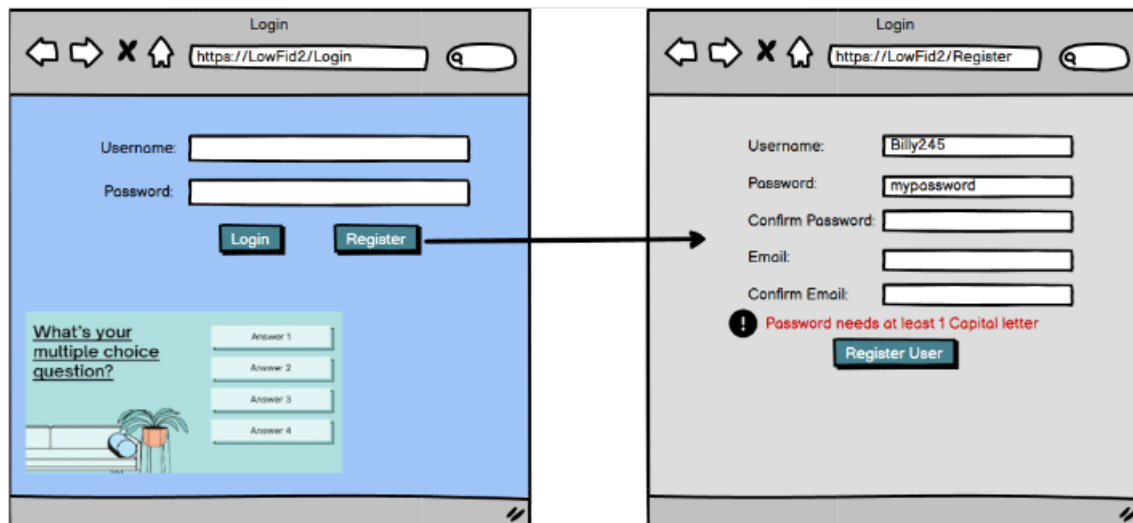


Fig. 25. Registration Page

The second improvement has to do with our search page: we are adding a button on the search bar next to the text field labeled “Search”. The user might not know to press the “Enter” key after writing their search prompt, thus a button will imply that the action of clicking the search button should come next to confirm the query. The third improvement to our design is the addition of a visual change when hovering over category icon buttons on the search page. The current layout does not preemptively indicate the user that the icons are clickable, even if they hover over them. This change will tackle this design flaw and make the website more intuitive to use. Both of these changes to the search page are shown in the following figure:

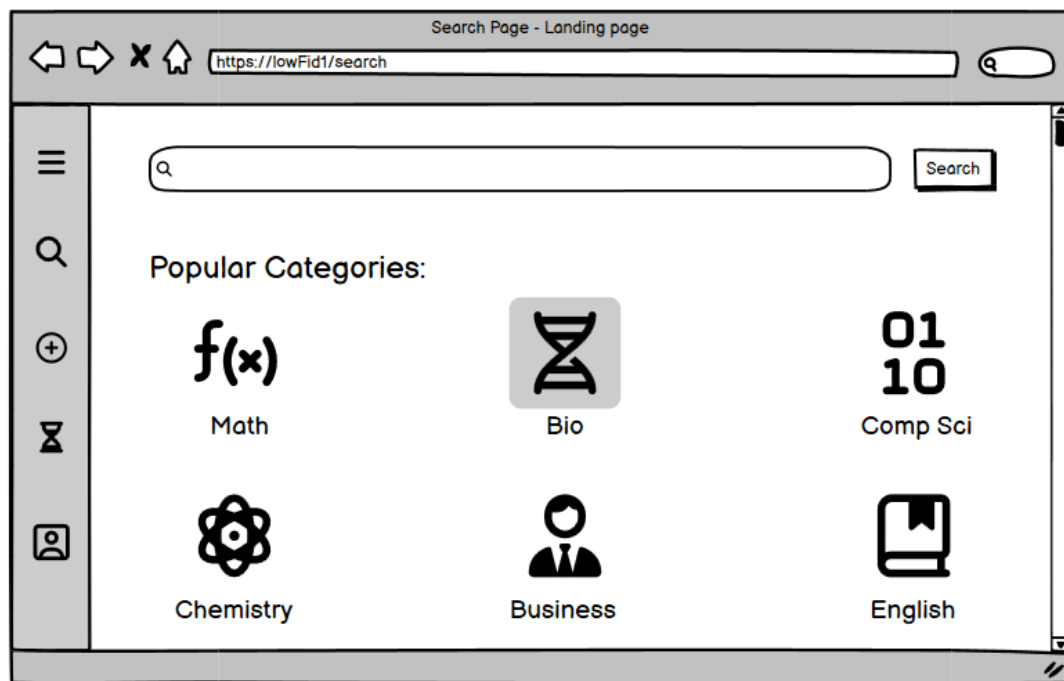


Fig. 26. Registration Page

The fourth improvement is very minimal; changing the text on the “Done” label to “Finish Quiz” to imply that the button should be pressed once the user is done taking their quiz.

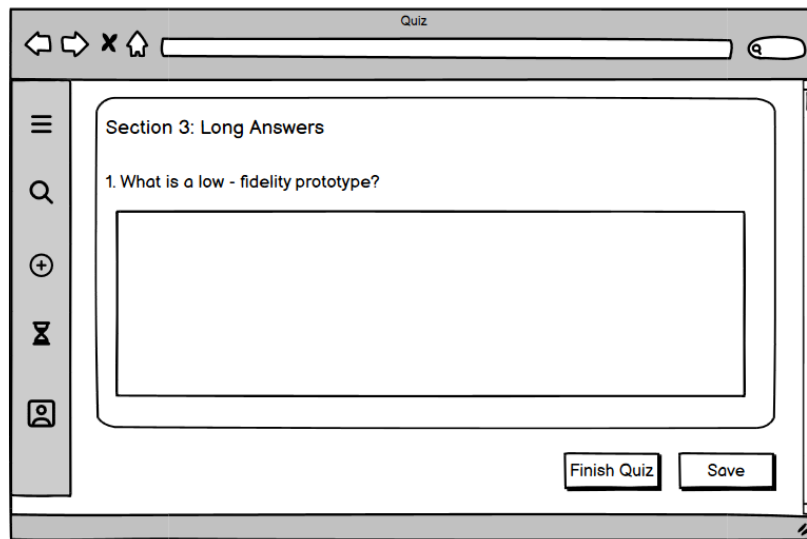


Fig. 27. Registration Page

The fifth improvement is to move the quiz title text field to the initial quiz creation page instead of with the “Add Section” buttons to avoid letting the user create a quiz with an invalid title. With this constraint, we hope that the user will be directed to creating a valid title before proceeding.

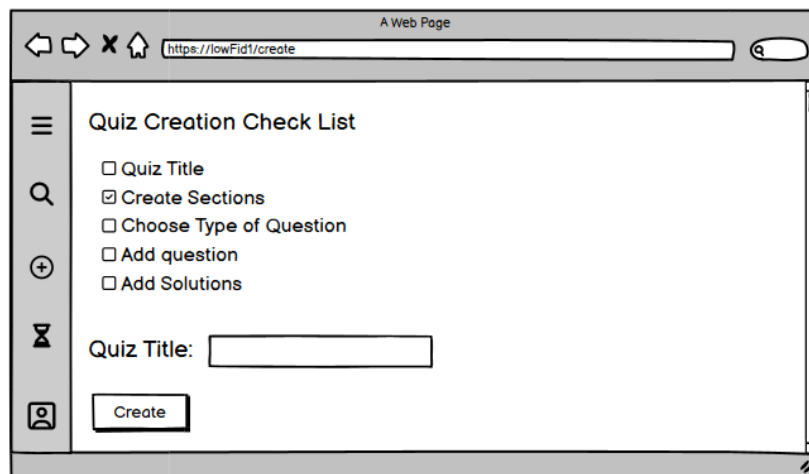


Fig. 28. Final Iteration: Quiz Creation Page

For the sixth improvement, we want the user to select the question type for a section they added to their new quiz to avoid having to select the type repeatedly for each question. With this change, the layout of the quiz creation page will be consistent and more clear. Furthermore, the done button on the add section page will be changed to “Next” instead of done to signify to the user that there are more steps after adding the sections.

A Web Page

https://lowFid1/create

Add Sections

Created Sections:

- Section 1: Multiple Choice Edit
- Section 2: Thermodynamics Edit

+ Add Section

Section Title:

Choose Type ▼ Add

Next

Fig. 29. Final Iteration: Add Sections Page

To add questions, the user will pick a section using the drop down menu, and the page will dynamically change to show the user that section's existing question and allow the user to add/edit more questions.

A Web Page

https://lowFid1/create

Adding Questions

Choose Section ▾

Questions:

- Q1: What is resistance? Edit Remove
- Q2: If you are given the current $I = 26 \dots$ Edit Remove

+ Add Question

Type Question:

Solution:

Add

Done

Fig. 30. Final Iteration: Add Questions Page

7 HIGH FIDELITY PROTOTYPE

7.1 Software Structure

The web system is designed using html. The application reads and writes to JSON files to access information. JavaScript is used to handle any interactive buttons, to set up the server and to assign actions on mouse hovers. CSS is the primary method of design and styling the web application. The JavaScript, CSS and image assets are stored in sub-folders, while the JSON and server files are stored in the main folder with the html files. The program is best run in Visual Studio, and thus the tutorial will be given assuming the use of VS.

To start up the program, first ensure that you are in the same directory as the project. Then we need to install express and fs. Start by accessing the terminal and type in the following commands:

- npm install express
- npm install fs

After that, run the server locally by typing in the command:

- node ./server.js

This will give you a link similar to: <https://localhost:3000>. The port number may vary. Ctrl + click will take you to the search page, which is our landing page.

The menu bar is functional. Clicking on each item will take you to the respective pages. To view what the icons represent, you can expand the menu bar by clicking the three bars icon at the top.

To access the other pages without the use of the menu bar or buttons, you can type the html page in url as follows:

- <https://localhost:3000/login>

This works for most html pages in the current prototype version. You do not need this to access any pages, all pages are accessible through menubar and button on each page. To proceed anyway, you can replace “login” in the url with the following words to access the other pages:

- profile
- register
- search
- create
- addSelection
- addmc
- addla
- addsa
- takeQuiz
- solutions
- history

7.2 User Manual

The visual friendly quiz prototype is a web platform that supports producing online quizzes to help students to self study and for teachers to help students create quizzes. There is no limitation to the number of quizzes available to be made.

(1) Overview

- (a) Our platform distinguishes itself by offering an unrestricted environment for quiz creation. Whether you're a student looking to reinforce your learning or a teacher seeking to diversify your teaching materials, you can create as many quizzes as you want.
- (b) The platform accommodates quizzes on a wide array of subjects, from mathematics and science to literature and history. This diversity ensures that both students and teachers can find content for their needs. Plus, our user-friendly search bar makes it incredibly easy to search and select your desired subjects.

(2) Registration

- (a) Click on the "Registration" Button: On the platform's homepage, you'll find the "Registration" button. Click on it to get started.
- (b) Enter the Required Information: You'll be directed to a separate registration page. Here, we'll need a few essential details to set up your account for a seamless quiz experience. Please enter the following information:
 - (i) Username: Choose a unique username that will represent you on the platform.
 - (ii) Email: Provide a valid email address for security
 - (iii) Password: Create a secure password to protect your account and the quizzes you create.
 - (iv) Date of Birth
 - (v) Education: Represent your school
- (c) Press "Register": Once you've filled in all the required information, click the "Register" button to create your account.

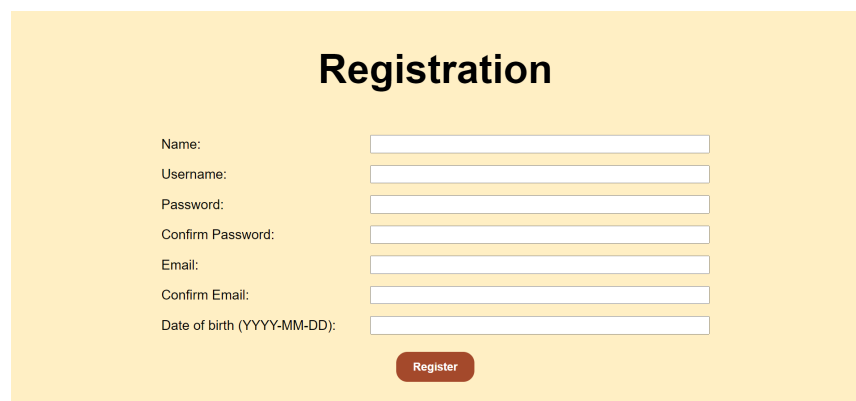
A screenshot of a web registration form. The form has a light yellow background. At the top, the word "Registration" is written in a large, bold, black font. Below the title, there are seven input fields arranged vertically, each with a label to its left: "Name:", "Username:", "Password:", "Confirm Password:", "Email:", "Confirm Email:", and "Date of birth (YYYY-MM-DD):". Each input field is a white rectangle with a thin grey border. At the bottom center of the form, there is a red button with the word "Register" in white text.

Fig. 31. Registration Page

(3) Logging In:

- (a) Log In: After successfully registering, you can log in to your account by visiting the login page. Enter your registered email and password, and you're ready to explore the world of quizzes on "The Friendly Quiz."

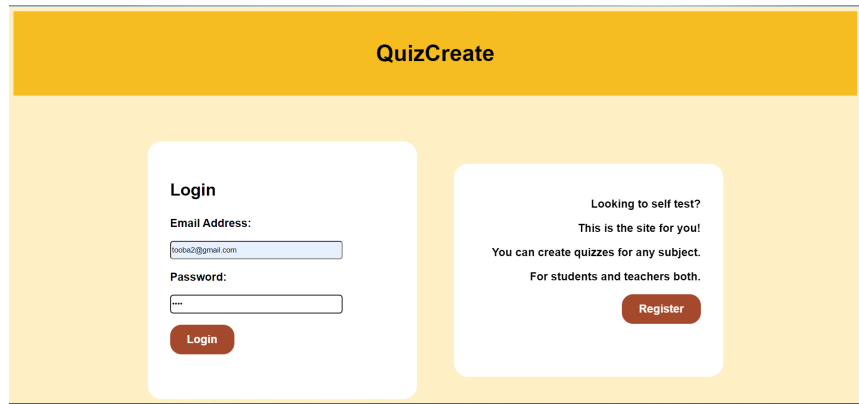


Fig. 32. Login Page

(4) Managing Your Account

- (a) Locating the Account page:

- (i) Click the Interaction Button: Located in the top right corner of the screen with 3 bars, you'll find an "Interaction" button. Click on it to reveal the menubar.

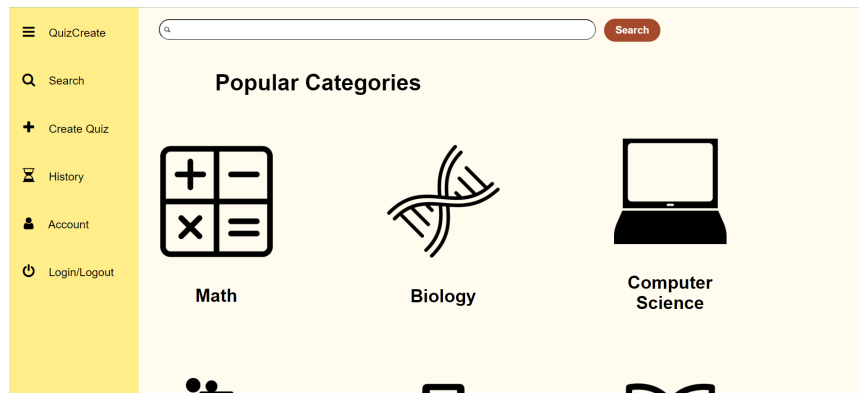


Fig. 33. MenuBar

- (ii) Select "Account": From the menu bar, click on the "Account" option. This will take you directly to your account page.

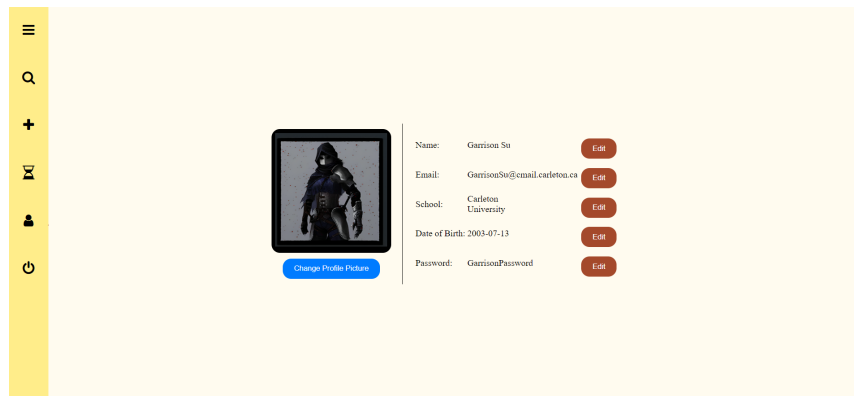


Fig. 34. Account Page

- (b) Editing Your Information: Once you're on your account page, you'll have several options to review and update your information. Upon creating your account, all the information you provided will be displayed on the screen from the time you registered. If you wish to make any changes, follow these steps:
- Click the "Edit" Button: Next to each piece of your information, you'll see an orange "Edit" button. Click on this button to change anything
 - Enter New Information: You'll be presented with a form where you can make adjustments to your information. This includes your username, email, and password. You must enter your new information and provide your current password to confirm the changes.
 - Submit the Changes: After entering your new details and current password, click "Submit" to save your changes.

Your information will be updated, ensuring that your account remains accurate and up-to-date. Whether you're changing your username, email, or password, the process is straightforward and secure. With this feature, "The Super Friendly Quiz" provides you with the flexibility to manage your account information according to your needs.

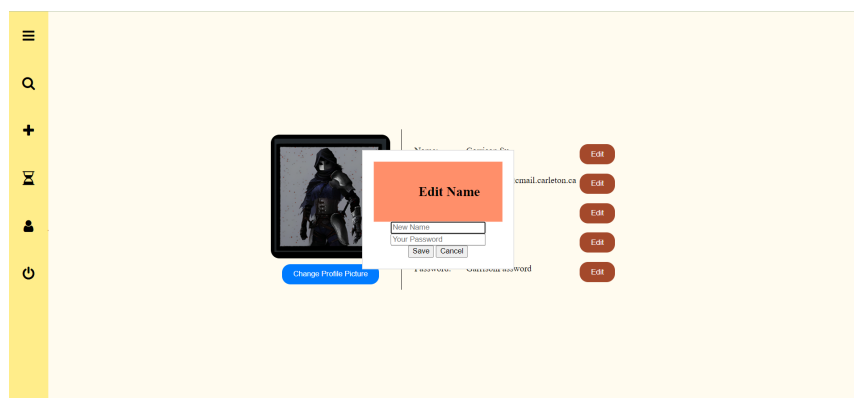


Fig. 35. Editing Name

(5) Managing and Creating Quizzes

(a) Creating your first quiz

(i) Start the quiz creation process

- (A) Access Your Dashboard: From your dashboard, click on the three horizontal lines icon located at the top left of the screen. This opens the main menu.
- (B) Click "Create Quiz": In the main menu, you'll find the "Create Quiz" option. Click on it, and you'll be redirected to a different page.
- (C) Provide a Title for Your Quiz: Start by giving your quiz a suitable and descriptive title. This title will help users understand the quiz's subject or theme.
- (D) Click "Create Quiz": After providing the title and selecting a question type, click the "Create Quiz" button to initiate the quiz creation process. You will be taken to the add sections page.

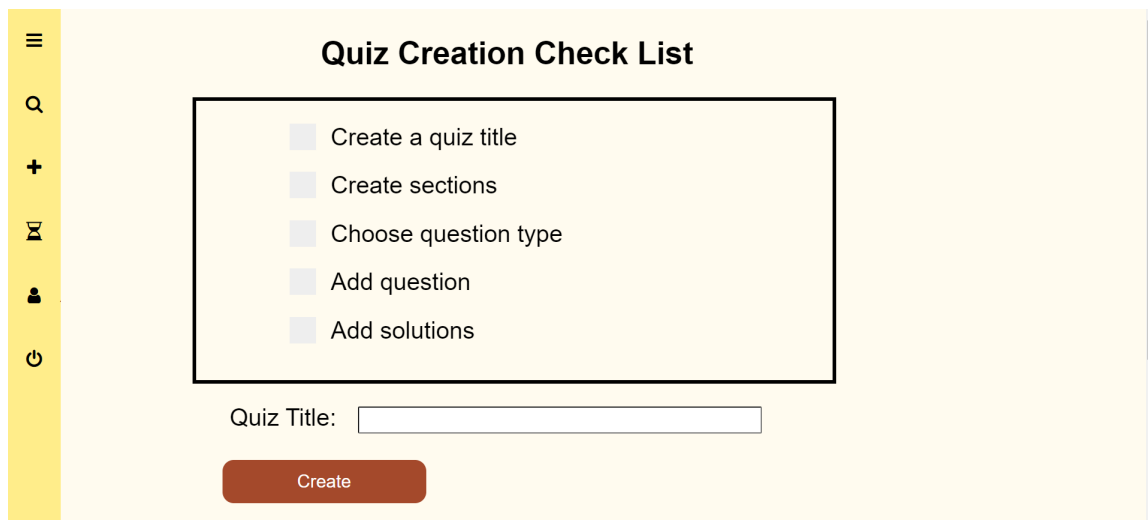
The image shows a web interface for creating a quiz. On the left is a yellow sidebar with icons for a menu, search, add, timer, user, and power. The main area has a light yellow background. At the top, it says "Quiz Creation Check List". Below this is a black-bordered box containing a checklist with five items, each with a light blue square checkbox: "Create a quiz title", "Create sections", "Choose question type", "Add question", and "Add solutions". Below the box is a text input field labeled "Quiz Title:". At the bottom is a red button with the word "Create" in white.

Fig. 36. Quiz Creation Page

(ii) Creating a section

- (A) Give your section a title.
- (B) Choose a Question Type: You'll need to select a question type for your section. You have three options: multiple choice, short answer, and long answer.
- (C) Click the add button. This will add the created section to the quiz. You can add as many sections as needed
- (D) Click next when the sections are created. This will take you to the add questions page.

Fig. 37. Quiz Creation Page: Adding Sections

(iii) Adding a question

- (A) Select a section from the drop down list: From the list of sections you've created, choose the one to which you'd like to add questions.

Fig. 38. Quiz Creation Page: Adding Questions

- (B) Write the Question: Write your question clearly and concisely. Be sure to make it as informative as possible.
- (C) Provide Answer Options: If applicable, provide answer options for multiple-choice questions. If it's a short or long answer question, you can ignore this step.
- (D) Mark the Correct Answer: Indicate the correct answer for multiple-choice questions. For short and long answer questions, you can type out the solution in the provided text box.
- (E) Assign Points: You have the option to assign points to each question, encouraging users to engage with the quiz actively.
- (F) Continue Adding Questions: You can add as many questions as you like, ensuring that your quiz is engaging

- (G) Complete the Quiz: Once you've added all the questions and assigned the points, click "Done" to finalize your quiz.

Fig. 39. Quiz Creation Page: Adding Questions

- (b) Accessing your created quizzes
- (i) After you've successfully created your quiz, you can easily access it from your history page.
 - (ii) Navigate to the main menu and click on "History." This will take you to your quiz history.
 - (iii) Press "Created Quizzes": You will be redirected to a page displaying all the quizzes you created.

Fig. 40. Created Quizzes Page

- (c) Managing your created quizzes
- (i) On the "Created Quizzes" page, you'll find a list of your quizzes. Here, you have the ability to perform various actions such as modify and delete.
 - (ii) Modify Quizzes: You can click on a quiz to view and make modifications if necessary. This feature allows you to update the quiz, edit questions, or change any quiz settings.
 - (iii) Delete Quizzes: If you decide to remove a quiz from your collection, you can do so from this page. Just click the "Delete" option associated with the quiz you wish to remove.

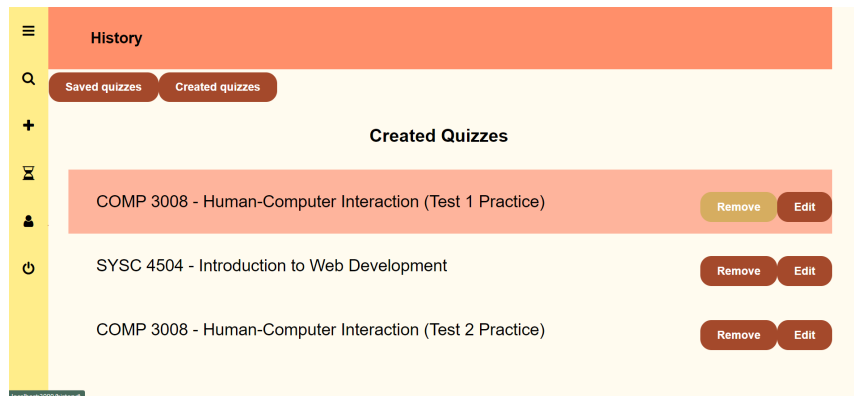


Fig. 41. Created Quizzes Page

8 USABILITY INSPECTION EVALUATION

8.1 Garrison Report

(1) Visibility of System:

The website has background highlights for most of the buttons which indicate what button is interactable, but not all buttons give a highlight. By pressing on those buttons, a new page is loaded which indicates a feedback response. There is no feedback while searching, hence we have to type the full name.

Severity Rating: 2/4 (minor usability problem)

(2) Match between system and the real world

One of the few things that matches the real world is the power button indicating turn off in real life which is an analogy that can help indicate to the user that pressing it would result in a logout. The color theme, yellow/beige is not commonly used on most websites.

Severity Rating: 2/4 (minor usability problem)

(3) User Control and Freedom

There are many missing features that are not added such as the missing delete buttons when there's an add button on the same page which may frustrate the user to find the delete button in the saved quizzes section.

Severity Rating: 3/4 (major usability problem)

(4) Consistency and Standards

The website employs icons that are easily recognizable and draw from real-world experiences. For instance, the magnifying glass icon is used for searching, a convention that users often encounter and understand. Additionally, the use of email addresses and passwords is a standard practice, considering that the vast majority of people have email accounts, making this method highly familiar to users. The only issue are font size and colors consistency throughout the web page.

Severity Rating: 1/4 (cosmetic problem)

(5) Error prevention:

The website currently has many notable issues. It lacks proper security checks, allowing users to potentially access someone else's account by changing the search bar username. Furthermore, there is a lack of validation for email addresses, as the system doesn't verify if the user has omitted the '@gmail.com' ending portion or a realistic date of birth during registration.

Severity Rating: 4/4 (catastrophe problem)

(6) Recognition rather than recall

The login username and password are required to be memorized since there is not a reset password.

Severity Rating: 2/4 (minor usability problem)

(7) Flexibility and Efficiency to Use:

The navigation bar works for both the button pressed and shows the drop box if the user needs words to help them distinguish from the buttons. There are no keyboard shortcuts to help experienced users.

Severity Rating: 2/4 (minor usability problem)

(8) Help users recognize, diagnose, and recover from errors

There are a few error checkers such as if the user enters the wrong password while editing their user information. Also, while changing the date of birth on the account page, it shows a calendar that user can navigate through instead of manually putting the date which could result in an error. If information is mistaken can be changed in the account page.

Severity Rating: 2/4 (minor usability problem)

(9) Help and Documentation

While there is limited documentation available, the combination of symbol buttons alongside straightforward text labels explains the actions and their purposes

Severity Rating: 2/4 (minor usability problem)

8.2 Tooba Report

(1) Visibility of System Status

The system status is available in some areas such as registering, or logging in successfully but it is not available in other areas such as confirming to the user when going to the next page when creating quizzes. The user is also not informed when a term is search for does and not result in any quizzes. The user is just greeted with an empty table.

Severity Rating: 2/4 (minor usability problem)

(2) Match between system and the real world

The system does match real world conventions and phrases. The log out button is shaped as a shutdown button.

Severity Rating: 1/4 (minor cosmetic problem)

(3) User control and freedom

The system most definitely does not support undo and redo. While the design iteration did mention inclusion of edit, remove and back buttons, the time constraints resulted them in not being implemented. There is no way to go back and change your quiz question or sections till after the quiz is done.

Severity Rating: 3/4 (major usability problem)

(4) Consistency and Standards

While the system follows general platform conventions. There are inconsistencies between the design choices. Pages have different colors of button, different font, inconsistent sizing, and inconsistent title design.

Severity Rating: 1/4 (minor cosmetic problem)

(5) Error Prevention

There is no error prevention beyond the login page. The user can sign up with the same email, enter text in number only boxes. This can cause many issues with security and usability.

Severity Rating: 4/4 (catastrophic usability problem)

(6) Flexibility and Efficient to use

The website is fairly easy to use. Experts can use the shortcut on the menu bar to access pages while novices have options to expand the menu bar if they don't know what they want yet. The quiz creation system could still be improved in design

Severity Rating: 2/4 (minor usability problem)

(7) Aesthetic and minimalist design

The style is pretty minimalistic with only what the user needs being available on the screen. The only issues is on the search page, the search bar is too small and the icons are too big respective to each other.

Severity Rating: 1/4 (minor cosmetic problem)

(8) Recognition rather than recall

Most things were based on recognition except the logout button.

Severity Rating: 1/4 (minor usability problem)

(9) Help users recognize, diagnose, and recover from errors.

Beyond the login page there is no error recovery available to the user. If the user runs into a problem, they would be left to figure it out on its own.

Severity Rating: 3/4 (major usability problem)

(10) Help and Documentation

There is no help provided in the system beyond the checklist of creating the quiz. The user is left to figure out most to everything on their own. There is no help page either. This can turn the user away from wanting to the use the system, if they are not able to solve issues they found.

Severity Rating: 2/4 (minor usability problem)

8.3 Merraj Report

(1) Visibility of System Status

When the user searches for quizzes using the search bar, they might not find any quizzes with their query. The application fails to notify the user about this, and it might make them believe that the application is still searching when it is actually not.

Severity Rating: 1/4 (cosmetic problem, search still works)

(2) Match between the system and the real world

The login and logout option in the menu bar is matched with a famous icon that generally indicates “powering off.” Users will therefore conceptually mix the two when, in reality, the application does not close if the icon is pressed.

Severity Rating: 1/4 (cosmetic problem)

(3) User control and freedom

In the quiz creation page, there is an option to add sections, but no option to delete or modify them if the user decides to change their mind for some parts of their new quiz. Therefore, they would have to restart the entire creation process again.

Severity Rating: 3/4 (high priority, can strongly benefit user experience)

(4) Consistency and Standards

The status of the system can be linked with which menu the user is currently on. This element of the interface is present in some instances of the application, such as the “History” and “Search” page, and absent in others, such as the “Create” page. This lack of consistency can lead to the user feeling confused and unsupported, especially if the user lacks knowledge in using a computer application.

Severity Rating: 1/4 (cosmetic problem)

(5) Error Prevention

Attempting to login with an invalid email (for example, an input without the ‘@’ character) will still allow the application to search for emails with the input.

Severity Rating: 2/4 (low priority, will not corrupt the application’s database)

Attempting to register with an invalid email like the one described previously will register the new user. The absence of this error check might lead to errors in the back-end; some emails stored will not be valid emails.

Severity Rating: 4/4 (usability catastrophe, not supposed to happen at all)

(6) Help and Documentation

Throughout the quiz creation process, despite the checklist, the application does not provide some texts to indicate to the user what to do.

Severity Rating: 1/4 (cosmetic problem)

8.4 Final Heuristic Evaluation

(1) Visibility of System Status

After our evaluations, we have concluded that there is a lack of consistent indications throughout the application's interface for the user to get a status of the system. The main problem that we have found is the issue regarding the search page with no results based on the query written in the search bar. The severity of this issue is moderately important since the main aspect of our design was to make it visual-friendly.

Severity Rating: 2/4 (minor usability problem)

(2) Match between system and the real world

In our evaluations were the same; the menu bar contains an icon related to logging in and out of a profile, yet this icon generally represents something different; powering off a system. We also mentioned that the color scheme used for this application is not used prominently on websites. Despite these errors, we have concluded that these errors are minor as the usability of the application is not greatly affected.

Severity Rating: 1/4 (minor cosmetic problem)

(3) User control and freedom

The user would have a very hard time navigating the application freely. The quiz creation contains many elements of addition, such as adding sections, questions, solutions, etc. But, there are no elements of deletion, such as deleting a section. If ever the user changes their mind, it would be very difficult for them to change what they have created. All in all, these issues are major and potentially catastrophic.

Severity Rating: 2/4 (minor usability problem)

(4) Consistency and Standards

There are issues relating to this aspect of the evaluation are cosmetic problems and visual faults. Therefore, the priority for their fixes are low.

Severity Rating: 2/4 (minor usability problem)

(5) Error Prevention

The lack of constraints in this design is an important issue to tackle. The user can write anything in any textbox, such as an invalid email, an invalid date of birth, a non-numerical input for a score, add duplicate emails, and more. These issues are also catastrophic, and they should be fixed as soon as possible.

Severity Rating: 4/4 (catastrophic usability problem)

(6) Flexibility and Efficient to use

For this aspect, both the menu bar and the quiz creation page need some minor improvements. As a team, we agreed that the quiz creation page does not allow for an efficient quiz creation experience despite its elements of guidance for those who want to feel supported throughout. Furthermore, for users that are more versed in computer applications, the absence of keyboard shortcut functionality will affect their experience as well.

Severity Rating: 2/4 (minor usability problem)

(7) Help and Documentation

This design does not provide any specific guidance for certain features. If the user runs into an error or has a question, they cannot access any source of information to get help.

Severity Rating: 3/4 (major usability problem)

9 DISTRIBUTED SUMMARY

9.1 Garrison Distribution

- (1) Part 1: Requirement Gathering
 - (a) a, is it feasible?
 - (b) 1 persona - Razi Judge
 - (c) 1 scenario - Student Scenario
- (2) Part 2: Initial Prototype
 - (a) Sketch: Design 2
- (3) Part 3: Prototype Evaluation and Iteration
 - (a) Cognitive Walkthrough Summary - Design 2
- (4) High Fidelity Prototype
 - (a) Back end and front end (html)
 - (b) User Manual
- (5) Usability Inspection Evaluation
 - (a) Personal Heuristic Evaluation
 - (b) Consolidation

9.2 Tooba Distribution

- (1) Part 1: Requirement Gathering
 - (a) a, who are the target users? (and why the interface fits the criteria?)
 - (b) 1 persona - Angela Battista
 - (c) 1 scenario - Teacher Scenario
- (2) Part 2: Initial Prototype
 - (a) Sketch: Design 2
- (3) Part 3: Prototype Evaluation and Iteration
 - (a) Cognitive Walkthrough Summary - Design 2
- (4) High Fidelity Prototype
 - (a) Code - Mostly Front-end
 - (b) Software Structure
 - (c) In line comments in code
- (5) Usability Inspection Evaluation
 - (a) Personal Heuristic Evaluation
 - (b) Consolidation

9.3 Merraj Distribution

- (1) Part 1: Requirement Gathering
 - (a) (a) - What is the existing need?
 - (b) 1 persona - Jennifer Kingston
 - (c) 5 sources of information
- (2) Part 2: Initial Prototype
 - (a) Descriptions of both initial designs
- (3) Part 3: Prototype Evaluation and Iteration
 - (a) 3(b) Explanation of our decision, and changes made to our chosen design
- (4) Part 4: High-Fidelity Prototype
 - (a) Code (a bit of front-end, a lot of back-end)
 - (b) Short video
- (5) Part 5: Usability Inspection Evaluation
 - (a) Personal Heuristic Evaluation
 - (b) Consolidation

10 REFERENCES

- [1] W3School. *How TO - Clickable Dropdown*. Retrieved from https://www.w3schools.com/howto/howto_js_dropdown.asp#:~:text=Example%20Explained,dropdown%20menu%20correctly%20with%20CSS
- [2] Youtube. *Sliding Menu using HTML and CSS (Sidebar)*. Retrieved from https://www.youtube.com/watch?v=_du4oMsWb84&ab_channel=Coditorial
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