

COM814: Project 2015-16

# Dissertation

School of Computing & Information Engineering

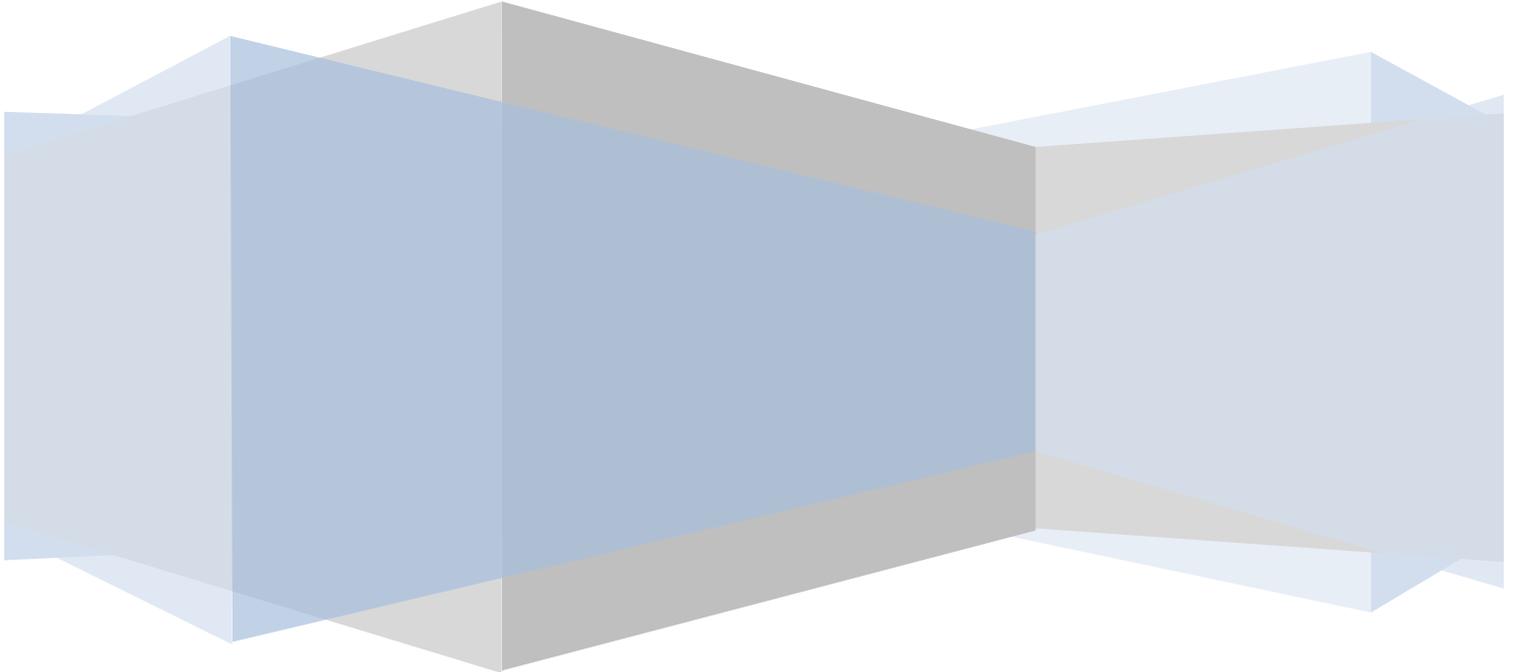
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An Online Quiz League

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31<sup>st</sup> August 2016



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## Abstract

Many people enjoy taking part in quizzes that challenge them intellectually and this experience is enhanced by competing against others. Although there are many sites that provide quiz leagues for local groups or clubs there are remarkably few quiz websites that can cater to users from many localities. There are a few websites that offer competition without being dependent on another user completing the task within a specific timeframe.

In order to address this issue it was decided to create an online quiz website that had a global leader board. Users could sign up for the site in order to take quizzes and have their details recorded on the leader board. This allows the user to have a competitive experience and yet not be dependent on their competitors having completed a quiz for them to continue competition. The website would also provide functionality for an administrator to manage the site and its users.

Such a website has been implemented alongside a database that holds the crucial data for the website. The site has effectively two parts; the member side and the admin side. There is a login feature for both of these. The member or admin then can access and interact with pages that pass requests and retrieve information from the database. This has been tested both at the end of each unit and on the final product. This website was developed using an incremental methodology and using typical web development technologies such as HTML5, CSS, PHP and JavaScript.

## **Chapter 1: Introduction**

### **1.1 Introduction**

Quizzes and games have always been popular but the internet provides the opportunity to reach a wide range of people and gives them access to these quizzes. Many people enjoy competing against others, whether in person or online.

The Guardian shows that, particularly in Britain, people are willing to and indeed eager to, demonstrate their knowledge and to do so against others. The article also shows that the presence of a prize, or a large prize, is not necessary for motivation to take part as long as the participants could compete against others and for this to be recorded or displayed in some way. This is evidenced by people being willing to undertake intellectually challenging quiz programmes on television, such as Mastermind, for far less prize money than some other less challenging game show. (Guardian, 2014)

Although online quizzes are not uncommon there is a lack of non-geographically based online quiz leagues. There are only two such sites appear in the top ten google searches under “online quiz league”; 2020quiz and Sporcle. The other search results are either geographically based or resources for pub leagues. (Google, 2016)

Additionally, there are a number of websites that provide the opportunity to play quizzes online but there are significantly fewer which have the function to both allow an administrator create their own quiz and to have a league table or leader board that keeps a record of the players’ scores.

### **1.2 Problem Statement**

The objective of this project is to provide a general knowledge online quiz league that has facilities for an administrator to create and deploy a range of quizzes on a variety of topics and at different levels of difficulty. These quizzes should be able to contain more than one type of question. The site should also provide the user with a leader board that allows them to compare their scores with other users.

### **1.3 Aim**

The aims of the Quiz Champs online quiz website are to develop a fun and engaging website that allows a member to “join” the site, take quizzes, have the scores recorded and

displayed in a leader board. In addition the site is intended to provide functionality for an administrator to manage the site, its content and its users.

## 1.4 Objectives

- To investigate and examine the current availability and state of online quiz websites at the present time. This will help to identify areas of weakness in competitor websites that could be exploited by this website to make it marketable. It would also give an example of what a similar website looks like when developing a prototype.
- To identify a set of requirements, both functional and non-functional, based on competing websites and a focus group that will provide a potential user's perspective. This will be essential to the design and implementation of the website.
- To develop a series of designs for the website and to implement these in a prototype that has a basic functionality.
- To design and build a database to store the questions, answers and user's information that can be accessed efficiently and without compromising the integrity of the data held.
- To review and examine the success of the website against the requirements set out. The functionality and usability will be tested using a focus group.
- To evaluate the final stage of the website development and to test this website as a whole.

## 1.5 Dissertation Outline

Chapter 2 - *Analysis Chapter* - This chapter deals with the examination of the problem and the identification of potential solutions to the problem. The chapter will outline and present the research carried out on the problem. This includes research on existing sites and the identification of trends that other sites have in common.

Chapter 3 - *Requirements Analysis Chapter* - This chapter deals with the requirements that have been identified as a result of a focus group's feedback and the existing background research.

Chapter 4 - *Design Chapter* - This chapter deals with the user interface and the overall relationship that exists between the components. The chapter will outline the user interface design, how the user will interact with the system and the design of the database.

Chapter 5 - *Implementation Chapter* - This chapter deals with the approach taken to implement the system. It will set out the various tools and sources used. It also includes a description of the process used and the lessons learned.

Chapter 6 - *Testing and Evaluation Chapter* - This chapter deals with the process undertaken to test the system and the test cases used. It also includes an evaluation of the final system in comparison to the requirements set out initially.

Chapter 7 - *Conclusions and Recommendations Chapter* - This chapter is a summary of the overall system, setting out any lessons learned or recommendations for improvements if the work was to be repeated.

## Chapter 2: Analysis

### 2.1 Introduction

As is set out in the objectives it is essential that a review of the current state of the market for online quizzes is carried out. This allows the examination of existing solutions to similar problems and gives an understanding of how this problem came to be. This review entails an analysis of the problem and a development of potential solutions.

In order to examine solutions to the problem research into the existing market was undertaken through looking at the top websites on Google and the mobile apps available in the Google Play store and Apple App Store. This has helped to develop the form of the solution.

As part of this examination of both the problem and potential solutions a rich picture was developed for each. These set out in an illustrative form the problem and the adopted solution. These can be found in Appendices 1 and 2.

### 2.2 Background Research

The initial steps were to examine the potential for making an app that would allow the user to take part in a quiz league. This was begun by looking at the app market. The two largest platforms for mobile or tablet apps are Android and iOS so an initial review of the quiz apps on these platforms was carried out. This quickly indicated that the market in both these platform's app stores was full of quiz apps. This suggested that this was not a wise route to continue with as there were very few "gaps in the market" that could be exploited to provide a unique product.

Additionally the development of a website ensures that the quiz is able to be used on a greater variety of devices. Although Android and iOS are by far the largest two platforms it is not feasible in the time frame set out to develop an app for both these platforms. A third possibility is to develop a cross-platform web app using technology such as Intel XDK. This technology uses HTML and other web design tools to develop apps that are able to be platform-agnostic. Although, this may seem like an ideal solution to use web design tools to develop an app that can run on all major platforms this is not the case. Hybrid apps do not have the full functionality of a natively designed app that can exploit the features of the device on which it runs. Therefore a hybrid app would not provide sufficient benefits to the

user that are not already present from a website in a browser, yet could potentially create disappointment for the user as it would not have the full functionality of an app. (Sitepoint, 2016). For example, the data for the questions would have to be held in the database online and as such the app would require online access to operate. Many users would be content with this but others may be disappointed that the app would have very little functionality offline. The difference is essentially one of expectations; a user always expects a website to require internet access, whereas a user will not always expect that an app will not operate without internet access. Therefore it would be preferable to provide a product that would not only meet these expectations but appeal to the user.

Although, mobile usage is growing at an extraordinary rate and overtaking desktop as the most popular digital device it remains a wise course of action to allow users to make the decision about which device is preferable (Comscore, 2016). It is possible to develop an app which provides the user with a positive interface experience on larger screen devices such as desktops and some tablets, as well as smaller screen devices such as mobile phones. It allows the widest possible pool of users to be met at an early stage of development.

Therefore it was decided that the best course of action would be to examine websites that carried quizzes or quiz leagues.

Most quiz leagues that exist online are localised to a particular areas and have private leagues for their members. Therefore this creates problems for people who wish to participate in a league without having to join the “Wrexham Quiz League” especially if they are in a more isolated area or simply want to compete against others from across the world.

Research has been carried out on several popular quiz league sites such as 2020quiz.com, sporcle.com, quizfactor.com, triviaplaza.com, actionquiz .com and Onlinequizcreator.com. Each of these sites has strengths and weaknesses and has different target audiences and are therefore not exact equivalents. Nevertheless, they are representative of existing sites and several sites contain the same or very similar features. The research undertaken is summarised in Table 1, which shows the most important features in each site.

Feature	Quiz2020	Sporcle	Quizfactor	Triviaplaza	Onlinequiz creator	Actionquiz
Head-to-Head Competition	✓	✓	✗	✗	✗	✗
Timed Quiz	✓	✗	✗	✗	✗	✗
Privacy Policy easy to find	✓	✗	✗	✗	✗	✗
Login/ registration	✓	✓	✗	✗	✓	✗
Create own quiz	✓	✓	✓	✗	✓	✗
Good design/ layout	✓	✓	✓	✗	✗	✗
Lots of content	✓	✓	✓	✓	✗	✗
Leader board	✓	✓	✓	✗	✗	✗
Categories	✗	✓	✓	✓	✓	✗
Recommendations	✗	✓	✗	✗	✗	✗
Links to live pub quizzes	✗	✓	✗	✗	✗	✗
Search function	✗	✓	✗	✗	✗	✗
Clear scoring	✓	✗	✗	✗	✗	✗
Easily navigated	✓	✗	✗	✓	✗	✓
Levels of difficulty	✗	✗	✓	✗	✗	✗
Prizes	✗	✗	✓	✗	✓	✗
Free to play	✓	✓	✓	✓	✓	✓
Social Media functions	✗	✓	✓	✗	✗	✗
Multiple languages	✗	✗	✗	✗	✓	✗
Pay for content	✗	✗	✗	✗	✓	✗

Table 1 – Summary of existing quiz league websites

Quiz2020 and Sporcle are the main non-geographically based quiz leagues and the former insists that the quiz taker goes “Head-to-head” against another quiz taker, while Sporcle gives the user this option. This is limiting for the user as they either have to ensure that the other user is online at the same time or that the quiz has to be taken within a particular

time-frame. This produces a lack of flexibility and independence for the user. The user is also limited in how many quizzes they can take within the time-frame specified and on which topics they can be taken. This model would also require an on-going commitment to the quiz league so that the user can participate fully in the league.

Another issue with these existing quiz leagues is that users may have to wait for answers to be given to the questions, perhaps dependant on the competitor having completed the quiz. This could be frustrating for users and result in an inconsistent or lack of interest and participation in the site.

Onlinequizcreator.com provides the user with the chance to win prizes, monetary or otherwise, if they are successful in completing certain quizzes. Although this may be quite appealing it requires much more funding which is usually met by increasing the amount of advertising on the website or insisting that users pay for access to these quizzes. This could be off-putting for a casual user and for those who simply seek the thrill of an intellectual challenge.

Triviaplaza.com, actionquiz.com and Onlinequizcreator.com do not have a league table and have no explicit progression in difficulty (some quizzes may be more difficult than others but it is not directly stated). The other sites have these features and it would be popular with quiz takers who wish to demonstrate their intellectual challenge, especially if they are not directly challenging another person.

The ability to record progress is only possible if there is some way to store and display identifying details of the user, such as a user name or alias. This creates the problem of storing this information securely and ensuring that it is in fact the user who is using the account; this is usually done by a unique password.

Quizstar.4teachers.org provides teachers with the opportunity to create educational quizzes for their pupils which is very useful for them but not so for the general population who may want to create a league or quiz themselves.

Sporcle has a wide range of content and is strong on a lot of other features such as categories, allowing the user to search for a quiz and giving the quiz taker

recommendations. Quiz2020 is the strongest website for a quiz league. It also provides the user with clear scoring rules and a privacy policy.

The most prevalent features that are included in these sites are; a breadth of content, the presence of the categories to choose from, the ability for an administrator to create their own quiz, and for the content to be free to access. Half of the sites surveyed have login or registration capabilities, a leader board, and have a good design and are easily navigated.

### **2.3 Why a website?**

In order to address the problem that is set out above it was decided, in light of the research, to develop a quiz league website that is free to use, has functionality for an administrator to login and create quizzes, and is not limited to a particular locality.

It was decided that the most effective way to be competitive against other online quizzes was to develop a website. This has a number of benefits as the main alternative would be to have a mobile app that offered quizzes. However, these are very popular and so the market is more or less saturated. It would be much more difficult to “stand out” and attract new users. A website offers more flexibility and a much greater level of compatibility. In addition the website could also be deployed on a mobile device without being limited to it.

The background research is also suggesting that there are a number of people who like to prove their intellectual abilities through quizzes and that such people prefer longer form or specialised quizzes such as Mastermind. The more “game-like” structure of many mobile apps is less inclined toward this sort of quiz. It should not be a deterrent for the longer-term serious quiz taker to use a website rather than an app.

An essential aspect that must be considered in the development of the proposed solution is to undertake an examination of the costs, risks and benefits of the solution for the customer.

Firstly, the costs of the quiz league website as proposed are fairly low at the outset. The labour costs are nil as there is a sole developer involved in the project who is working for no wage. There is, however, an opportunity cost, which is calculated assuming that the developer is giving up the potential to work elsewhere during the time it takes to complete the website. Therefore the figure of £3,900 is calculated assuming that the developer is

giving up the opportunity to take 600 hours of work at least £6.50 which is the minimum wage per hour for an over-21 in Northern Ireland. There are negligible other costs as the website will be hosted on the university servers, during development, and not be charged and all the programs required are freely available to the developer. This is certainly a very sustainable cost to the customer.

Secondly, there is significant potential to extend the website beyond its existing bounds. This would allow the customer to monetise the website and earn profits without additional significant or excessive capital investment. The costs for hosting the site and the labour costs would no longer be nil if the product were to be commercialised. Therefore the long-term future of the project is secure and is easily adaptable to the movement of the market.

## **2.4 Summary**

This chapter has summarised some of the main potential competitors for the quiz website and the research undertaken by the developer to examine fully the requirements for the site. The knowledge gained has informed the requirements and the design of the site.

## Chapter 3: Requirements Analysis

### 3.1 Introduction

This chapter identifies the requirements for the website that are the result of the research taken and gleaned from the input of the focus group. It also includes an outline and justification for the priorities given to each of these requirements.

### 3.2 Focus Group

In order to more accurately identify the requirements for the website research was undertaken with a focus group of six adults, two women and four men, who take part in quizzes online from time to time. It was difficult to find existing regular online quiz league takers as they usually take part either anonymously or under pseudonyms. In either case it is extremely unlikely that any quiz site would be prepared to give out personal details so that their users could be contacted. The members of the focus group were asked five questions and given a number of options to answer based on the customers' desires and the background research that was undertaken. The questions asked and the findings of the focus group are set out in Appendices 3 and 4 respectively.

The focus group revealed that the users prioritised that the site be free to use, have a login and registration and a quiz search.

As a result of the focus group, discussions with the customer and what has been inferred from the most popular competing websites in the background research, it has been determined that the potential users of the website would ideally prefer to compare their scores against those who have competed at the same difficulty level, who have completed the same quiz and have competed in the same category. Although it is desired that all these smaller, sectionalised leader boards are included it is best to include a full leader board for all quiz takers. This is to be developed first as a basic requirement and then extended to include the other leader boards.

In addition, it has been determined through the focus group that the preferred formats for the questions would be in "True or False" or in "Multiple Choice" as well as preferring that there would be more than one question type in the quizzes. Therefore the administrator create quiz function will include the ability to create these types of quizzes. This could be extended to include the other formats suggested by the focus group.

The research undertaken suggested that the most popular content for the quiz included General Knowledge, Sport and TV or Film questions. In addition competing sites either rotate the topics they take or they have a large breadth of categories to take. Therefore the best course of action is to provide the administrator with the ability to manage the content on the site easily to meet the demands of the users.

The focus groups also suggested that the quizzes should be available in a number of difficulty levels and for the quizzes to be able to be rated by the user. It was also suggested that it should include pictures. This allows the site to exploit “a gap in the market” as most of the rest of the quiz league sites do not have a number of difficulty levels. It is also a useful feature to have a rating system as it provides feedback to the administrator about the most popular quizzes and which quizzes should be removed.

The website needs to be free to access for all users as this was a feature that is present in all the competitors as well as being a feature that was crucial for the members of the focus group. Several other sites provide premium content as an extra feature with prizes; however in this website it is preferred that this is a potential extension of the website rather than a core development or feature. Another specific feature that the focus group desired was the ability to search for quizzes by name. This was not always present in competing quiz sites and therefore would provide a useful benefit over competitors.

### **3.3 System Requirements**

In order to address the problem presented it is essential that certain features are present in the website. To this end it has been decided to set out a series of Use Cases that would outline how the user would interact with the website. From these Use Cases a series of requirements based on the Volere template were created. These requirements set out all that must be met to successfully allow the user to interact with the website as planned.

The use cases and requirements are based on the background research, the questionnaires’ data and the customer’s requirements. The full list of the Use Cases and Volere Requirements are found in appendices 5 and 6. However, an example of each is given in Figure 1 and Figure 2.

### 3.4 Use Cases

As Figure 1 shows the Use Case sets out how the user is going to interact with the system, in this case how the user will log in to the system. The use case also outlines any potentially different ways in which the user could interact with the system, for example if the user forgets their password. As this work was completed as part of the design phase the Use Cases do not always reflect exactly how the user would interact with the final completed website. For example, the login page was eventually considered redundant as the user can login directly from the home page; therefore the login page was removed from the site.

Name	Login	Number	1
Summary	To login to the online quiz league website		
Users	User Database		
Preconditions	User already has login		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User clicks on login icon</li> <li>3. Accesses login page</li> <li>4. User enters username</li> <li>5. User enters password</li> <li>6. User presses enter</li> <li>7. Accesses "My home" page</li> </ol>		
Alternative Paths	<ol style="list-style-type: none"> <li>1. User doesn't have an account <ul style="list-style-type: none"> <li>- User is re-directed to register for account</li> </ul> </li> <li>2. User enters wrong username <ul style="list-style-type: none"> <li>- User is prompted again</li> </ul> </li> <li>3. User enters wrong password <ul style="list-style-type: none"> <li>- User is prompted again</li> </ul> </li> <li>4. User clicks "forgot password" <ul style="list-style-type: none"> <li>- User is emailed correct password</li> </ul> </li> </ol>		

Figure 1 – Use Case 1

### 3.5 Volere Requirements

Volere allows the developer to coalesce all that the system requires by linking the Use Cases to the requirements and allows the attributes of each requirement to be clearly set out. Each requirement states the Use Case it is linked to, a brief description of the requirement, its rationale and source and how the requirement's success will be identified. In addition the Customer Satisfaction and Dissatisfaction boxes allow the importance of the requirement to be set out clearly which will inform the Requirement Priorities. Finally any dependencies and changes that have been made to the requirement are stated. An example of such a requirement is shown in figure 2.

<b>Requirement Number:</b>	1	<b>Requirement Type:</b>	3. Users of the product	<b>Use case number:</b>	1, 15
<b>Description:</b>	The website will provide a login for user				
<b>Rationale:</b>	To allow the user's name and progress to be recorded				
<b>Source:</b>	Customer requirement Background research Focus group				
<b>Fit Criterion:</b>	The user can log in to the website and have a unique password that allows them to save, record and access their previous score				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>	Database, user interface		<b>Conflicts:</b>	none	
<b>History:</b>	Created 12/1/16				

Figure 2 – Volere Requirement 1

### 3.6 Non-functional requirements

There have also been a series of non-functional requirements that have been identified based on background research and the data collected from the questionnaire. These requirements are set out in Table 2 with their source as well as in Appendix 6 as Volere Requirements.

<b>Non-functional requirement</b>	<b>Source</b>
Privacy policy, rules and scoring of quizzes , user terms and conditions, including sanctions for violations is clearly stated on the website	Background research Customer Requirement
The website is robust	Customer Requirement
The website is extendable	Background research Customer Requirement
Timing of the transition between pages to be kept to a minimum	Background research Customer Requirement
Easy to use and clear website	Background research and questionnaires
Content is free to user	Focus group
Quizzes contain pictures	Focus group

Table 2 – Non-Functional Requirements

### 3.7 Requirement Priorities

It was decided in order to mitigate somewhat the risks set out, in particular those concerning insufficient time and learning of new skills, that it would be best to set out a series of priorities for the website so that the minimum viable product could be identified. Therefore those priorities were assigned according to what was considered the most vital requirements to achieve a minimum viable product. These are reflective of the customer satisfaction and dissatisfaction ratings in the Volere requirements. This minimum viable product could then be expanded upon and enhanced according to these priorities. Although there are several ways of setting out these priorities it was decided to use

“Moscow” (what the system Must, Should, Could, and Would do) for its simplicity and ease of use. Therefore the priorities of the requirements are detailed in Table 3. They are listed with their Volere requirement number attached as each requirement may be enhanced beyond its basic essentials, for example requirement 3 that states more than one format of question can be scaled from only two formats as an essential to three or four as the website is further developed.

Must	<ol style="list-style-type: none"> <li>1. The website will provide a login for user</li> <li>2. The website provides a global leader board listing username, score and number of quizzes taken.</li> <li>3. The website provides quizzes with more than one format. For example, multiple-choice, true/false etc.</li> <li>4. The user can select the topic they would like to answer a quiz on based on the options that have been provided to them.</li> <li>5. Users are able to compete against multiple users by allowing more than one user to register with the site</li> <li>6. The user is able to re-take quizzes they have previously taken</li> <li>7. The administrator is able to log in the system and access his/her privileges</li> <li>8. The administrator is able to create a quiz for others to take</li> <li>15. The user is able to register their details with the website</li> <li>16. The user is able to take a quiz</li> </ol>
	<p><b>Non-Functional</b></p> <ol style="list-style-type: none"> <li>19. Privacy policy is clearly stated on the website</li> <li>19. User terms and conditions, including sanctions for violations are clearly stated on the website</li> <li>19. Rules and scoring of quizzes are clearly stated on the website</li> <li>21. Content is free to user</li> <li>24. The website is extendable</li> <li>23. The website is robust</li> </ol>
Should	<ol style="list-style-type: none"> <li>9. The user can select a quiz based on the difficulty level it has been given</li> <li>10. The ability to search for a quiz based on keywords that describe it.</li> <li>6. The user can re-do quiz but the leader board the counts number of attempts</li> <li>3. The website provides quizzes with at least three formats. For example, multiple-choice, true/false etc.</li> <li>17. The administrator is able to assign a difficulty level to a quiz</li> <li>18. The quiz is marked within one second</li> </ol>
	<p><b>Non-Functional</b></p> <ol style="list-style-type: none"> <li>20. Easy to use and clear website</li> <li>22. Quizzes contain pictures</li> <li>18. Timing of the transition between pages to be kept to a minimum</li> </ol>
Could	<ol style="list-style-type: none"> <li>11. The user can search for quizzes by the rating they have been given by other users</li> <li>12. The user can rate a quiz out of 5 stars</li> <li>13. The user’s score for each quiz is recorded</li> <li>14. The user is able to recover a forgotten password</li> <li>15. The user can re-do quiz but the leader board the counts number of attempts and weights the score accordingly</li> </ol>
Would	<ul style="list-style-type: none"> <li>• Prizes for quiz winners</li> </ul>

	<ul style="list-style-type: none"> <li>• Ability to go head-to-head with other users</li> <li>• More languages and culturally relevant materials for different regions</li> <li>• Premium content for users who join/pay for more quizzes</li> <li>• Ability for administrator to restrict quiz to particular users</li> <li>• Ability for administrator to create a private league</li> </ul>
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Table 3 – Requirement Priorities

The “Would” requirements have not yet got a Volere requirement number as they are to be used in the next stage of development as the project is potentially extended; therefore it is not important to expand this fully at this stage.

Therefore the expected product must and should have the features set out in Table 4 which compares them to the main competitors.

Feature	Quiz2020	Sporcle	Quizfactor	Triviaplaza	Onlinequiz creator	Actionquiz	Quiz Champs
Head-to-Head Competition	✓	✓	✗	✗	✗	✗	✗
Timed Quiz	✓	✗	✗	✗	✗	✗	✗
Privacy Policy easy to find	✓	✗	✗	✗	✗	✗	✓
Login/ registration	✓	✓	✗	✗	✓	✗	✓
Create own quiz	✓	✓	✓	✗	✓	✗	✓
Good design/ layout	✓	✓	✓	✗	✗	✗	✓
Lots of content	✓	✓	✓	✓	✗	✗	✓
Leader board	✓	✓	✓	✗	✗	✗	✓
Categories	✗	✓	✓	✓	✓	✗	✓
Recommendations	✗	✓	✗	✗	✗	✗	✗
Links to live pub quizzes	✗	✓	✗	✗	✗	✗	✗
Search function	✗	✓	✗	✗	✗	✗	✓
Clear scoring	✓	✗	✗	✗	✗	✗	✓
Easily navigated	✓	✗	✗	✓	✗	✓	✓
Levels of difficulty	✗	✗	✓	✗	✗	✗	✓

Prizes	✗	✗	✓	✗	✓	✗	✗
Free to play	✓	✓	✓	✓	✓	✓	✓
Social Media functions	✗	✓	✓	✗	✗	✗	✗
Multiple languages	✗	✗	✗	✗	✓	✗	✗
Pay for content	✗	✗	✗	✗	✓	✗	✗

Table 4 – Summary of Quiz Champs features compared against competitors

### 3.8 Validation

The requirements have been validated in co-operation with the stakeholders, in particular with the Project Supervisor. The use of the Volere Template linking the requirements to the use cases also helps to prevent superfluous requirements.

### 3.9 Summary

This chapter has outlined the means by which the requirements have been decided upon and the means by which the requirements were validated. The priority given to each requirement to ensure that the minimum viable product could be achieved.

## Chapter 4: Design

### 4.1 Introduction

The design of any software system is crucial but there are additional concerns when there is a user interface that the public will use as usability of the system is the “make or break” factor for most users. It is therefore crucial that the system is designed to be robust, easy and intuitive to use and extendable to meet the needs of the users and the desires of the administrators.

### 4.2 User Interface

The user interface is one of the key elements in ensuring the success of the website. Therefore there needs to be a clear and consistent design to the website and for it to be appealing to the user.

### 4.3 Design Principles

Shneiderman has set out eight “golden rules” for interface design which will be taken into account for the design of the user interface. (Shneiderman, 1985) In light of these “golden rules” it has been decided that the design of each page is of a consistent design. Key functions and shortcuts should be in a consistent place on the page and in menus. This would aid the user to navigate the site easily and avoid confusion. For example the “home” button should be displayed always in the same location.

Additionally, the system should allow for easy navigation; the user is to be able use shortcuts and avoid unnecessarily long routes through the site, be provided feedback to users as they go through the site, especially if an action is completed and that they can easily reverse their actions. In other words they can jump between pages and that they shouldn't have to use the back button in the browser repeatedly but be able to access pages through the site's own links.

Users should also be able to feel like they are in control of the system and that they are manipulating the system. In this website it must be designed so that actions, such as starting a quiz, are initiated by the user in their own time rather than starting automatically upon starting the page.

The website should not have any excessively complex displays or for the user to have to remember where to find links, rather it should be intuitive to the user.

## 4.4 Comparative Designs

In order to find the most appropriate layout for the website some of the most popular quiz sites were examined and from this the basis of the design template could begin, in light of the principles discussed already.

The first site was 2020quiz.com. This site is professional looking and it is one of the more developed quiz league sites that exist. A couple of screenshots exist of the homepage in Figures 3 and 4.

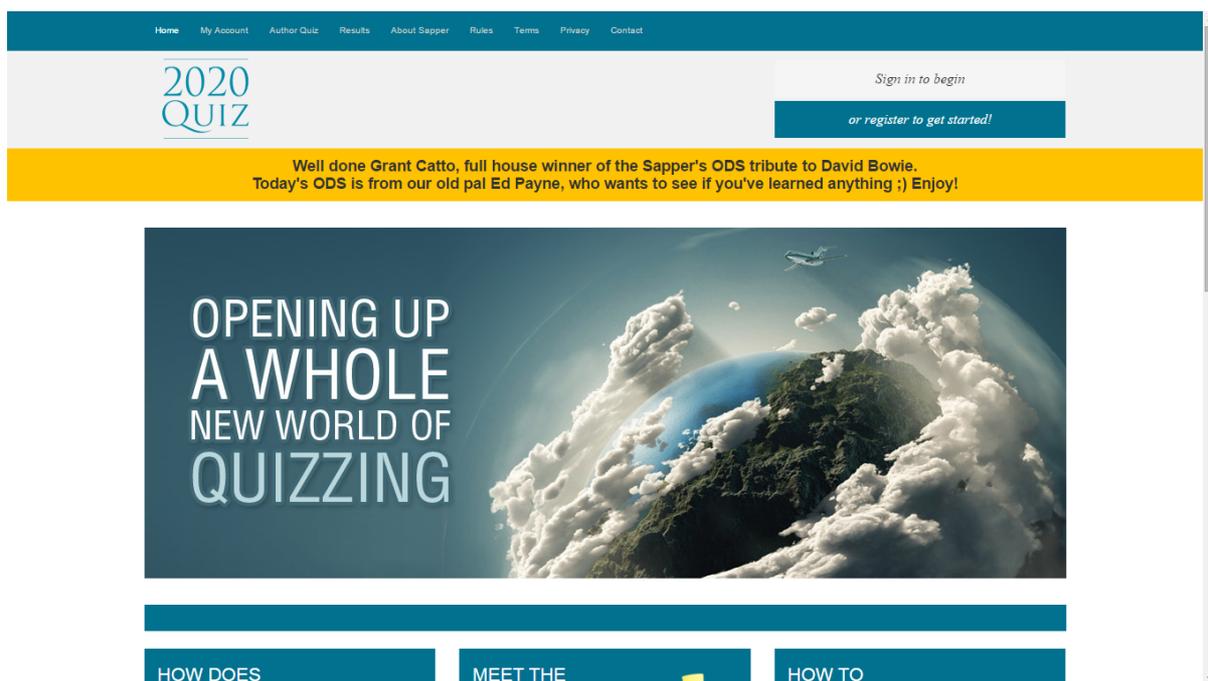


Figure 3 – Quiz2020 Homepage (top)

As is clearly shown there is an easily navigated bar along the top which provides the user with access to all the key features, such as their own account, the ability to author their own quiz and the results table. It also provides clear and obvious access to some of the non-functional features which are useful to the user, for example the rules and privacy policy. Another strong point of the design is the clear button allowing the user to register with the site.

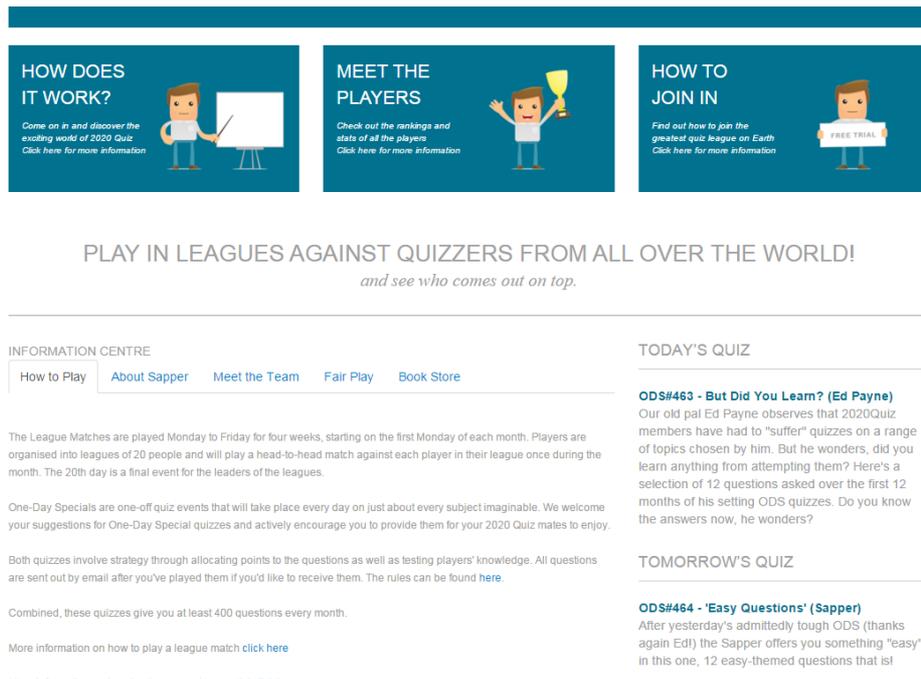


Figure 4 – Quiz2020 Homepage (bottom)

In the lower part of the homepage there are a few “tiles” that provide links that are useful for new users and are therefore highlighted by the images and the large tiles. There are also smaller text information given and appropriate links. There is a constant colour-scheme throughout and the blue colour is helpful in suggesting that the site is professional.

The second site to be examined is [sporcle.com](http://sporcle.com). This is probably the most popular quiz website and has a large amount of content. As is shown in Figure 5.

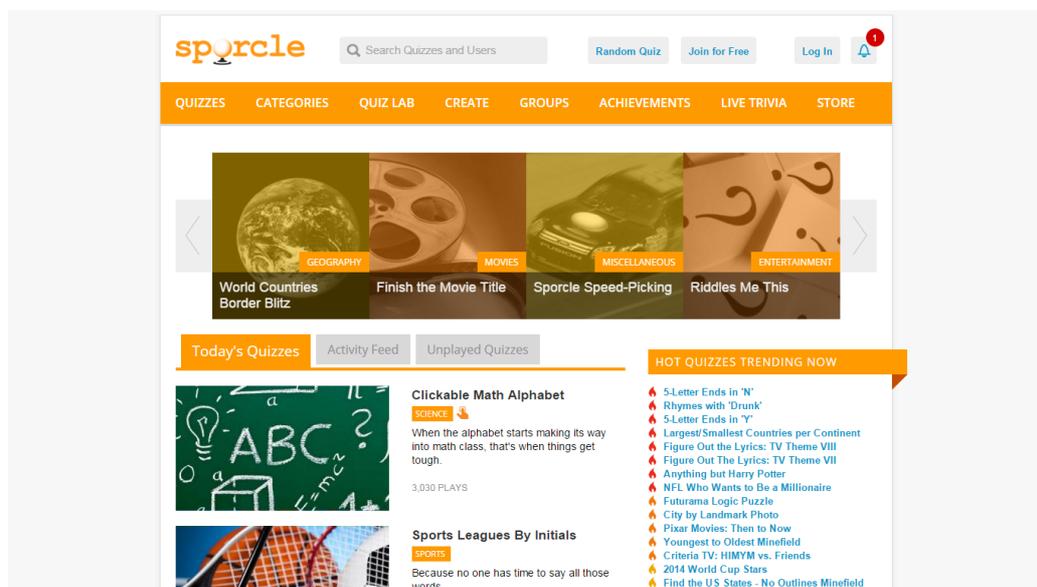


Figure 5 – Sporcle Homepage

The website has a consistent colour scheme and like quiz2020 it uses a horizontal bar at the top to allow the user to navigate. It also has a button to allow the user to login. It differs in that the homepage contains much more detail as to the quiz categories and which ones are popular. The orange colour scheme is clear and attractive but it also projects a vibrant and energetic feel to the site. (Smashing Magazine, 2010)

#### 4.5 Diagrams

In light of the principles set out by Shneiderman and the formats used in other quiz leagues it has been decided to incorporate a horizontal navigation bar on the top of the homepage that will be replicated throughout the other pages. This will allow access to the main features of the site from any of the other pages and it is simple to understand and use. This bar focuses the user's attention on the content below which should be in a lighter background. Headers, titles, categories etc. should be in a bright colour that will focus the user's attention to these features. The ordinary text should be in black to contrast with the light background without being too bright that could be straining on the eyes after prolonged exposure. (Cannon, T, 2012)

It was also decided to have as professional looking website as possible as although the quizzes should be fun, it is unwise to appear gimmicky or just a novelty as this may put off users seeking an intellectual challenge.

The website has been designed using "bootstrap" to enhance its accessibility on mobile devices. Although this is not a priority for the site it is something that would be desirable in the long-term as an extendable feature.

The user interface design for the homepage provides a template for the other pages on the site. The design is using a consistent colour scheme, it provides the user with simple navigation around the site and it allows the user to easily reverse their actions as the menu provides shortcuts. The colour scheme uses blue and black as the main colours as this provides a professional look to the site and it doesn't seem childish or too much like a silly game. It also has a small header menu which can always be present for navigation without it impacting the amount of space there is for content. The homepage, which is used as a

template for the other pages, is shown in Figure 6. The other pages are included in Appendix 7.

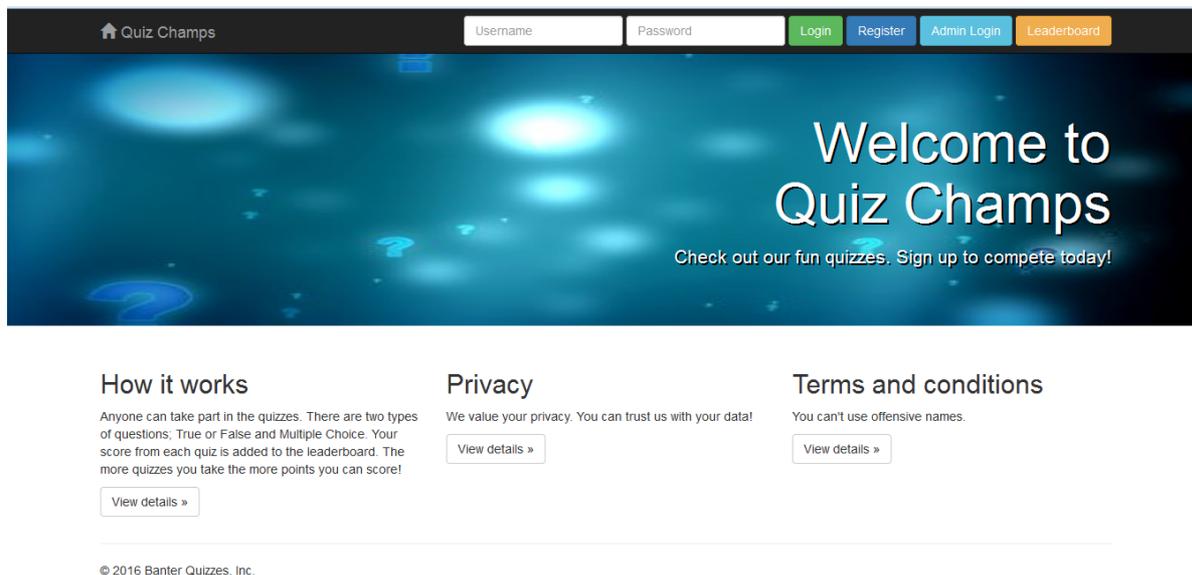


Figure 6 – Homepage template

## 4.6 Architecture

The system operates on a server-client model, the client accesses the quizzes through a website held on a server through the internet. This server also holds the database which contains all the data required for the system to run. There are two main aspects to the architecture of the website, firstly the website design itself which will be outlined in the site map. Secondly, the other fundamental aspect of the website is the database. In this section both of these designs will be examined.

## 4.7 Website Design

The site design is fairly straightforward. The user can access the user home page from the Homepage. This user homepage contains links to the leader board and allows access to each quiz for which they can search by genre, type and/or level, or by name alone. The user can also access the privacy policy, the rules and scoring and terms and conditions from the initial homepage. The Administrator is able to manage the site and members from the admin homepage. This page contains links to the relevant pages. The site design for the member side and for the administrator side are shown in Figures 7 and 8 respectively.

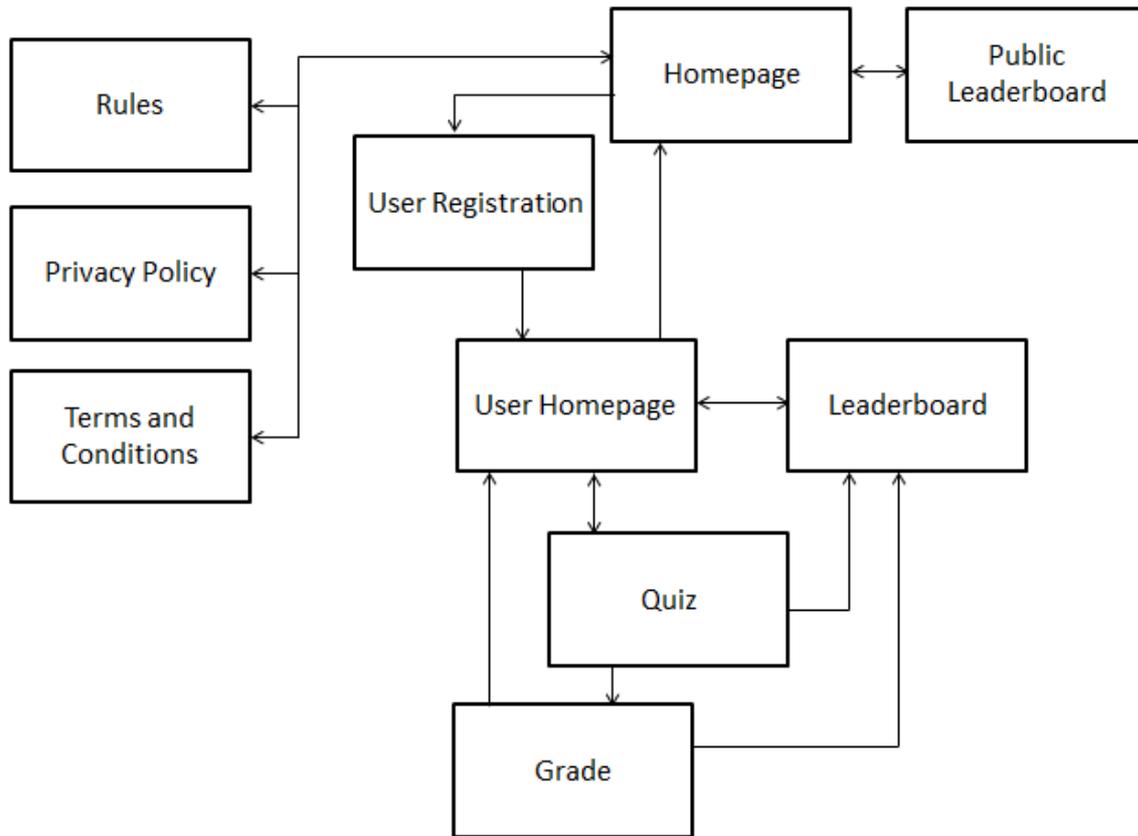


Figure 7. Site Design for the user side of the website

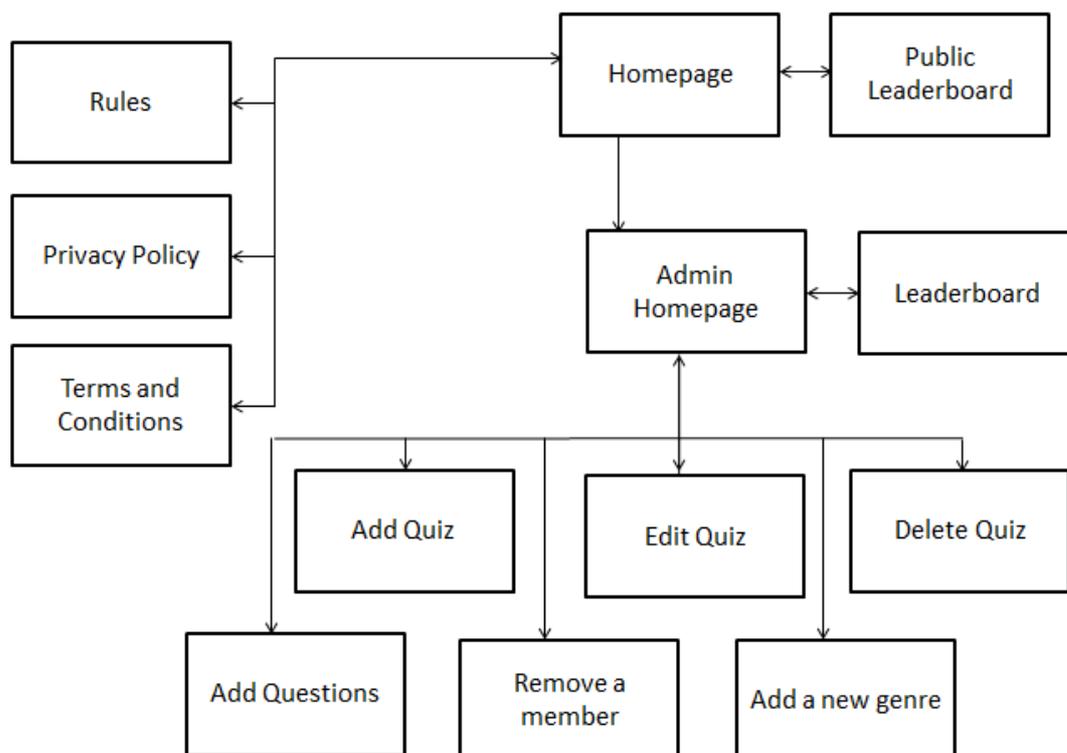


Figure 8. Site design for the Administrator side of the website

## 4.8 Database

The database has been developed with the following entities: questions, answerlist, setofquestions, quiz, attempt, genre, type, level, members and admin.

Questions holds the data for each question; its text, genre, type, level and the score awarded. The data for each differing genres, types and levels are held in the genre, type and level tables respectively. Each question has an answerlist which contains the correct answer, and up to three wrong answers for the matching question. Each question also can be used in a setofquestions. Each setofquestions assigns the display order of the questions for each quiz. Each quiz must have a number of questions but does not link directly with the questions but with the setofquestions. This allows each question to be used in more than one quiz. Each quiz also has an admin who created the quiz. Every time a member (or user) attempts a quiz their score and member\_no are stored in the attempt table which is linked to the member table which stores the data about each user that registers with the site.

The database has been normalised to the Third Form and all many-to-many relationships have been eliminated. The Entity-Relationship diagram in Figure 9 details these relationships in further detail. The database was initially designed to incorporate two types of question; multiple choice and true or false. This met the minimum requirements but also be flexible enough to be extendable to another type of question. This was achieved by the incorporation of the “!Obscuro!” format. This format builds upon the existing structure in place. The object of this format is not simply to find the right answer but the most obscure answer from three correct answers and avoid the one wrong answer. This fits neatly with the answerlist format in place as “correct” is the most obscure answer, “wrong1” and “wrong2” are used for the other correct answers while “wrong3” is still used for a wrong answer.

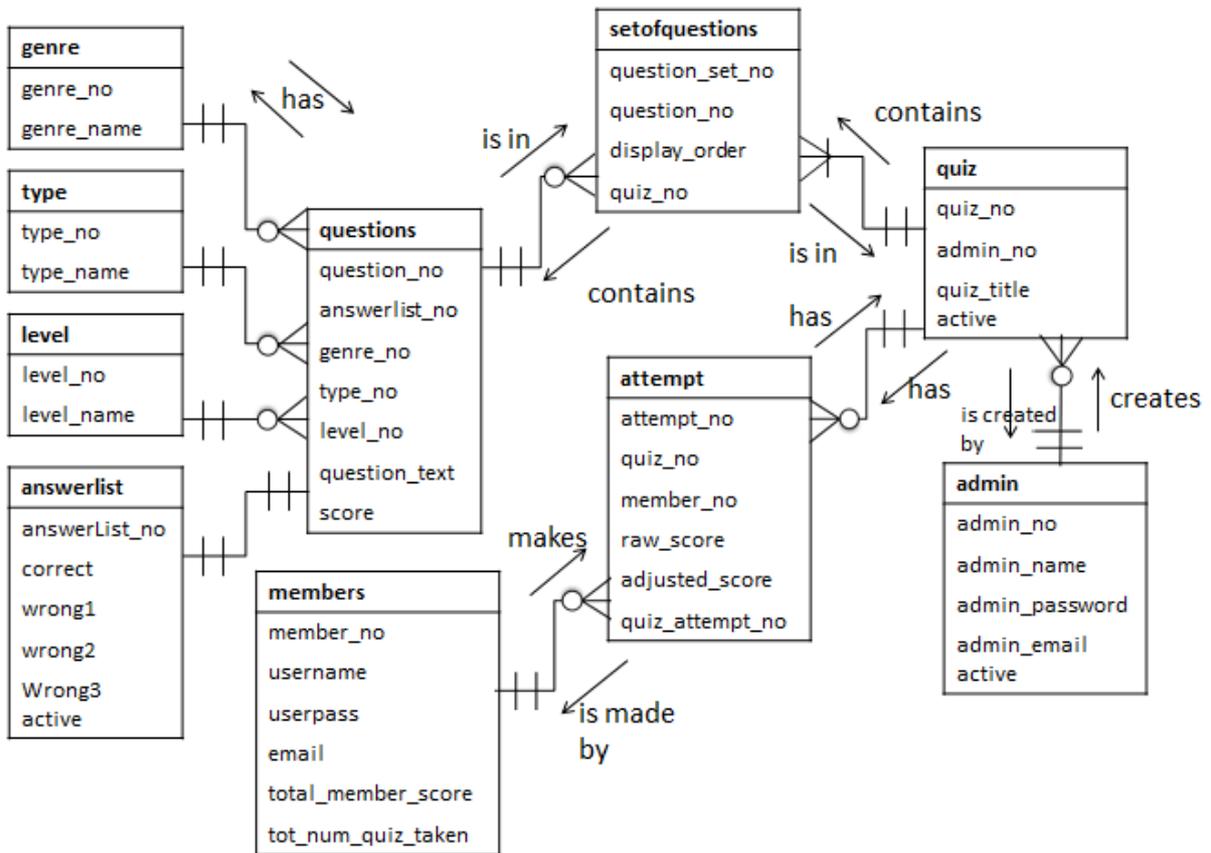


Figure 9. Entity-Relationship Diagram of Database

The Data Flow Diagram has also been updated to more accurately depict the system as it stands. There are effectively two halves to the system, one is accessed by members of the site and the other by the site administrator. Figure 10 shows the user side of the data flow and Figure 11 shows the data flow from the Administrator’s perspective.

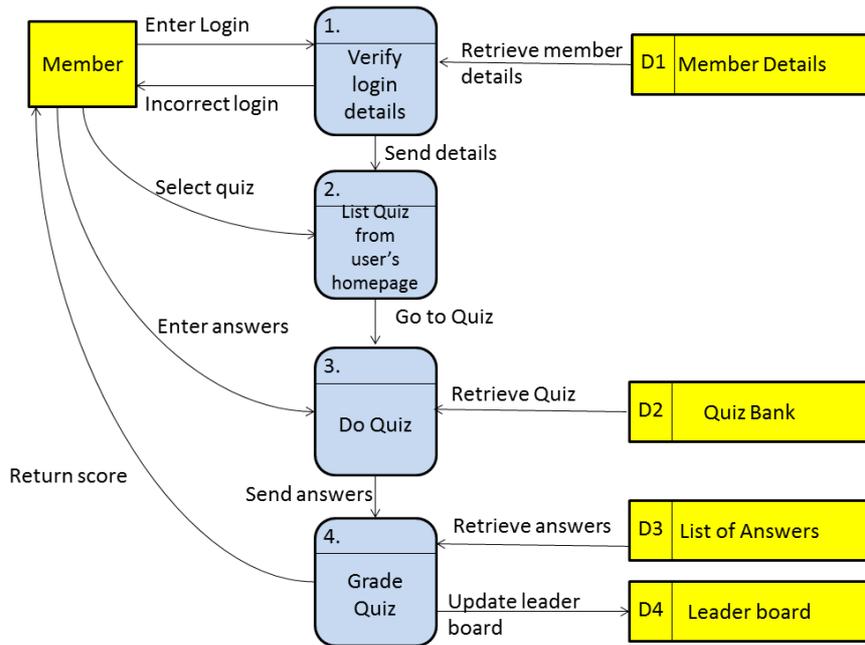


Fig 10. Data Flow Diagram (User side)

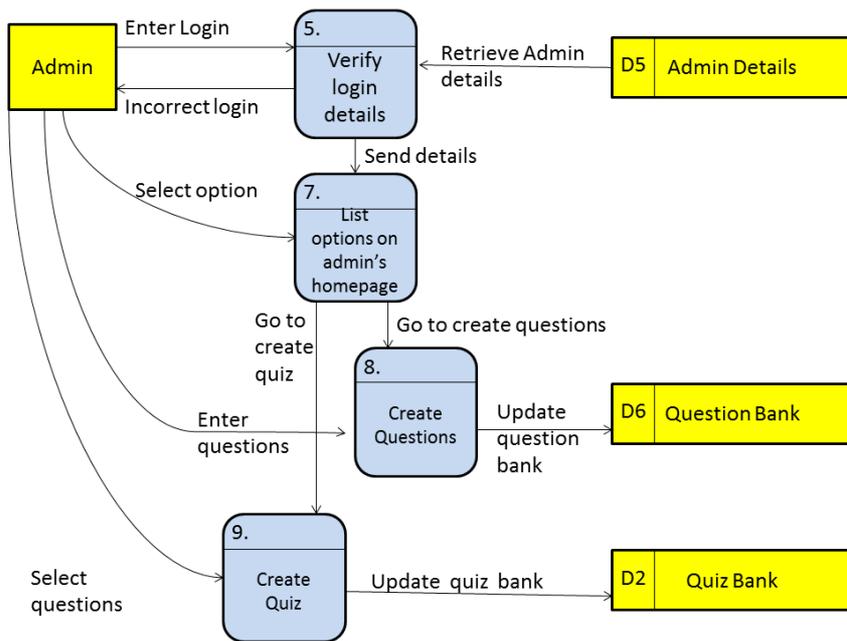


Fig 11. Data Flow Diagram (Admin side)

### 4.9 Summary

This chapter has set out the design work that was undertaken for the website, incorporating the user interface and the design principles that have underpinned this work. The design also included plans for the database and the usability of the site

## Chapter 5: Implementation

### 5.1 Introduction

This chapter concerns how the site and database have been implemented. It also discusses the methodology that underpins this implementation. The chapter outlines the technologies and tools used as well as the process that was undertaken.

### 5.2 Methodology

In the implementation of the design of the website requires a design methodology. There are a number of approaches that could have been taken. The most popular methodology presently in industry seems to be Agile however as this methodology is designed ideally for groups of developers and this project was developed by a sole individual it was considered less suitable as it would have had to be adapted.

A number of other approaches were examined, including a waterfall methodology, however it was decided that the most appropriate methodology was the incremental model. This had a number of advantages as it allows the development of working software quickly, and it is easy to test and debug at each small iteration. This was particularly useful in this case as the developer had little to no experience in the development of some of the technologies that were to be used in the project and therefore the small iterations prevent an unworkable product emerging too late to be corrected. This is significant in helping addressing risk. This model also requires the developer to address the planning and design of the whole system in advance to allow for the iterations to develop. (istqbexamcertification, 2015)

This methodology required the development of a number of increments and a Gantt chart. The initial design of these increments was reviewed after the second increment was complete in order to account for conclusions reached by learning the technologies and the initial stages of development. It became apparent that the order and scales set out were no longer appropriate or wise. For example the full implementation of the user interface would prove to be difficult and less of a priority than at least a rudimentary development of both the user interface and the user-side functionality. Additionally, it was found to be easier and simpler to achieve some of the functionality than was initially envisaged. These changes were relatively simple to implement and proved one of the strengths of this

methodology as it identified problems, or potential problems, at a stage that allowed them to be corrected.

There were a number of key milestones that need to be addressed in the development

- Analysis and Design Report – 22nd January 2016
- Design and Implementation – 13th June 2016
- Dissertation Submission – 1st September 2016

Writing and researching the Analysis and Design Report functioned as Increment 1 as it involved the design and development of the project, including background research, system planning and the implementation of the proposed solution through planning. This was allocated about 60 hours.

The second increment was allocated a significantly larger section of time as it was difficult to dedicate a large amount of time to the project owing to a large number of other commitments, including learning the key technologies. However, it was identified that it was ideal to develop the database as early as possible. This is the most fundamental aspect of the system and so was best served by being dealt with first. This was to be completed by 1st April 2016 having spent around 50 hours on the development of the database.

The third increment included the writing of the Design and Implementation report that had to be completed by 13th June. In this increment the basis of the user interface was begun and storyboarded. A prototype of the user interface of the site was developed at this stage. This increment also took part in the exam period and therefore it is expected to be slower in making progress due to other commitments. It was allocated around 50 hours.

The fourth increment was to develop the basic functionality of the user side of the website. It was allocated 80 hours to complete. The deadline for this increment was 27th June.

In the fifth increment the administrator functions were developed to a basic level. It was completed within 80 hours including testing by 11th July.

In the sixth increment the full functionality of the user side features were developed. It took about 80 hours and was completed by 25th July.

The seventh increment was the development of the full functionality of the admin features, the ability to add a new genre and to search for a quiz by name. This increment was planned to have 80 hours of work and was completed by 8th August.

The eighth increment was planned to concern the development of the user password and the login system. This increment was 80 hours long and completed by 22nd August.

The final increment concerned the testing of the system and the final write up of the dissertation. This took about 40 hours and was completed by 1st September.

Throughout each increment Integration Testing occurred to ensure that the system is functioning well overall. There was also testing of each increment's tasks. The write-up of each report and the Dissertation also occurred throughout the project and within each increment. Acceptance Testing occurred throughout the project but is not set aside as a specific task.

The breakdown of each increment is shown in Appendix 8.

### **5.3 Technology**

Although there are a number of technologies that could be used to develop such a website it was been decided that it was ideal to use technologies that are standard and commonly used. This allows the website to be as compatible as possible with the widest number of users' systems. To this end it was decided that the best technology to use for the database would be MySQLi as it is probably the most popular and widely used SQL technology. The database was designed and populated using phpMyAdmin for testing purposes.

The website was designed using a Bootstrap template which provides a greater compatibility with mobile devices. Although not specifically optimised for mobile devices the website would be easier to use than a standard HTML desktop site on mobile devices and could be much more easily extended to be fully compatible. The languages used in the website itself to display content are HTML5 and CSS. These languages were chosen as they are the most commonly used and provide the greatest level of functionality with the most common browsers. These languages also have the latest features available which allows for greater flexibility in function within the website.

Certain features such as the username and password entry require server-side language for security reasons. The most commonly used language is PHP which has been selected for this project. PHP is also used when handling data from the database, it has proven to be a very powerful language that has provided much of the functionality of the website. There is also limited use of Javascript to provide some of the functionality. The SQL calls to the database are handled as part of MySQLi command. This was selected as MySQL has been deprecated and so is no longer suitable for this.

## 5.4 Environment

As the website was developed using the different technologies listed above a number of different tools were needed to implement these. The following tools were used:

- The HTML, PHP and CSS files were written using Notepad++. This program was simple and straightforward to use.
- The database was built and managed through phpMyAdmin, initially on the Dunluce server at Ulster University, then subsequently on localhost through Xampp and finally externally hosted on Hostinger, a commercial web server company.
- Xampp, as already suggested, was used to provide an environment for web development without doing so “live”
- Mozilla Firefox was the main browser used for testing, although increment testing was also carried out on Google Chrome.

All of these tools were available online at no cost which made them particularly suitable.

The project was developed on a Dell Inspiron 1545 running Windows 7 on an Intel Pentium Dual-Core 2.20GHz processor. The project was also tested on this device, as well as on an Android mobile device, namely an HTC One M8S running Google Chrome. Some additional final testing was also done on the website using Safari on an iPhone 5S. The use of mobile devices was to determine the suitability of the website for smaller screens and the impact of bootstrap.

## 5.5 User Interface Implementation

The initial page is the homepage. The top “bar” contains a link to the login for both the members and the admin including the text inputs for both the username and password. There is also a link to register as a member. The top right hand corner has a button linking

to the leader board. The main body has a large “jumbotron” welcoming the user. Below this there are links to the rules, privacy and terms and conditions pages as these are not highlighted features but need to be easily found and accessed.

Both the public leaderboard and the internally accessed leaderboard are simple and clear. They both simply have a table that lists the position, username, total score and the number of quizzes taken of each member. The table is ordered by the total score. The only difference between them is the internally accessed leaderboard has buttons that allow the member to return to their homepage and to logout whereas these are unnecessary for the member. This could be extended to score according to the most points scored in as few quizzes as possible or to have top scorers highlighted more prominently. The page meets the basic requirements but is also easily extendable.

The next main page the user can access is the member homepage (userhomepage). It follows the same format and structure as the main homepage but the “jumbotron” is used to welcome the member back. The page allows the user to search for quizzes based on criteria set out. This can be done in two ways; either by searching by free text for a particular quiz title, or by selecting from three dropdown lists (one each for genre, level and type) and selecting “Find this Quiz” to list all the quizzes that meet these criteria.

One of the most important pages is the quiz page itself. It retains the top bar that is present in all pages which allows easy navigation. The quiz page lists the number of times the quiz has been attempted and how this will affect the scoring of the quiz (the more often the quiz is taken the lower the score awarded). The question is displayed with the various potential options below in clickable buttons that change colour to yellow when clicked. There is a final submit button that sends the quiz to be marked.

The admin page is also accessible from the homepage, it also follows the same basic format as the homepage with the “Jumbotron” and the buttons to select whether the admin wants to add a new quiz, edit an existing quiz, delete a quiz, add questions to the question bank, add a new genre or remove a member. Each of these buttons links to another page that carries out each of these functions. These follow the same format as the other pages.

The site is therefore simple and clear to navigate as the top bar provides the navigational links between each page.

## **5.6 Database Implementation**

The database was fully developed and normalised to third normal form at the initial stages of development. This followed by and large the design of the database set out in the first increment however there were a number of changes made.

The first was to change the setofquestions table so that the quiz\_no for each row was added. This ensured that every column was dependant on the primary key. It had been initially envisaged that a “set of questions” would have a single number that each question would have but this would violate the dependence on a single unique key, therefore each “setofquestions” is not a set, or collection, of questions but is now an identifier as to the quiz to which the question is related and the order in which the question is to be displayed.

The second change was to add an “active” column to quiz, questions, answerlist, admin and members tables. This allows the user or admin to remove certain entities from the website without having to call a delete command. Active can be set to “YES” if it is to be included in searches in the website. This prevents potentially unintended loss of data as the data is not actually deleted but merely hidden from the user.

## **5.7 Database-Website Interaction**

The website needs to interact with the database on nearly every page. This is done through a series of mySQLi queries embedded in php scripts. The results are processed and displayed through the HTML5 and CSS of the relevant webpages. Initially the interaction occurred through MySQLi queries however this was found to be deprecated and no longer a suitable technology to use.

## **5.8 Website Implementation**

Although it would be too tedious to discuss fully all aspects of the website’s implementation but it is necessary to discuss certain key aspects.

Firstly, the implementation of quizzes themselves is the key aspect of the site. Each quiz’s details are stored in the database. After the user has decided which quiz to take the website retrieves this information from the database. It also retrieves the member and the

number of attempts the user has made of this particular quiz. As the answers to the questions are options from which a user can select only one a series of radio buttons inside a form are displayed. These radio buttons are hidden by CSS formatting so that they appear to be clickable buttons. When a user clicks on a button it will turn yellow. The options are retrieved from the database but are “shuffled” to avoid the correct answer always being in the same place each time. Finally, the user can submit the quiz for marking with a button at the bottom but only if an answer has been given for each question. This is checked by a JavaScript function which runs when the button is clicked.

Secondly, the grading of the quizzes is a significant feature that needs to be looked at. The quiz page sends the user’s inputted answers to the grade page as a form using the POST method. This prevents the user’s inputted data from being available to see in the URL. The details of the member and of the quiz are also sent in this way for the same reason. The number of times a user has attempted this particular quiz is also sent and this is checked against the database’s record of the number of times it has been attempted. This is done to prevent the user from hitting the back button and resubmitting several times. If this is attempted the user is simply redirected to their homepage. The user’s inputted data is compared to the correct answers and scores calculated in a php script. The member’s records in the database are then updated to reflect the new score and this indirectly updates the leader board as it is based on these records. The raw score calculated is then used to calculate the final score to be added to the user’s records. This is to reflect the number of times the user takes the quiz, for example if it is the second time a quiz is taken the score will be divided by two etc.

Thirdly, the login and registration for the user and admin process is a key feature of the website. It was initially envisaged that the user and admin login would occur on separate pages however it became simpler and feasible to allow the username and password for both to happen on a top bar on the homepage. The username and password is then compared against the usernames and passwords stored in the database, and if both of these match then the user is given permission to access the relevant homepage.

The registration process occurs on a separate page, and the user has to enter a valid email address, a username of at least four characters and a password of between six and twenty

characters, of which at least one must be a number. The email address and username entered are compared with the already existing email addresses and usernames of the members and if duplicated they are prevented from proceeding. These restrictions are carried out by a JavaScript function that is called on submission. The user is warned by an alert and can't proceed until these conditions have been met.

On submission the new member's details are stored in the database but the password entered is hashed before it is entered into the database. This provides a greater level of security for the passwords from a potential hacker. The hashing process is deterministic which allows the user's hashed password to be the same every time it is entered by the user which is essential for the verification of a correct password. Although there are many ways to hash a password the method used was sha1. This hash has a php function which made it simple to implement but is also widely considered to be secure and relatively fast. The other considered alternative was to use MD5 but this has proven to be less secure as it is more likely to produce collisions. (Stack Overflow, 2016) It is the hashed version of the password that is compared during the login process.

## 5.9 Process

The incremental methodology set out was followed and provided a successful basis for the development of the site and nearly all the targets set out were met. However, there were a number of issues that became apparent as the process was undertaken.

Firstly, it became apparent that the order and scales set out were no longer appropriate or wise as a result of the conclusions reached by learning the technologies and the initial stages of development. For example the full implementation of the user interface would prove to be difficult and less of a priority than at least a rudimentary development of both the user interface and the user-side functionality. Additionally, it was found to be easier and simpler to achieve some of the functionality than was initially envisaged.

Secondly, initially the development of the website was initially was done using the Dunluce Server at Ulster University as this had been used previously for database development. However, this server became increasingly unreliable to use and so it was decided that it would be best to develop the site offline and then publish it at the end of the final

increment. This path was followed using xampp and then the site was published on a Hostinger server finally and was made accessible on [www.quizchamps.xyz](http://www.quizchamps.xyz).

### **5.10 External Sources**

In the implementation of the site a number of external sources were used to assist in the development of the site. The only external source of code to be directly incorporated into the website came from Bootstrap. There are a number of templates that are available to use on the Bootstrap website and several of these formed the basis of the web pages developed. The Privacy Policy and Terms and Conditions were created using online generators from [privacypolicy.com](http://privacypolicy.com) and Shopify respectively. (privacypolicy, 2016) (Shopify, 2016)

Additionally, as the developer had limited knowledge of the technologies used in the project it was necessary to do a lot of learning and research into these technologies, therefore the starting point for a lot, if not most of, the code was from examples or tutorials found online. The w3schools and stackoverflow websites were particularly useful to this end. However, these initial examples have been greatly changed and adapted beyond their initial formats.

### **5.11 Summary**

The implementation was greatly aided by both the design process and the methodology used. The implementation of the database was fairly straightforward once the design had been established although it was edited somewhat afterwards. In addition the entities could have been better named in hindsight. The incremental methodology was helpful as it allowed problems to be identified early and corrected.

## Chapter 6: Testing and Evaluation

### 6.1 Introduction

This chapter deals with the process of testing and evaluation of the website against the objectives set out at the beginning of the project and requirements that were developed from these. Testing occurred throughout the project with testing at the end of each increment, at the end of the website's development and was sent out for acceptance testing to the project supervisor and to a small focus group.

### 6.2 Testing

All the testing during the develop process occurred on the device used to develop the software. The website was tested primarily on Mozilla Firefox and to a lesser extent on Google Chrome. As such the website is best viewed on these platforms.

### 6.3 Unit Testing

Each increment provided for testing of the work completed in the increment. This is outlined in a series of test cases for each unit which can be found in Appendix 9. The test cases for Increment Four are shown in Table 4. This testing was carried out by the developer at the end of each increment. The test cases were met in nearly all cases and when it was not met plans were put in place to implement the corrections to the error in a subsequent increment. The testing during each increment was focused primarily on the functionality of the website however it also provided an opportunity to view the website's usability. This produced several changes in the design and functionality of the website. For example the "add new quiz page" was changed significantly to ensure correct display of the questions and a much more usable interface to add a new question that permitted searches among the questions.

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Quiz page lists all questions for the relevant quiz	All ten questions from the quiz are listed in order	All ten questions from the quiz are listed in order	PASS
2	Quiz page lists title of the quiz	The quiz title appears at the top	The quiz title appears at the top	PASS
3	Quiz page allows all questions to be answered	User can click on correct answer	User can click on correct answer	PASS

		for each question	for each question	
4	Leaderboard lists all users and their score	All users and scores listed	All users and scores listed	PASS
5	User homepage allows the user to find quizzes by their genre	User can click a link that leads to a page that lists quizzes by genre	User can click a link that leads to a page that lists quizzes by genre	PASS
6	User homepage allows the user to find quizzes by their type	User can click a link that leads to a page that lists quizzes by type	User can click a link that leads to a page that lists quizzes by type	PASS
7	User homepage allows the user to find quizzes by their level of difficulty	User can click a link that leads to a page that lists quizzes by difficulty	User can click a link that leads to a page that lists quizzes by difficulty	PASS
8	Database has sufficient data to allow testing	Database is filled with testing data where relevant	Database is filled with testing data where relevant	PASS
9	Quiz questions can be answered	User can click a button indicating the answer selected	User can click a button indicating the answer selected	PASS
10	Answers are marked	User is informed of his/her score	User is informed of his/her score	PASS
11	User's score is added to the database	User's score is updated in Leaderboard	User's score is updated in Leaderboard	PASS

Table 5. Test Cases for Increment 4 – Basic functionality for members

## 6.4 Acceptance Testing

As planned after increment eight the site was to be submitted to others for testing and feedback. This was achieved by uploading the quiz and database to a live server and asking for feedback from potential users. Feedback was received from a small focus group of six people, four men and two women, as well as from the project supervisor. The focus group were asked to use the site by registering and taking quizzes, including logging in and out. They were also asked to list any issues that they encountered or any elements of the site that were confusing, the questions they were asked are found in Appendix 10. The problems identified by the focus group were much fewer in number than the project supervisor however they were focusing much more on usability than functionality. A number of issues were identified as outlined in Table 5.

Issue identified	Number of users experiencing it	Solution
Clicking on answer button changed to colour to green, user had assumed question was answered correctly	3	When button is pressed it now turns yellow
Some question buttons were not able to be pressed	2	Used htmlspecialchars, htmlentities to encode the apostrophes. This prevents the html output from being "cut off"
Users expected the quiz search to find quizzes with only that genre of question	4	Explanation of how the search works is provided on the userhomepage above the search
Users were confused by decimal points in the adjusted scores that didn't appear in the leader board.	1	Scores are now rounded before they are displayed to the user.

Table 6. Focus group feedback on the site

The feedback from the focus group was on the whole positive. All of the users found it straight forward to take quizzes and to view their scores on the leader board. There were no reported navigational problems nor any issues with the user interface as it appeared to have been logical for them to navigate the site.

Several more issues were identified by the project supervisor. These along with the solutions found are found in Appendix 11 and Appendix 12 respectively. All of these issues will not be discussed here fully but some of the most crucial problems are.

Firstly, a significant issue was the lack of browser compatibility. As Firefox was the main browser used for testing the response of Chrome and Internet Explorer to the website was not accounted for. This was a failure in planning that had not been identified early on. It was a potentially serious problem as a significant browser could have been excluded from use if the issue had not been resolved in time. As it stands the problem was fairly simple to solve in the end and the site is functional on Internet Explorer.

Additionally, Chrome did not issue a warning or explanation like Firefox when the user did not complete the quiz. This did not affect the functionality of the site but would be confusing for users. Otherwise there were not significant differences between the two browsers.

Secondly, it was identified that the admin login page was not necessary as its functions could be dealt with on the main home page in the same way that the user login did except by hitting a different button. This has been implemented and works well.

Thirdly, additional password restrictions were added to prevent a user entering a one letter password. This was an issue that had been brought up. This was done by adding a restriction on the validation of user input on a JavaScript function.

Finally, there was an issue of errors emerging when adding a new quiz or adding new questions to an existing quiz as some question was left out or part of the question text was missing. This appeared to be caused by the presence of apostrophes in the question text which interfered with the html quote marks to “cut off” sections of the question text. This was also the root cause of buttons that couldn’t be clicked in answering questions. This was resolved by using the question number throughout the process and accessing the database to display the question text to the user.

## 6.5 Evaluation

As result of the testing process it is necessary to compare the finished product against the requirements that were set out, both the functional and non-functional. The requirements were also prioritised and this must also be taken into account as part of the evaluation.

The first section of requirements was categorised as “MUST”. The functional requirements at this priority are definitely well covered as the testing revealed. The website would be completely unusable if they were not. For example the user is able to login, take a quiz have it scored and compare with other users. Administrators can also login, access their privileges and add new quizzes.

However, there is room for debate when the non-functional requirements are considered. Although it is clear that the user can access the functionality of the website for free and that the privacy policy, rules and terms and conditions are easily accessible the extent to which the system is robust and extendable.

The system has shown itself to be extendable as a third type of question has been able to have been added in the course of the development process. There is certainly room to develop more functionality, such as the ability to change a password for a member, an

admin registration or a sectionalised leaderboard (users grouped together at similar difficulty level etc.) It also would not be especially difficult to implement a rating for each quiz although this would require amending the database but not its fundamental structure. However, if a significantly different format of question, such as asking the user for answers that were not inputted from a list of options, was desired this could prove to be harder to implement within the existing structure which limits the extendibility of the system. Essentially the extendibility of the system is dependent on what the developer wishes to extend it to do but it is clear that the fundamental structure of the system allows for significant additional functionality to be added fairly simply. The “could” and “would” priorities that were set out at the beginning of the process could be built upon the existing structure in place without significant difficulty.

The other significant aspect is the robustness of the system. On the whole the system has proven fairly robust, especially after the correction of the flaw that allowed the user to resubmit a graded quiz with the back button. The user is given fairly limited scope to input free text and in most cases is simply selecting pre-set options. The user is also prevented from carrying out an SQL injection as all the text inputs parameterise the input. The system overall has been able to limit the opportunities for errors or unexpected user input and steps have been taken to deal with it when it does occur, such as the re-direct to the user homepage when a user tries to re-submit a completed quiz.

The “should” requirements were designated a lower priority but they were included prominently in the planning of each increment as it was felt that these requirements were likely to be achievable within the timeframe set out. This has proven to be a wise decision as the functional requirements have been met. The search by keyword is actually a search by title but as it is envisaged that the titles of the quizzes are largely going to be descriptive, and the user can search for quizzes by the questions that it contains, this is not a problem. The addition of a third format of questions was much easier to implement than planned, although as previously stated the further extendibility for this aspect is dependent on the nature of the type of question that is desired. The current formats all are based on answering from a number of options that are presented to the user.

Again it is the non-functional requirements at this stage that is more debatable, perhaps as they are more difficult to objectively define in the same way that the functional requirements are. For example it is a largely subjective judgement as to what extent a site is easy to use and clear. In this case it is necessary to seek as wide as possible the input of others. The focus group that took part in acceptance testing by and large felt that the site was straightforward to use or at least expressed no issues with it. This would suggest that this requirement has been met. Additionally the transition between pages has been kept to a minimum for users as the transitions between pages are quick and without any noticeable lag.

Thirdly, the “could” requirements have not been implemented to anywhere near the same extent in this version of the website. This is the result of the planning that was set in place, these features were given a much lower priority and did not affect the ability of the product to be viable. The only one of these requirements, which are all functional, to be implemented was the adjusting of scores for re-taken quizzes. This is because it was a much simpler requirement to implement than had been envisaged at the planning stage. The other requirements were not included in the increments at this stage. The website however has proven itself to be extendable from the “first cut” and could quite easily incorporate these requirements. The “would” requirements would require a larger level of effort but nothing that has been done so far should inhibit the development of these features.

## **6.6 Summary**

This chapter has dealt with the way in which the work undertaken in this project has been tested both at the incremental and final stages. It has also given an evaluation of the project in light of the requirements that were set out at the beginning of the process.

## **Chapter 7: Conclusions and Recommendations**

### **7.1 Introduction**

This chapter will summarize the project as a whole, evaluating whether or not the project has met its objectives, the evaluation of the learning undertaken and what would be done differently if the project were to be repeated from scratch.

### **7.2 Project Appraisal**

On the whole the project has met the objectives that were set out at the beginning. The project was designed to investigate the current state of online quizzes and to identify areas of weakness among potential competitors and how this may be exploited. This has been achieved as the requirements of the website were based on research undertaken that revealed a lack of websites that provided non-geographically based quizzes.

These requirements were identified at the earliest stage possible and this allowed the implementation of a website that was able to address the problem. The designs for the website were built upon and implemented into an initial prototype. All of this was meeting the objectives that were set out.

The project also aimed to incorporate a database that was to retain its integrity whilst providing the website with all the crucial data that it held. This has been achieved as the database was developed early on and was the basis of all the data accessed by the website.

Finally the objectives included a desire to review and examine the website against the requirements set out. This was to be achieved by a focus group which was carried out. The findings of this evaluation have been included in this dissertation. This process also included testing of the website as a whole.

### **7.3 Learning Undertaken**

The developer had virtually no knowledge of the technologies involved in this project at the start of the project. Therefore the amount of learning that took place was considerable. The use of databases was taught as part of the MSc course and as such provided a good base for learning to take place in this aspect of the project. It was good to have a solid base to build from as the database was a fundamental part of the project and would have precluded any other development. The developer's knowledge levels about website design and development have obviously increased greatly. An understanding has developed of the

main features of HTML5, CSS, PHP and JavaScript. This was largely self-taught by using the tutorials and examples given online particularly w3schools website. This delayed the development of the site considerably in comparison to what would have been possible with a more experienced developer. Nevertheless, any subsequent development of this project or another web based project would be able to be developed much more quickly as the developer has become much more experienced as a result of this project.

The project has provided the developer with a much better understanding of development methodologies. This was helped by the research undertaken in the early stages as to the most appropriate methodology for this project. The developer has been able to develop a hands-on knowledge of an incremental methodology which has revealed the importance of a flexible and dynamic approach to potential problems that may arise. It is necessary to set out in advance the objectives of each increment in order to properly test the software.

The developer in the course of the project was able to begin to understand the fundamentals of testing and the criteria that need to be set out. This was an initial weakness as the testing was not sufficiently set out explicitly for each increment. This led to some errors being retained through a couple of increments without being dealt with early enough. Although this was not critical to the project it proved that the level knowledge needed to be improved.

Another aspect of the project that taught the developer a lot was the requirements of a secure login system and the need to encrypt passwords and ensure that users' data was dealt with securely.

The importance of clearly setting out exactly what the requirements were for the system was also an aspect of the project that had not previously been encountered by the developer in the course beforehand, however it became increasingly clear how important this was for the project. The use of Volere to set out these requirements was a crucial aspect of this and was very useful for achieving these ends.

On the whole the amount of learning that has taken place throughout the course of the project has been considerable and would provide the developer with many of the fundamentals of the software development process and its potential pitfalls.

## 7.4 Recommendations

Many lessons have been learned as result of this project and if the project were to be repeated again from scratch then a number of different approaches would have been taken.

Firstly, the issue of browser compatibility was not fully grasped early enough. This should have been addressed as a requirement early on in the project and the testing taken on Chrome, Firefox, Internet Explorer and Safari. This would have allowed the compatibility issues with Internet Explorer to have been identified early on. Although the compatibility issues were able to be resolved in good time this was a potentially avoidable problem.

Secondly, another issue that could have been looked at earlier was the linking of questions to genre, level and type rather than questions. Although this is useful for the administrator when creating quizzes there is some confusion for those taking the quizzes as most of them expect to be able to search for quizzes that meet the criteria entered rather than to find quizzes that contain at least one question which had the criteria set out. For example, if a user searches by genre for sport all quizzes containing a sports question are found. This can produce a situation where a user takes a quiz expecting to take sport questions but find only one sport question among a lot of other questions.

Thirdly, if the project were to be repeated it would focus more fully on the user interface and the planning of how the user would move between the pages. For example, the design of the login system failed to take into account the fact that the member and admin could both log in from the homepage. This led to the development of an unnecessary login page for admins. This was wasteful and distracted from time that could have been spent on other aspects of the site.

Fourthly, another modification that would have been wise to implement would be a distinction between the username and the displayed name in the leader board. As the leader board is publicly displayed it effectively allows all the active usernames to be displayed to anyone who accesses the site. These usernames are also used to log in users. Therefore there is the possibility that a potential hacker has already been given a list of all the usernames for the site which are half of the details required to login. Therefore the security of the site is effectively based upon the strength of user's password alone rather than a hacker having to identify both the username and the password.

Finally, another aspect that should have been investigated early on was how to develop a website locally rather than live. The use of the Dunluce Server was initially useful as a backup and to allow the project supervisor to view the site remotely, however as the server became increasingly unreliable this created problems and wasted crucial development time. The use of a live server is also poor development practice and this had not been considered early on. Therefore this is something that would be changed if the project were to be repeated.

## **7.5 Summary**

This chapter has looked at the learning that has been undertaken throughout the project. This has been proven to be considerable, additionally there have also been many lessons learned about the difficulties that have arisen from the project, including errors that would be avoided if the project were to be repeated. On the whole the evaluation of the project has shown that the project has been successful and has met its objectives.

## Bibliography

Stack Overflow. 2016. *Stack Overflow*. [ONLINE] Available at: <http://www.stackoverflow.com/>. [Accessed 31 August 2016].

W3Schools Online Web Tutorials. 2016. *W3Schools Online Web Tutorials*. [ONLINE] Available at: <http://www.w3schools.com/>. [Accessed 30 August 2016].

## References

Color Theory for Designers, Part 1: The Meaning of Color – Smashing Magazine. 2016. [ONLINE] Available at: <https://www.smashingmagazine.com/2010/01/color-theory-for-designers-part-1-the-meaning-of-color/>. [Accessed 22 January 2016].

comScore, Inc. 2016. *Mobile Internet Usage Skyrockets in Past 4 Years to Overtake Desktop as Most Used Digital Platform - comScore, Inc.* [ONLINE] Available at: <http://www.comscore.com/Insights/Blog/Mobile-Internet-Usage-Skyrockets-in-Past-4-Years-to-Overtake-Desktop-as-Most-Used-Digital-Platform> [Accessed 30 August 2016].

Cannon, T (2012) *An Introduction to Color Theory for Web Designers*, Available at: <http://webdesign.tutsplus.com/articles/an-introduction-to-color-theory-for-web-designers--webdesign-1437> (Accessed: 6th June 2016).

Google. 2016. [ONLINE] Available at: [https://www.google.co.uk/?gfe\\_rd=cr&ei=oPeYVtvmJYLj8wfc4IOIDw&gws\\_rd=ssl#safe=off&q=online+quiz+league](https://www.google.co.uk/?gfe_rd=cr&ei=oPeYVtvmJYLj8wfc4IOIDw&gws_rd=ssl#safe=off&q=online+quiz+league). [Accessed 22 January 2016].

hash - Algorithm Complexity & Security: MD5 or SHA1? - Stack Overflow. 2016. *hash - Algorithm Complexity & Security: MD5 or SHA1? - Stack Overflow*. [ONLINE] Available at: <http://stackoverflow.com/questions/2948156/algorithm-complexity-security-md5-or-sha1> [Accessed 30 August 2016].

How to win quizzes – from pub contests to Mastermind | Life and style | The Guardian. 2016. [ONLINE] Available at: <http://www.theguardian.com/lifeandstyle/2014/sep/12/how-to-win-quizzes-pub-mastermind>. [Accessed 22 January 2016].

Privacy Policies.com. 2016. *Login - Privacy Policies.com*. [ONLINE] Available at: <http://privacypolicies.com/privacy/edit/X6iLyL>. [Accessed 31 August 2016].

Shneiderman's Eight Golden Rules of Interface Design. 2016. [ONLINE] Available at: <http://faculty.washington.edu/jtenenbg/courses/360/f04/sessions/schneidermanGoldenRules.html>. [Accessed 22 January 2016].

Shopify. 2016. *Terms and Conditions Generator - Free Template for Your Website*. [ONLINE] Available at: <https://www.shopify.co.uk/tools/policy-generator/show/QWVHUnhMZ3hLNE15M0ovK1RVZldGQT09LS16T3N6V0NRWGUrMjZrcjQ3>

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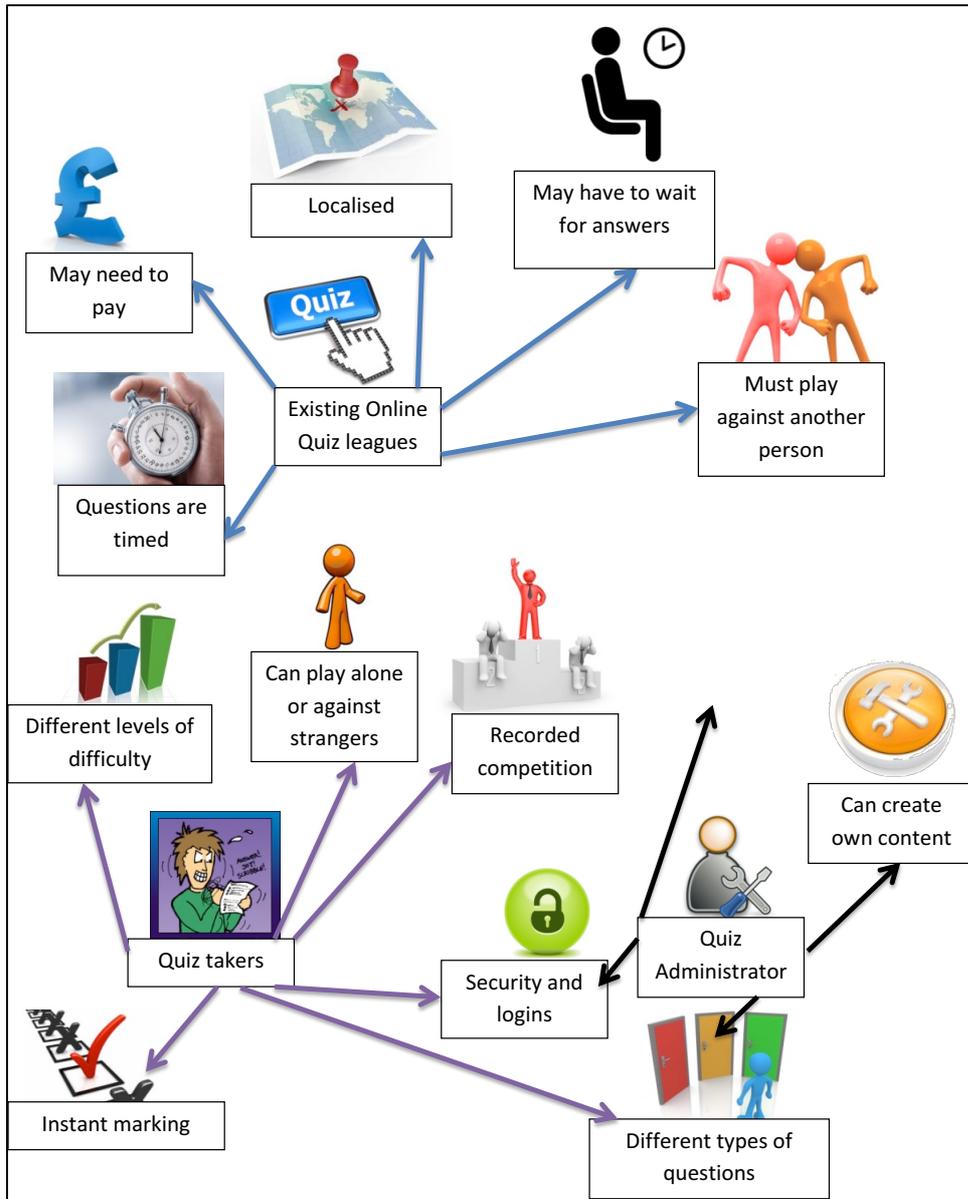
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Site Point . 2016. *Native vs Hybrid App Development*. [ONLINE] Available at:<https://www.sitepoint.com/native-vs-hybrid-app-development/>. [Accessed 30 August 2016].

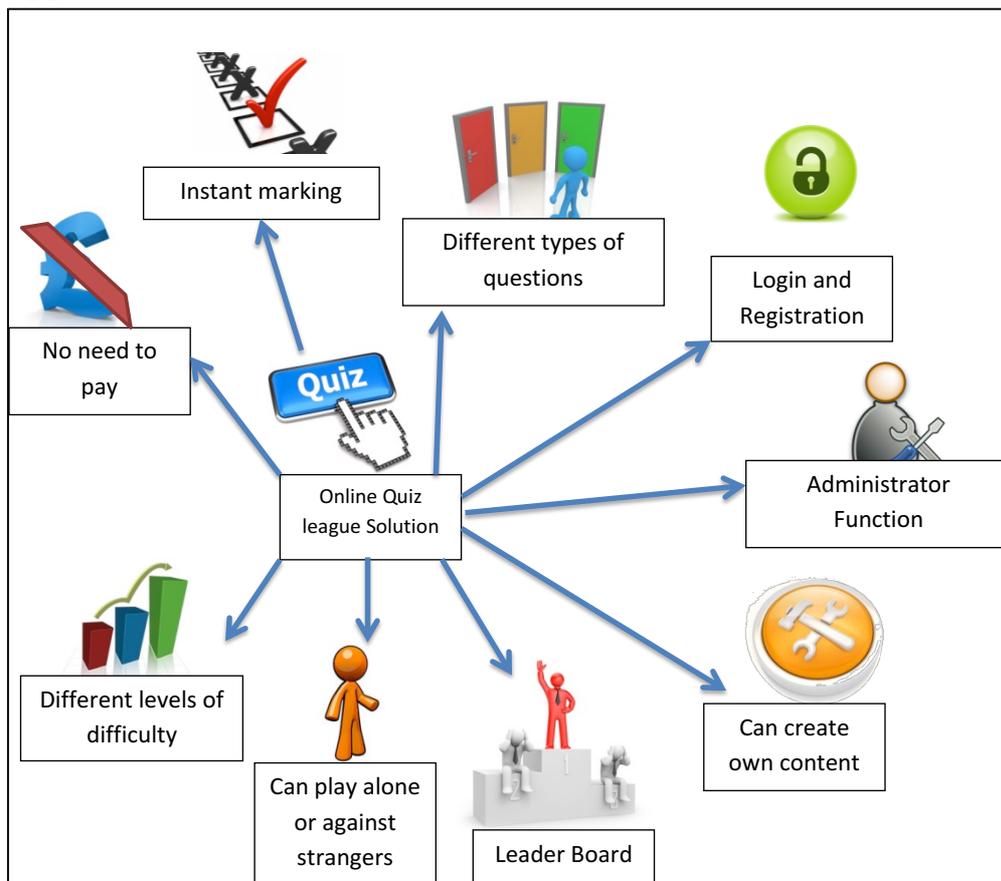
What is Incremental model- advantages, disadvantages and when to use it?. 2016. [ONLINE] Available at: <http://istqbexamcertification.com/what-is-incremental-model-advantages-disadvantages-and-when-to-use-it/>. [Accessed 22 January 2016].

# Appendices

## Appendix 1 - Rich Picture of the Problem



## Appendix 2 – Rich Picture of the Solution



## Appendix 3 – Focus Group Questionnaire

### Questionnaire

#### Quiz Content

Q1 Please rank which of these topics would encourage you to participate in an online quiz website by choosing from “very much” to “not at all”:

Please tick one box in each row

	Very much	Quite	indifferent	Not very much	Not at all	Don't Know
General Knowledge	<input type="checkbox"/>					
Sport	<input type="checkbox"/>					
Music	<input type="checkbox"/>					
TV/Films	<input type="checkbox"/>					
Geography and places	<input type="checkbox"/>					

Are there any other topics you would like to suggest:

---

**Q2** Please rank which of these formats would encourage you to participate in an online quiz website by choosing from “very much” to “not at all”:

**Please tick one box in each row**

	Very much	Quite	indifferent	Not very much	Not at all	Don't Know
True or False	<input type="checkbox"/>					
Multiple Choice	<input type="checkbox"/>					
Ordering answers	<input type="checkbox"/>					
Matching	<input type="checkbox"/>					
Filling in blanks	<input type="checkbox"/>					

Are there any other formats you would like to suggest:

---

**Q3** Please rank which of these “leagues” would be most important in an online quiz website by choosing from “very important” to “not at all”:

**Please tick one box in each row**

	Very important	Quite important	indifferent	Not very important	Not at all	Don't Know
With all participants of the website whether I know them or not	<input type="checkbox"/>					
With all participants of the quiz I have done whether I know them or not	<input type="checkbox"/>					
Only with participants who have taken the same level of quiz as I	<input type="checkbox"/>					
Only with participants who have taken the same topic as I	<input type="checkbox"/>					
With participants who have taken similar number of tests	<input type="checkbox"/>					

Are there any other types you would like to suggest:

---

**Q4** Please rank which of these features would be most important in an online quiz by choosing from “very important” to “not at all”:

**Please tick one box in each row**

	Very important	Quite important	indifferent	Not very important	Not at all	Don't Know
Quizzes to be available in different difficulty levels	<input type="checkbox"/>					
Quizzes to have different formats. i.e. True or False, Multiple Choice, etc.	<input type="checkbox"/>					
Quizzes to have pictures as part of the question	<input type="checkbox"/>					

To be able to repeat a quiz you have taken before

To be able to repeat a quiz you have taken before but the score is limited

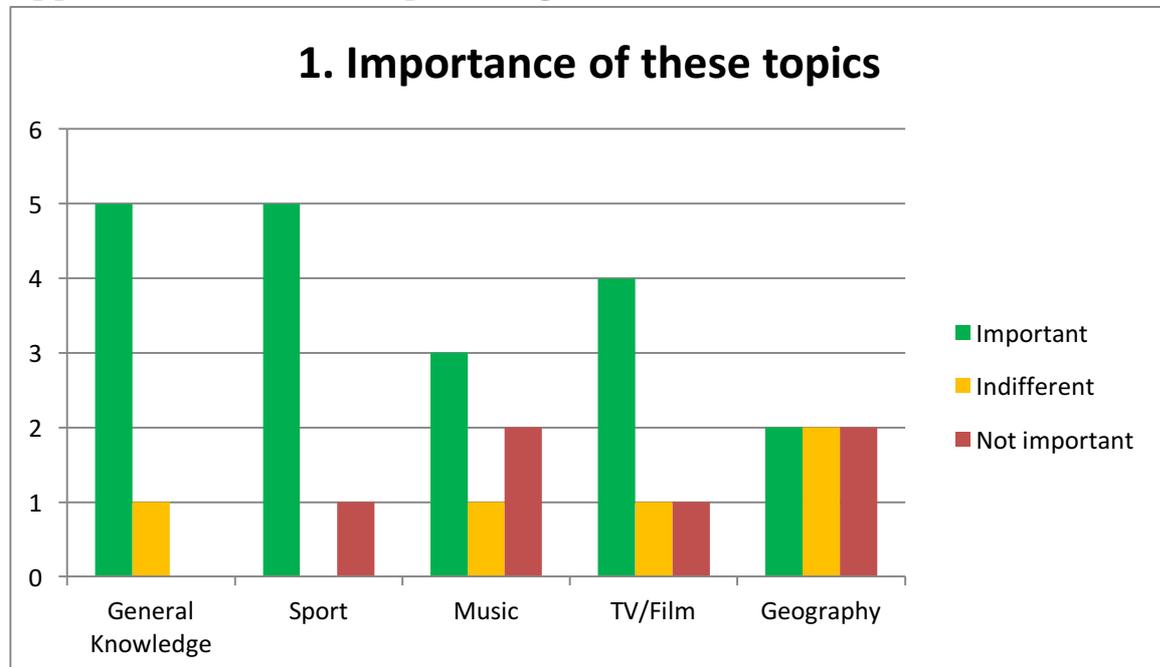
Are there any other types you would like to suggest: \_\_\_\_\_

**Q5** Please rank which of these features would be most important in an online quiz website by choosing from “very important” to “not at all”:

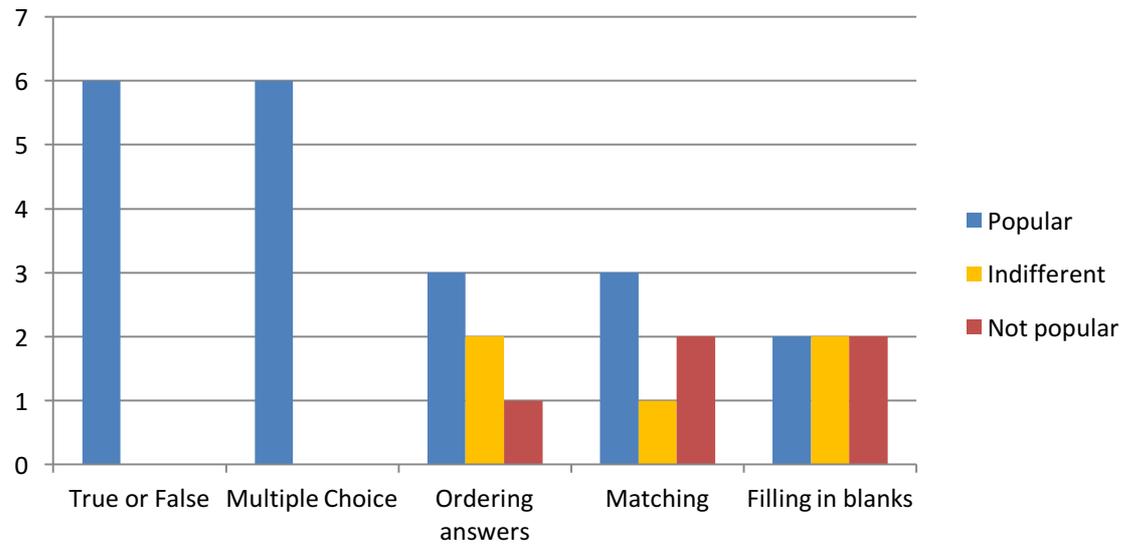
**Please tick one box in each row**

	Very important	Quite important	indifferent	Not very important	Not at all	Don't Know
Content to be free to access	<input type="checkbox"/>					
Ability to create your own username and password	<input type="checkbox"/>					
Ability to rate quizzes on how good they are	<input type="checkbox"/>					
For there to be premium content with prizes	<input type="checkbox"/>					
To be able to search for quizzes by name	<input type="checkbox"/>					
Are there any other features you would like to suggest:	_____					

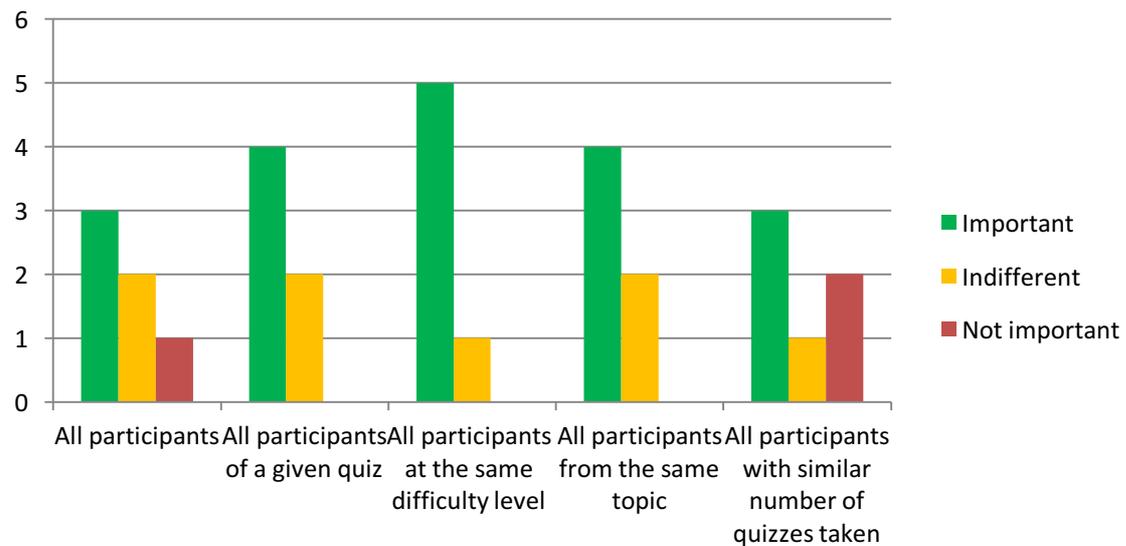
## Appendix 4 – Focus Group Findings



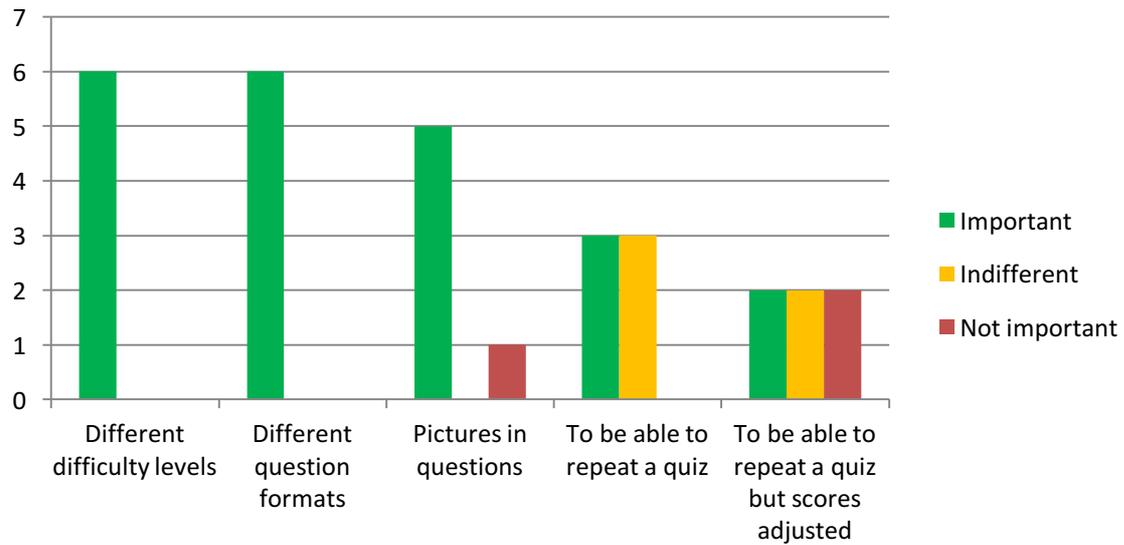
## 2. Popularity of question format



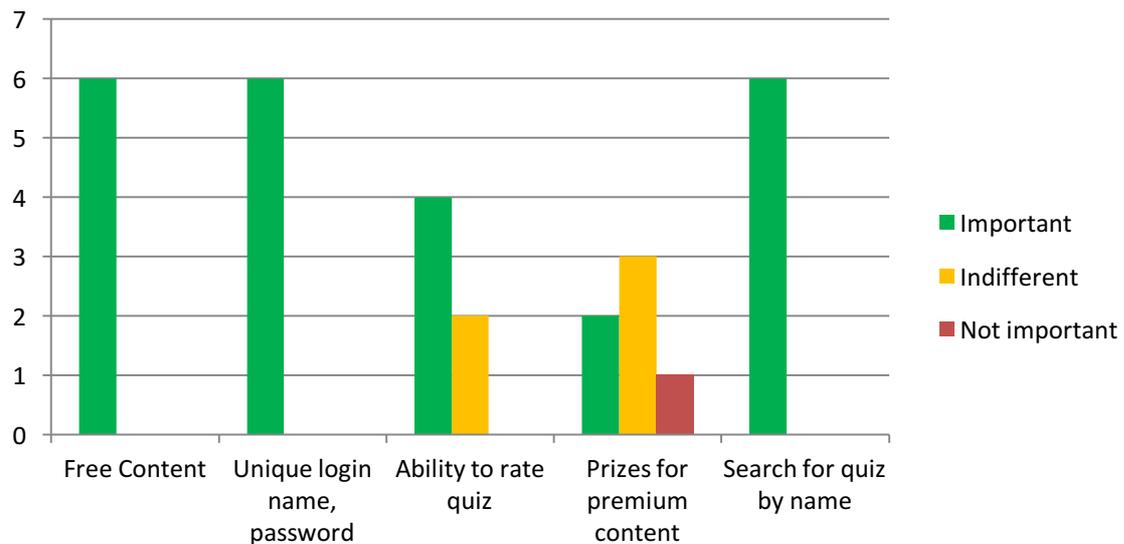
## 3. Importance of these league formats



#### 4. Importance of these features



#### 5. Importance of these features



### Appendix 5 – Use Cases

Name	Leader board	Number	2
Summary	To access the leader board listing username, score and number of quizzes taken		
Users	User Database		
Preconditions	Leaderboard has been set up		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User clicks on leader board icon</li> </ol>		
Alternative Paths			

Name	Types of questions	Number	3
Summary	To answer questions that have more than one format		
Users	User		
Preconditions	Administrator has created questions		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User selects a quiz</li> <li>3. User answers questions with more than format</li> </ol>		
Alternative Paths			

Name	Categories	Number	4
Summary	To choose different topics to answer from		
Users	User		
Preconditions	Quizzes have been organised into groups Links from categories have been set up		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User chooses a category listed</li> <li>3. User chooses a quiz</li> </ol>		
Alternative Paths			

Name	Competition	Number	5
Summary	To compete against other users without requiring a timed "head-to-head"		
Users	User		
Preconditions			
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User chooses a quiz (a number of ways to get to this)</li> <li>3. User answers the questions</li> <li>4. User's score is entered to the leader board</li> <li>5. User accesses leader board to view progress</li> </ol>		
Alternative Paths			

Name	Re-do quiz	Number	6
Summary	To repeat a quiz that has been taken		
Users	User		
Preconditions	User has already taken the quiz		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User chooses a quiz (a number of ways to get to this)</li> <li>3. User answers the questions</li> <li>4. User's score is entered to the leader board (Ideally adjusted for the number of times taken.)</li> <li>5. User's number of quizzes taken total increases on the leaderboard</li> </ol>		
Alternative Paths			

Name	Administrator login	Number	7
Summary	To login as an administrator		
Users	User		

Preconditions	Database has been set up Username and password storage
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User clicks to login as administrator</li> <li>3. User enters username and password</li> <li>4. User accesses Administrator home page</li> </ol>
Alternative Paths	<ol style="list-style-type: none"> <li>1. User doesn't have an account <ul style="list-style-type: none"> <li>- User is re-directed to register for account</li> </ul> </li> <li>2. User enters wrong username <ul style="list-style-type: none"> <li>- User is prompted again</li> </ul> </li> <li>3. User enters wrong password <ul style="list-style-type: none"> <li>- User is prompted again</li> </ul> </li> <li>4. User clicks "forgot password" <ul style="list-style-type: none"> <li>- User is emailed correct password</li> </ul> </li> </ol>

Name	Create quiz	Number	8
Summary	To create a quiz		
Users	User (administrator)		
Preconditions	User has already got an administrator username and password		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses Administrator Homepage</li> <li>2. User chooses the type of quiz to create</li> <li>3. User enters questions and answers and title</li> <li>4. User saves the data</li> <li>5. Quiz is available on the site</li> </ol>		
Alternative Paths			

Name	Difficulty levels	Number	9
Summary	To select a quiz with a different level of difficulty		
Users	User		
Preconditions	Quizzes have been created Quizzes have been assigned a difficulty level		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User selects icon/link to page with quizzes of the desired difficulty</li> <li>3. User selects a quiz from this page</li> </ol>		
Alternative Paths			

Name	Search	Number	10
Summary	To search for a quiz by keyword		
Users	User		
Preconditions	Quizzes have been created Quizzes have been assigned a title/topic		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User types in keyword they are looking for and clicks search</li> <li>3. User accesses results page</li> <li>4. User selects a quiz from this page</li> </ol>		
Alternative Paths	<ol style="list-style-type: none"> <li>1. No keyword is found <ul style="list-style-type: none"> <li>- User is given option of searching again</li> </ul> </li> </ol>		

Name	Recommendations	Number	11
Summary	To access a quiz by the rating it was given		
Users	User		
Preconditions	Quizzes have been created Quizzes have been assigned a rating		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User selects icon/link to page with quizzes of the desired rating</li> <li>3. User selects a quiz from this page</li> </ol>		
Alternative Paths			

Name	Rating	Number	12
Summary	To rate a quiz out of 5 stars		
Users	User		
Preconditions	Quizzes have been created		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User selects a quiz</li> <li>3. User answers questions</li> <li>4. User is given option of rating the quiz</li> <li>5. User enters the number of stars the quiz should be given</li> </ol>		
Alternative Paths			

Name	Record score	Number	13
Summary	To have score recorded of quiz taken		
Users	Database		
Preconditions	Database exists User has logged in		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User selects a quiz</li> <li>3. User answers questions</li> <li>4. User's score is saved to the database with the Username and the quiz taken</li> </ol>		
Alternative Paths			

Name	Recover password	Number	14
Summary	To recover a forgotten password		
Users	User		
Preconditions	User has registered		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User clicks on login icon</li> <li>3. Accesses login page</li> <li>4. User enters username</li> <li>5. User clicks "forgot password"</li> <li>6. User is emailed correct password</li> </ol>		
Alternative Paths			

Name	Register	Number	15
Summary	To register login details		

Users	User
Preconditions	
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User clicks on login icon</li> <li>3. Accesses login page</li> <li>4. User clicks on "register"</li> <li>5. User completes information required</li> <li>6. User's details are entered to the database</li> </ol>
Alternative Paths	

Name	Take Quiz	Number	16
Summary	To take a quiz		
Users	User		
Preconditions	Quizzes have been created		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User selects a quiz</li> <li>3. User answers questions</li> </ol>		
Alternative Paths			

Name	Assign a difficulty level	Number	17
Summary	To assign a difficulty to a quiz		
Users	User (administrator)		
Preconditions	Quiz exists User has Administrator privileges		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses Administrator Homepage</li> <li>2. User chooses the quiz they want to assign difficulty to</li> <li>3. User selects the desired level.</li> </ol>		
Alternative Paths			

Name	Mark quiz	Number	18
Summary	To have the quiz automatically marks		
Users	User		
Preconditions	Quiz exists		
Basic Course of Events	<ol style="list-style-type: none"> <li>1. User accesses Administrator Homepage</li> <li>2. User chooses the quiz they want to assign difficulty to</li> <li>3. User selects the desired level.</li> </ol>		
Alternative Paths	<ol style="list-style-type: none"> <li>1. User accesses home page</li> <li>2. User selects a quiz</li> <li>3. User answers questions</li> <li>4. Website displayed their score in 1 second</li> </ol>		

## Appendix 6 – Volere Requirements

<b>Requirement Number:</b>	2	<b>Requirement Type:</b>	3. Users of the product	<b>Use case number:</b>	2, 5, 13
<b>Description:</b>	The website provides a global leader board listing username, score and number of				

	quizzes taken.		
<b>Rationale:</b>	To allow all the users' names, scores and number of quizzes taken to be displayed so that users can compete against each other		
<b>Source:</b>	Customer requirement Background research		
<b>Fit Criterion:</b>	The user can access a list of all the top scores, who scored them and the number of quizzes taken.		
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5
<b>Dependencies:</b>	User login	<b>Conflicts:</b>	
<b>History:</b>	Created 12/1/16		

<b>Requirement Number:</b>	3	<b>Requirement Type:</b>	2.Client, customer and other stakeholders	<b>Use case number:</b>	3
<b>Description:</b>	The website provides quizzes with more than one format. For example, multi-choice, true/false etc.				
<b>Rationale:</b>	To allow users to have variety in the types of questions they can answer to help keep the quiz interesting				
<b>Source:</b>	Customer requirement Background research Focus group				
<b>Fit Criterion:</b>	User can take quizzes that either have more than one format of question or take multiple/ a variety of quizzes that have one format but the website as a whole has more than one				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>	Database, user interface	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	4	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	4
<b>Description:</b>	The user can select the topic they would like to answer a quiz on based on the options that have been provided to them.				
<b>Rationale:</b>	To allow users to easily navigate to quizzes that interest them				
<b>Source:</b>	Customer requirement Background research Focus group				
<b>Fit Criterion:</b>	User can choose quizzes based on the topics that are displayed on the website				
<b>Customer Satisfaction:</b>	4	<b>Customer Dissatisfaction:</b>	4		
<b>Dependencies:</b>	Quizzes, quizzes being assigned a topic	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	5	<b>Requirement Type:</b>	3.Users of the type	<b>Use case number:</b>	5, 2
<b>Description:</b>	Users are able to compete against multiple users by allowing more than one user to register with the site				
<b>Rationale:</b>	To allow the user to compete against other users				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	User can view their own score on the leader board and compare it with the other users, whose usernames appear beside it.				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>	Database, user logins, quizzes to be taken by more than one user	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	6	<b>Requirement Type:</b>	3.Users of the type	<b>Use case number:</b>	6, 16
<b>Description:</b>	The user is able to re-take quizzes they have previously taken				
<b>Rationale:</b>	To allow the user to improve their knowledge				
<b>Source:</b>	Background research				
<b>Fit Criterion:</b>	User is able to re-select the quizzes they have taken before				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		
<b>Dependencies:</b>	Quizzes	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	7	<b>Requirement Type:</b>	2.Client, customer and other stakeholders	<b>Use case number:</b>	7, 15
<b>Description:</b>	The administrator is able to log in the system and access his/her privileges				
<b>Rationale:</b>	To allow the administrator to easily access the tools to add/edit quizzes				
<b>Source:</b>	Customer requirement				
<b>Fit Criterion:</b>	The administrator is able to enter a unique username and password and access the administrator homepage				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>	Database, user interface	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	8	<b>Requirement Type:</b>	2.Client, customer and other stakeholders	<b>Use case number:</b>	8, 7
<b>Description:</b>	The administrator is able to create a quiz for others to take				
<b>Rationale:</b>	To allow the development and expansion of content				
<b>Source:</b>	Customer requirement				

<b>Fit Criterion:</b>	Administrator can create quizzes		
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5
<b>Dependencies:</b>	Administrator login, user interface	<b>Conflicts:</b>	
<b>History:</b>	Created 12/1/16		

<b>Requirement Number:</b>	9	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	9
<b>Description:</b>	The user can select a quiz based on the difficulty level it has been given				
<b>Rationale:</b>	To allow the organisation of the quizzes by difficulty and for the user to easily navigate them				
<b>Source:</b>	Background research Focus group				
<b>Fit Criterion:</b>	The quizzes are organised into groups according to difficulty				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		
<b>Dependencies:</b>	Quizzes are assigned a difficulty level	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	10	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	10
<b>Description:</b>	The ability to search for a quiz based on keywords that describe it.				
<b>Rationale:</b>	To allow the user to easily search for a particular quiz				
<b>Source:</b>	Background research Focus Group				
<b>Fit Criterion:</b>	The search function finds the quiz by keywords				
<b>Customer Satisfaction:</b>	2	<b>Customer Dissatisfaction:</b>	2		
<b>Dependencies:</b>	Database	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	11	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	11, 12
<b>Description:</b>	The user can search for quizzes by the rating they have been given by other users				
<b>Rationale:</b>	To allow popular quizzes to be prominent on the site and poor quizzes to be highlighted to the administrator				
<b>Source:</b>	Background Research Focus group				
<b>Fit Criterion:</b>	User can identify the rating of each quiz				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		
<b>Dependencies:</b>	Quizzes	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	12	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	12, 11
<b>Description:</b>	The user can rate a quiz out of 5 stars				
<b>Rationale:</b>	To allow the user to provide feedback on the popular quizzes				
<b>Source:</b>	Background research Focus group				
<b>Fit Criterion:</b>	User has the ability to rate a quiz after having completed it				
<b>Customer Satisfaction:</b>	2	<b>Customer Dissatisfaction:</b>	2		
<b>Dependencies:</b>	Quizzes, database		<b>Conflicts:</b>		
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	13	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	13, 18
<b>Description:</b>	The user's score for each quiz is recorded				
<b>Rationale:</b>	To allow the user's records to be compiled and displayed				
<b>Source:</b>	Customer requirement Background research Focus group				
<b>Fit Criterion:</b>	The user's score is displayed after the quiz				
<b>Customer Satisfaction:</b>	4	<b>Customer Dissatisfaction:</b>	4		
<b>Dependencies:</b>	Database		<b>Conflicts:</b>		
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	14	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	14
<b>Description:</b>	The user is able to recover a forgotten password				
<b>Rationale:</b>	To allow the user to access his/her account even if they have forgotten the password				
<b>Source:</b>	Customer Requirement Background research				
<b>Fit Criterion:</b>	The user is sent an email if they request a password reminder				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	1		
<b>Dependencies:</b>	Database, user login		<b>Conflicts:</b>		
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	15	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	15, 1
<b>Description:</b>	The user is able to register their details with the website				
<b>Rationale:</b>	To allow the user to participate fully in the website by having a username				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The user can complete a form and have their details saved				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		

<b>Dependencies:</b>	database	<b>Conflicts:</b>	
<b>History:</b>	Created 12/1/16		

<b>Requirement Number:</b>	16	<b>Requirement Type:</b>	3.Users of the product	<b>Use case number:</b>	16
<b>Description:</b>	The user is able to take a quiz				
<b>Rationale:</b>	To allow the user to answer questions on the quiz				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The user can complete a quiz				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>	database	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	17	<b>Requirement Type:</b>	2. Client, customer and other stakeholders	<b>Use case number:</b>	17
<b>Description:</b>	The administrator is able to assign a difficulty level to a quiz				
<b>Rationale:</b>	To allow the administrator to determine the difficulty of a given quiz				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The administrator can select a difficulty and the system saves it				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		
<b>Dependencies:</b>	database	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	18	<b>Requirement Type:</b>	2. Client, customer and other stakeholders	<b>Use case number:</b>	18, 2
<b>Description:</b>	The quiz is marked within one second				
<b>Rationale:</b>	To allow the user to gain their score				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The user can see their score within one second of completing quiz				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		
<b>Dependencies:</b>	database	<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	19	<b>Requirement Type:</b>	11. Usability Requirements	<b>Use case number:</b>	
<b>Description:</b>	Privacy policy, rules and scoring of quizzes , user terms and conditions, including sanctions for violations is clearly stated on the website				
<b>Rationale:</b>	To allow the user to easily understand key aspects of the site				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The user can easily access these policies				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>			<b>Conflicts:</b>		
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	20	<b>Requirement Type:</b>	10.Look and Feel Requirements	<b>Use case number:</b>	
<b>Description:</b>	Easy to use and clear website				
<b>Rationale:</b>	To allow the user to easily understand the navigation of the site				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The user can easily navigate the site				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		
<b>Dependencies:</b>			<b>Conflicts:</b>		
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	21	<b>Requirement Type:</b>	13.Operational Requirements	<b>Use case number:</b>	
<b>Description:</b>	Website is free to use				
<b>Rationale:</b>	To allow the user to access the site without payment				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The user can access the site without payment				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>			<b>Conflicts:</b>		
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	22	<b>Requirement Type:</b>	10. Look and Feel Requirements	<b>Use case number:</b>	
<b>Description:</b>	Quizzes contain pictures				
<b>Rationale:</b>	To allow the user to take quizzes that contain pictures				

<b>Source:</b>	Customer requirement Background research		
<b>Fit Criterion:</b>	The user can take a quiz that has a picture		
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3
<b>Dependencies:</b>		<b>Conflicts:</b>	
<b>History:</b>	Created 12/1/16		

<b>Requirement Number:</b>	22	<b>Requirement Type:</b>	10. Look and Feel Requirements	<b>Use case number:</b>	
<b>Description:</b>	Quizzes contain pictures				
<b>Rationale:</b>	To allow the user to take quizzes that contain pictures				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The user can take a quiz that has a picture				
<b>Customer Satisfaction:</b>	3	<b>Customer Dissatisfaction:</b>	3		
<b>Dependencies:</b>		<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	23	<b>Requirement Type:</b>	14. Maintainability and portability Requirements	<b>Use case number:</b>	
<b>Description:</b>	Website is robust				
<b>Rationale:</b>	To allow the user to use the website without issue				
<b>Source:</b>	Customer requirement Background research				
<b>Fit Criterion:</b>	The website is easily kept operational				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>		<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

<b>Requirement Number:</b>	24	<b>Requirement Type:</b>	14. Maintainability and portability Requirements	<b>Use case number:</b>	
<b>Description:</b>	Website is extendable				
<b>Rationale:</b>	To allow the developer to extend the features of the site				
<b>Source:</b>	Customer requirement				
<b>Fit Criterion:</b>	The website is easily expanded after completion				
<b>Customer Satisfaction:</b>	5	<b>Customer Dissatisfaction:</b>	5		
<b>Dependencies:</b>		<b>Conflicts:</b>			
<b>History:</b>	Created 12/1/16				

## Appendix 7 – Initial designs of main pages

Quiz Champs

### Leaderboard

The top table...

Position	Username	Total Score	Number of quizzes taken
1 🏆	jsmith	243	40
2 🥈	david_gleghorne	145	21
3 🥉	benny_t	72	44
4	FreddyC	45	9
5	testUser101	2	1
6	del_boy1	0	0
7	Sarah202	0	0

### Leaderboard (public access)

Log Out Leaderboard

Hello benny\_t!

Take a new quiz and climb up the leaderboard

Search for Quizzes

Search by Quiz Title

Search

Search by Genre, Level and/or Type

Find quizzes that contain questions with a particular Genre, Level and/or Type. Quizzes may contain questions with more than one Genre, Level or Type.

Genre: Select All | Level: Select All | Type: Select All

Find this Quiz

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### User Homepage

## Leaderboard

The top table...

Position	Username	Total Score	Number of quizzes taken
1 🏆	jsmith	243	40
2 🥈	david_gleghorne	145	21
3 🥉	benny_t	72	44
4	FreddyC	45	9
5	testUser101	2	1
6	del_boy1	0	0
7	Sarah202	0	0

## Leaderboard (for a member)

### Easy Quiz 1

10 questions are available

This quiz has been attempted by you once.  
The number of points awarded for the leaderboard will be the score normally awarded divided by 2.

1. For which country did Michael Owen play football?

- [Northern Ireland](#) [Wales](#) [Scotland](#) [England](#)

2. The Guinness company is famous for making which product?

- [Televisions](#) [Beer](#) [Cars](#) [Cakes](#)

3. In which field did Agatha Christie become famous?

- [Acting](#) [Wrestling](#) [Crime Fiction](#) [Dance](#)

4. An Admiral is a high ranking officer in which force?

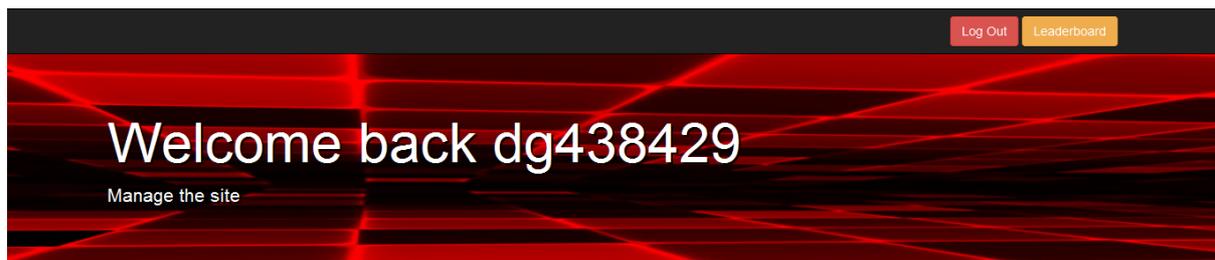
- [Navy](#) [Army](#) [Police](#) [Air Force](#)

## Example of a quiz

## Your Score!

5 / 10 correct  
3 / 10 points for the leaderboard

## Grade Page



[Log Out](#) [Leaderboard](#)

# Welcome back dg438429

[Manage the site](#)

### Add Quiz

Create a new quiz from existing questions.

[Create a Quiz »](#)

### Edit Quiz

Edit an existing quiz.

[Edit a Quiz »](#)

### Delete Quiz

Delete an existing quiz.

[Delete a Quiz »](#)

### Add Questions

Create new questions. Choose either True or False, Multiple Choice or 10scuro!

[Add a Question »](#)

### Remove a member

Remove an existing member from the site.

[Remove Member »](#)

### Add a new genre

Add a new genre of questions.

[Add genre »](#)

## Admin homepage

[My Homepage](#)
[Log Out](#)
[Leaderboard](#)

## Add New Quiz

Search for questions to add to the quiz

Genre

Level

Type

Question	Genre	Level	Type	Add
A bibliophile is someone who enjoys which activity?	General Knowledge	Difficult	Multiple Choice	<a href="#">+</a>
An Admiral is a high ranking officer in which force?	General Knowledge	Easy	Multiple Choice	<a href="#">+</a>
Diaper is the North American term for what?	General Knowledge	Easy	Multiple Choice	<a href="#">+</a>
How many satellites has the planet Uranus?	General Knowledge	Difficult	Multiple Choice	<a href="#">+</a>
In heraldry, which family member is denoted by a rose?	General Knowledge	Difficult	Multiple Choice	<a href="#">+</a>
In London, what are King's Cross, St Pancras and Maida Vale?	General Knowledge	Easy	Multiple Choice	<a href="#">+</a>

### Add new quiz page

[My Homepage](#)
[Log Out](#)
[Leaderboard](#)

## Add new question

Question text

Correct Answer text

Wrong Answer 1 text

Question genre

- Sport
- General Knowledge
- Music
- History
- Geography
- TV/Film
- Religion
- Literature
- Astrophysics

Question level

- Easy
- Medium
- Difficult

Question type

True or False

### Add new question page

## Find a quiz to edit

WARNING!

Any changes to a quiz will not affect the already existing scores of the quiz.  
If you wish to change all or most of the questions of a quiz it is recommended that you create a new quiz.

Quiz Title

Easy Quiz 1

[Edit this Quiz](#)

## Edit a Quiz page

## Change Quiz Title

Quiz Title

[Change Quiz Name](#)

---

## Change Quiz title Page

## Add New Question

Questions already added

Number	Question	Genre	Level	Type
1	What was the full first name of gangster Al Capone?	History	Difficult	Multiple Choice
2	Which children's author owned Hill Top Farm in the Lake District?	Literature	Difficult	Multiple Choice
3	What does it mean when a written phrase is put 'in parenthesis'?	Literature	Difficult	Multiple Choice
4	Which British prime minister said, "When I want to read a novel, I write one."?	History	Difficult	Multiple Choice
5	In which mountain range is K2, the second highest mountain in the world?	Geography	Difficult	Multiple Choice
6	Who created the detective C. Auguste Dupin?	Literature	Difficult	Multiple Choice
7	In Greek mythology, who was the god of flocks and herds?	Religion	Difficult	Multiple Choice
8	Which river rises near Lake Baikal and flows to the Laptev Sea?	Geography	Difficult	Multiple Choice
9	In which Dickens novel do the Cheeryble Brothers appear?	Literature	Difficult	Multiple Choice
10	The Four Noble Truths are central to which religion?	Religion	Difficult	Multiple Choice

### Search for questions to add to the quiz

Genre  Level  Type

## Add Question to Quiz Page

## Remove Question

Questions already added

Number	Question	
1	What was the full first name of gangster Al Capone?	
2	Which children's author owned Hill Top Farm in the Lake District?	
3	What does it mean when a written phrase is put 'in parenthesis'?	
4	Which British prime minister said, "When I want to read a novel, I write one."?	
5	In which mountain range is K2, the second highest mountain in the world?	
6	Who created the detective C. Auguste Dupin?	
7	In Greek mythology, who was the god of flocks and herds?	
8	Which river rises near Lake Baikal and flows to the Laptev Sea?	
9	In which Dickens novel do the Cheeryble Brothers appear?	
10	The Four Noble Truths are central to which religion?	

## Remove Question from Quiz Page

## Find a quiz to Delete

Quiz Title

Difficult Humanities 1

Delete this Quiz

## Delete Quiz Page

## Find a member to remove

Member

jsmith

Remove this Member

## Remove Member Page

## Add new genre

Genre Title

Add

Add New Genre Page

### Appendix 8 - Increments

Increment	Actions	Date of Completion
1	<ul style="list-style-type: none"> <li>• Analysis and Design Report writing</li> <li>• Research into problem</li> <li>• Research into solution</li> <li>• Implementing planning</li> </ul>	22 <sup>nd</sup> January 2016
2	<ul style="list-style-type: none"> <li>• Learning SQL</li> <li>• HTML5, PHP, CSS learning</li> <li>• Design of database</li> <li>• Database development</li> <li>• Normalisation of database</li> <li>• Database testing</li> </ul>	1 <sup>st</sup> April 2016
3	<ul style="list-style-type: none"> <li>• User interface design</li> <li>• Storyboarding</li> <li>• Design and Implementation Report Writing</li> <li>• Population of database with testing data</li> <li>• Home Page prototype creation</li> <li>• Quiz Page prototype creation</li> <li>• Leaderboard Page prototype creation</li> <li>• Other “front-end” Page prototype creation</li> <li>• User interface testing</li> <li>• Integration testing</li> </ul>	6 <sup>th</sup> June 2016
4	<ul style="list-style-type: none"> <li>• Basic Quiz functionality</li> <li>• Basic Categories functionality</li> <li>• Basic Leaderboard functionality</li> <li>• Basic Scoring functionality</li> <li>• Design and Implementation Report Writing</li> <li>• Functionality testing</li> </ul>	20 <sup>th</sup> June 2016

	<ul style="list-style-type: none"> <li>• Integration testing</li> </ul>	
5	<ul style="list-style-type: none"> <li>• Basic Admin create quiz functionality</li> <li>• Basic Admin Add question functionality</li> <li>• Basic Admin Edit/Delete quiz functionality</li> <li>• User session development</li> <li>• Increment testing</li> <li>• Integration testing</li> <li>• Dissertation Writing</li> </ul>	11 <sup>th</sup> July 2016
6	<ul style="list-style-type: none"> <li>• Full homepage creation</li> <li>• Full quiz page creation</li> <li>• Full leaderboard page creation</li> <li>• Other “front-end” Page fully developed</li> <li>• Full functionality for “member-side” features</li> <li>• Increment testing</li> <li>• Integration testing</li> <li>• Dissertation Writing</li> </ul>	25 <sup>th</sup> July 2016
7	<ul style="list-style-type: none"> <li>• Adding new genre functionality</li> <li>• Full functionality for “admin-side” features</li> <li>• Fully created user interface for both members and admin</li> <li>• Search for quiz by keyword functionality</li> <li>• Increment testing</li> <li>• Integration testing</li> <li>• Dissertation Writing</li> </ul>	8 <sup>th</sup> August 2016
8	<ul style="list-style-type: none"> <li>• Administrator login functionality</li> <li>• User login</li> <li>• Password and recovery</li> <li>• Increment testing</li> <li>• Integration testing</li> <li>• Dissertation Writing</li> </ul> <p>Potential for “could” priorities such as:</p> <ul style="list-style-type: none"> <li>• Third type of quiz</li> <li>• Ability to rate a quiz and search for rated quizzes</li> </ul>	22 <sup>nd</sup> August 2016
9	<ul style="list-style-type: none"> <li>• Full system testing</li> <li>• Dissertation Writing</li> </ul>	1 <sup>st</sup> September 2016

## Appendix 9 – Test Cases for each Increment

### Test Cases for Increment 2 – Database Development

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Database is designed to be in third normal form	All individual attributes are dependent on the primary key in the table	All individual attributes are dependent on the primary key in the table	PASS
2	Database is extendable	Meets requirements for	Meets some, could need	PASS – Partly...

		additional features	change depending on new type of questions	
3	Database is created with appropriate constraints	All primary keys can't be null, all data is correctly categorised	All primary keys can't be null, all data is correctly categorised	PASS
4	Data has integrity	No data entered is invalid	No data entered is invalid	PASS

### Test Cases for Increment 3 – User Interface Development

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Home page is created and can link to other relevant pages	Home page with working links	Home page with working links	PASS
2	Home page follows the basic design set out in planning	Home page with navigational links according to design and layout set out	Home page with navigational links which works but lacks the exact form of the design	PASS – Partly...
3	Home page has top bar that allows navigation through the site	Bar across the top of the home page with link buttons on the right of the bar	Bar across the top of the home page with link buttons on the right of the bar	PASS
4	Quiz page has top bar that allows navigation through the site	Bar across the top of the quiz page with link buttons on the right of the bar	Bar across the top of the quiz page with link buttons on the right of the bar	PASS
5	Leader board has top bar that allows navigation through the site	Leaderboard has links to other parts of the site	Leaderboard has links to other parts of the site	Partly => leaderboard for the non-members should have different links to members' view.
6	User home page has top bar that allows navigation through the site	User home page has links to other parts of the site	User home page has links to other parts of the site	PASS
7	User homepage allows the user to return the homepage	User home page has links to homepage	User home page has links to homepage	PASS
8	All links function as expected	Clicking on the correct button takes the user to be correct page	Clicking on the correct button takes the user to be correct page	PASS

### Test Cases for Increment 4 – Basic functionality for members

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Quiz page lists all questions for the relevant quiz	All ten questions from the quiz are listed in order	All ten questions from the quiz are listed in order	PASS
2	Quiz page lists title of the quiz	The quiz title appears at the top	The quiz title appears at the top	PASS
3	Quiz page allows all questions to be answered	User can click on correct answer for each question	User can click on correct answer for each question	PASS
4	Leaderboard lists all users and their score	All users and scores listed	All users and scores listed	PASS
5	User homepage allows the user to find quizzes by their genre	User can click a link that leads to a page that lists quizzes by genre	User can click a link that leads to a page that lists quizzes by genre	PASS
6	User homepage allows the user to find quizzes by their type	User can click a link that leads to a page that lists quizzes by type	User can click a link that leads to a page that lists quizzes by type	PASS
7	User homepage allows the user to find quizzes by their level of difficulty	User can click a link that leads to a page that lists quizzes by difficulty	User can click a link that leads to a page that lists quizzes by difficulty	PASS
8	Database has sufficient data to allow testing	Database is filled with testing data where relevant	Database is filled with testing data where relevant	PASS
9	Quiz questions can be answered	User can click a button indicating the answer selected	User can click a button indicating the answer selected	PASS
10	Answers are marked	User is informed of his/her score	User is informed of his/her score	PASS
11	User's score is added to the database	User's score is updated in Leaderboard	User's score is updated in Leaderboard	PASS

### Test Cases for Increment 5 – Basic functionality for admin

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Admin can create a new	Database is	Database is	PASS

	quiz	updated to include a new quiz	updated to include a new quiz	
2	Admin can add new questions to the question bank	Database is updated to include a new question and matching answerlist	Database is updated to include a new question and matching answerlist	PASS
3	Admin can edit an existing quiz	A question can be removed or added from a quiz	A question can be added but not deleted	Partial FAIL
4	Admin can delete a quiz	A quiz can be removed from the database	A quiz can be removed from the database	PASS
5	Sign out function for users	Users can't access pages once they have signed out	User can still access these pages	FAIL -> to be implemented later as part of login function

#### Test Cases for Increment 6 – Full functionality for members

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Home page has background image for "jumbotron"	Image fills the jumbotron	Image fills the jumbotron	PASS
2	Terms and conditions available and linked to homepage	User can click on link and read terms and conditions	User can click on link and read terms and conditions	PASS
3	Rules available and linked to homepage	User can click on link and read rules	User can click on link and read rules	PASS
4	Privacy policy available and linked to homepage	User can click on link and read privacy policy	User can click on link and read privacy policy	PASS
5	User Homepage has background image for "jumbotron"	Image fills the jumbotron	Image fills the jumbotron	PASS
6	User can search for quizzes by genre, level, and/or type	User can select the genre, level and/or type of the question from each dropdown list. On hitting submit the list of quizzes that meet these criteria.	User can select the genre, level and/or type of the question from each dropdown list. On hitting submit the list of quizzes that meet these criteria.	PASS
7	Leaderboard is formatted correctly and has images	Leaderboard has images of medals	Leaderboard has images of medals	PASS

	included	for 1 <sup>st</sup> -3 <sup>rd</sup> .	for 1 <sup>st</sup> -3 <sup>rd</sup> .	
8	Quiz page lists the user's number of attempts	A small box is present listing the number of attempts at a quiz	A small box is present listing the number of attempts at a quiz	PASS
9	Quiz page states how the quiz will be scored	A small box is present listing the number of attempts at a quiz affects the scoring	A small box is present listing the number of attempts at a quiz affects the scoring	PASS
10	Quiz has buttons instead of radio buttons	Each quiz has a number of buttons rather than radio buttons to reveal the answers	Each quiz has a number of buttons rather than radio buttons to reveal the answers	PASS
11	Quiz won't submit unless all questions are answered	Submit button doesn't work until all questions are answered	Submit button doesn't work until all questions are answered	PASS
12	User is given the result of the scoring both as a raw score and what is entered in the leaderboard.	Grade page states both raw score and adjusted score	Grade page states both raw score and adjusted score	PASS

#### Test Cases for Increment 7 – Full functionality for admin

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Admin can add a new genre to the quiz	New genre is added to database	New genre is added to database	PASS
2	Admin Home page has background image for "jumbotron"	Image fills the jumbotron	Image fills the jumbotron	PASS
3	Admin can edit quizzes	Admin can add and remove questions and change quiz name	Admin can add and remove questions and change quiz name	PASS
4	Admin can set quizzes to inactive	Quizzes no longer deleted from database but "active" set to NO	Quizzes no longer deleted from database but "active" set to NO	PASS
5	Add quiz and add question errors corrected	Admin can search for questions by genre, level and type.	Admin can search for questions by genre, level and type.	PASS
6	Admin can remove a member	A member is able to be set "Active"	A member is able to be set "Active"	PASS

		is NO	is NO	
7	User can search for quiz by name	User can input the name of a quiz into a text box, on hitting submit the quiz that has this name is listed.	User can input the name of a quiz into a text box, on hitting submit the quiz that has this name is listed.	PASS
8	Third type of question added	Users can take "obscuro" questions and have them marked correctly	Users can take "obscuro" questions and have them marked correctly	PASS

### Test Cases for Increment 8 – Login with password functionality

Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	Member can login with password	Member can enter username and password to access userhomepage	Member can enter username and password to access userhomepage	PASS
2	Admin can login with password	Admin can enter username and password to access userhomepage	Admin can enter username and password to access userhomepage	PASS
3	Password is hashed before being stored in database	Database stores hash of password	Database stores hash of password	PASS
4	Password is verified against the database	User can't continue without valid username and password	User can't continue without valid username and password	PASS
5	User can register for membership	User can enter username, password and email address and have details entered into database	User can enter username, password and email address and have details entered into database	PASS
6	Entered email address is verified	Email address has to be valid and not taken to proceed	Email address has to be valid and not taken to proceed	PASS
7	Entered username is verified	username must not be taken to proceed	Email address must not be taken to proceed	PASS

## Appendix 10 – Focus Group Feedback Questionnaire

Question	Were you successful?	Please report any issues here:
Please attempt to register for the site using an email address, a new username and password		
Please attempt to log out of the site once you have logged in		
Please attempt to Log in again using the username and password you created		
Please attempt to search for a quiz by genre, level and/or type		
Please attempt to search for a quiz by name		
Please attempt to take and complete a quiz		
Was your quiz scored correctly and satisfactorily?		
Please attempt to access the leader board and find your updated score		

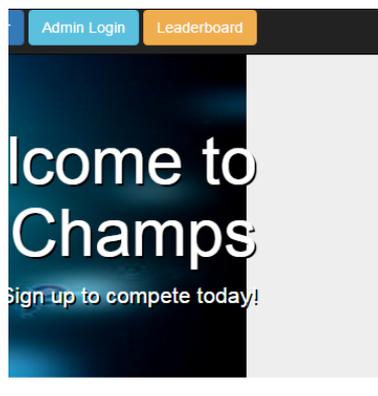
## Appendix 11 – Acceptance Testing Findings

### QUIZCHAMPS - TEST REPORT

The following issues were found:

#### User Interface

With browser maximised, the welcome banner doesn't extend to the full width of the screen and text overflows the background on the right hand side.



Is there a need for an Admin login page? Could/should be consistent with normal user login – ie, username and password on homepage.

Error messages on the Admin login page are obscured by the page header.

If the Quizchamps icon is clicked when logged in, and the Quizchamps homepage is displayed, there is no way to get back to the users homepage. Same for Admin.

Good practice to enforce some format on passwords – e.g., minimum length, alpha and numeric characters, etc. At the moment I can set up a one character password.

Would be useful if the search for a quiz worked on partial input rather than having to be exact.

Helpful if lists were presented alphabetically – e.g results of a search for a quiz, list of options in all dropdown menus.

Best to report score that will actually be added to leaderboard – in this case 3 was added.



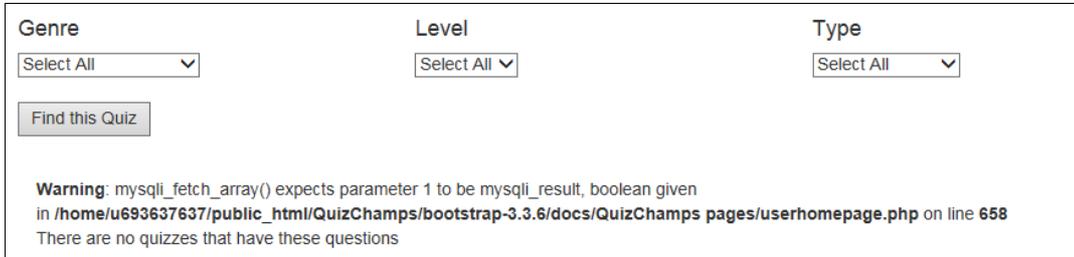
May be useful to list genre, level, difficulty and type as well as the question text when listing the questions available to add to a quiz.

## Browser Issues

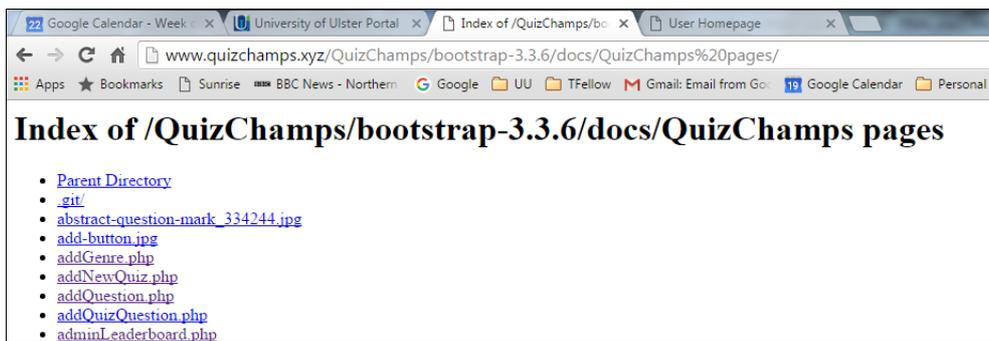
When trying to submit an incomplete quiz, Firefox gives a pop-up message saying 'Select one of these Options' - Chrome doesn't.

Works well on Chrome and Firefox (with minor differences), but not on Internet Explorer (tested on Internet Explorer 11).

Internet Explorer gives the following error when trying to select a quiz



Can directly access the directory structure and run scripts (including Admin scripts) without being logged in.



Was able to change the status of a quiz (from being taken 15 time back to not taken) by directly manipulating the url changing the '13' at the end to '18'.

http://www.quizchamps.xyz/QuizChamps/bootstrap-3.3.6/docs/QuizChamps%20pages/quiz.php?theQuiz=Difficult%20Quiz%202&x=13

In Chrome, couldn't always select 'It's a Battlefield' in answer to Q3 in Difficult Quiz 2, but could in Firefox.

Shouldn't be able to press the browser's back button from the Score page and resubmit the quiz.

When on the Score page, I can navigate to another page (eg, Leaderboard), then press the back button and resubmit the same score to the leaderboard.

## Functionality

Questions that contain an apostrophe are not added correctly to a quiz.

The screenshot shows the 'Add New Quiz' interface. At the top, it says 'Add New Quiz' and 'Questions already added'. Below this is a table with two columns: 'Number' and 'Question'. The table contains three rows of data:

Number	Question
1	What is Pat
2	can I type an
3	My name is Pat

Below the table is a search section titled 'Search for questions to add to the quiz'. It features three dropdown menus for 'Genre' (set to 'Select All'), 'Level' (set to 'Select All'), and 'Type' (set to 'Select All'). A 'Find Questions' button is located below these menus.

At the bottom of the interface is another table with two columns: 'Question' and 'Add'. It lists three questions, each with a blue plus icon in the 'Add' column:

Question	Add
What is Pat's first name?	+
My name is Pat	+
can I type an 's'?	+

When a quiz is finalised, not all questions are necessarily included. Quiz below has one question – it should have four. May be connected to the issue with apostrophes.

The screenshot shows a quiz interface for 'CCC'. It displays '1 questions are available' and a message: 'You have not attempted this quiz yet.' Below this, the first question is listed: '1. My name is Pat'. There are two buttons, 'Yes' and 'No', for answering the question. At the bottom, there is a 'Submit Quiz' button.

Unable to edit an existing quiz – server throws a 404 page not found error.

## Appendix 12 – Solutions to the Acceptance Testing Findings

### User Interface

Issue	Solution
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With browser maximised, the welcome banner doesn't extend to the full width of the screen and text overflows the background on the right hand side.	The CSS element "background-size" was changed from being specifically set to 1400px, 310px to a percentage value (100%, 100%).
Is there a need for an Admin login page? Could/should be consistent with normal user login – ie, username and password on homepage.	User and admin can now login on same homepage, but press different buttons
Error messages on the Admin login page are obscured by the page header.	Removed Admin Login page, it is now handled on homepage
If the Quizchamps icon is clicked when logged in, and the Quizchamps homepage is displayed, there is no way to get back to the users homepage. Same for Admin.	Remove this button from all logged in pages as this button's function is essentially that of the log out button
Good practice to enforce some format on passwords – e.g., minimum length, alpha and numeric characters, etc. At the moment I can set up a one character password.	Validation of the email, username and password has been updated to force the entry of at least one number in the password, with between 6 and 20 characters and the username must have at least 4 characters.
Would be useful if the search for a quiz worked on partial input rather than having to be exact.	SQL command to have like instead of just a selecting the exact command.
Helpful if lists were presented alphabetically – e.g results of a search for a quiz, list of options in all dropdown menus.	Changing SQL command to include "ORDER BY quiz_title ASC".
Best to report score that will actually be added to leaderboard – in this case 3 was added. (decimal points...)	Adjusted score is rounded using the php round() function and displayed accordingly
May be useful to list genre, level, difficulty and type as well as the question text when listing the questions available to add to a quiz.	This has been implemented by adding new columns that list all of these. The database is accessed to find all of this.

### Browser Issues

Issue	Solution
When trying to submit an incomplete quiz, Firefox gives a pop-up message saying 'Select one of these Options' - Chrome doesn't.	Required on input has been removed. A javascript script validates the user input instead. This produces an alert in both firefox and chrome.
Works well on Chrome and Firefox (with minor differences), but not on Internet Explorer (tested on Internet Explorer 11).	Testing on internet explorer, Microsoft Edge and Safari
Internet Explorer gives the following error when trying to select a quiz Mysqli_fetch_array()	Heading of the form moved to above of the select tags. This allows the page to function correctly.
Can directly access the directory structure and run scripts (including Admin scripts) without being logged in.	.htaccess file was updated to prevent access to the index, it now just produces a 404 error
Was able to change the status of a quiz (from	Use session variables to pass the username

being taken 15 time back to not taken) by directly manipulating the url changing the '13' at the end to '18. http://www.quizchamps.xyz/QuizChamps/bootstrap-3.3.6/docs/QuizChamps%20pages/quiz.php?theQuiz=Difficult%20Quiz%202&x=13	between pages instead of "get".
In Chrome, couldn't always select 'It's a Battlefield' in answer to Q3 in Difficult Quiz 2, but could in Firefox.	Used htmlspecialchars, htmlentities to encode the apostrophes.
Shouldn't be able to press the browser's back button from the Score page and resubmit the quiz.	The user's attempt number for that quiz is checked to see if it has already been created. If so it re-directs to the user's homepage
When on the Score page, I can navigate to another page (eg, Leaderboard), then press the back button and resubmit the same score to the leaderboard.	The user's attempt number for that quiz is checked to see if it has already been created. If so it re-directs to the user's homepage

### Functionality

Issue	Solution
Questions that contain an apostrophe are not added correctly to a quiz.	Use question_no instead of question_text to add them to the quiz. This is the primary key for the questions so it is superior in any case.
When a quiz is finalised, not all questions are necessarily included. Quiz below has one question – it should have four. May be connected to the issue with apostrophes.	Use question_no instead of question_text to add them to the quiz. This is the primary key for the questions so it is superior in any case.
Unable to edit an existing quiz – server throws a 404 page not found error.	The page name was editAQuiz.php whereas the link was attempting to connect to editaquiz.php

### Appendix 13 - Dictionary of Code Files Used

File	Purpose
homepage.php	Main page that allows access to all other pages.
Privacy.html	Page that displays the Privacy Policy
Rules.html	Page that displays the Rules
Terms.html	Page that displays the Terms and Conditions
publicLeaderboard.php	Page that displays the leader board to an user not logged in
registration.php	Page that allows a user to register for the site
dbConnectl.php	PHP script that allows connection to the database
userhomepage.php	Main page for Member. Contains links to all other member pages
quiz.php	Page that displays the questions and answers for a member to take a quiz
grade.php	Page that scores a quiz and displays the result to a user
leaderboard.php	Page that displays the leader board to an Member logged in
session.php	PHP script to verify that the member is logged in
adminhomepage.php	Main page for Administrator. Contains links to all other

	administrator pages
addQuestion.php	Page that allows Administrator to add a new question to the database.
deleteQuiz.php	Page that allows Administrator to prevent a user from accessing a particular quiz.
addGenre.php	Page that allows Administrator to add a new genre to the database.
removeMember.php	Page that allows Administrator to prevent a user from signing in any more.
addNewQuiz.php	Page that allows Administrator to add a new quiz to the database.
editAQuiz.php	Page that allows Administrator to select a quiz to edit and then provides links for options on how to edit this quiz
addQuizQuestion.php	Page that allows Administrator to add a question to an already existing quiz
removeQuizQuestion.php	Page that allows Administrator to remove a question from an already existing quiz
changeQuizName.php	Page that allows Administrator to change the name of an already existing quiz
adminLeaderboard.php	Page that displays the leader board to an Admin
sessionAdmin.php	PHP script to verify that the Admin is logged in