**Solution 1**

**1.1 Summary of Project**

The aim of the project is to create a web application which will take in information from users (such as requirements, topics interest and career details) in order to recommend appropriate IBM Skills Share courses. The web application should make access to the online learning more intuitive and personalised - to expand the technological skill base of users in their educational, professional and personal pursuits. A long term goal is to aid users in keeping up with technological changes, as rapid expansion continues in the many industries with regards to technology.

The requirements of the project are based on the brief from IBM and the communications from John MacNamara as the representative (henceforth known as ‘the client’). The client has indicated that gamification and other elements to encourage user engagement are needed, as well as the ability to access the web application on multiple devices and formats.

The web application should be usable by a wide array of people - but the web application is particularly targeted at university students and professionals, as that is the target audience that most of the IBM Skills Share courses cater for.

**1.1.1 Front-End Overview**

The user can enter the web application from the login and registration pages. When first registering, the user is immediately led to the chatbot. After the chatbot, or for users who registered in previous sessions, the user dashboard is displayed. From the user dashboard, the user can select the leaderboard, the learning pathway (to get course access), the calendar, course exploration or progress tracking.

The front-end was built using JavaScript, HTML5, React.js and CSS3 - which ensures that the web application responds well to user requests, creates consistent behaviour and is dynamic.

**1.1.1 Back-End Overview**

The backend is created using Express.js and Node.js as they are compatible with JavaScript, work asynchronously and allow for the system to be scalable. The database shall be managed by MongoDB and used to store user and course data. MongoDB is appropriate as it can handle large amounts of varying data.

**1.3 User Requirements**

**1.3.1 Functional Requirements**

**1.3.1.1 FR1 - User Interaction and Engagement**

| **ID, type and title** | **FR1.1 - Web Application – Mobile-compatible web application** |
| --- | --- |
| **Description** | A web application which can be accessed on various mobile devices. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Partially implemented - so far has only been implemented on personal computers. |
| **Justification** | FR1.1 is a dependency for all of the other functional requirements, so implementation began on it first . However, the courses are academic in nature and often involve programming, so are most likely to be used on a personal computer. |

| **ID, type and title** | **FR1.2 - User Management – User Authentication and registration system** |
| --- | --- |
| **Description** | To access the web application, new users must register. Registering involves giving personal information (such as an email and a name), as well as creating a password. After registering, users can log in, which allows them access to their personal study record. To log in, the user must provide a registered email and password. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Implemented. |
| **Justification** | User management is necessary for the privacy of users and the security of the system. FR1.12 is also required before users can access their progress or have their points tracked for the leaderboard. Implementation was a priority. |

| **ID, type and title** | **FR1.3 - Chatbot – Chatbot Integration** |
| --- | --- |
| **Description** | After a user has registered, they will be directed to the chatbot in order to recommend an IBM course to begin their journey. The users will answer questions pertaining to their current and previous work, aspirations and level of experience. An appropriate course will be provided. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Implemented. |
| **Justification** | The chatbot is the main element that the client was focused on - the chatbot is intended to guide users through IBM courses and give a great starting point - which is the main goal of the system as a whole. |

| **ID, type and title** | **FR1.4 - Learning Pathway – Guided learning pathway presentation on homepage** |
| --- | --- |
| **Description** | Users can click a “Start the journey” button in order to gain access to the structured study plan. The user must agree to terms and conditions provided, in order to access the courses. |
| **Updated Requirement** | The learning pathway will be part of the user dashboard - meaning that the terms and conditions are offered before accessing the dashboard for the first time and that the user dashboard displays current and recommended IBM courses. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Partially implemented - terms and conditions have not been included. |
| **Justification** | The Learning Pathway and the User Dashboard serve similar purposes in terms of guiding the user, so expanding the User Dashboard to include the Learning Pathway simplifies the user experience. Terms and conditions have not been implemented, as they have limited effect on the development of the system. |

| **ID, type and title** | **FR1.5 - Course Access – Accessibility to IBM Online Courses** |
| --- | --- |
| **Description** | The Learning Pathway guides users to targeted and appropriate IBM courses, which are customised to their educational needs. The links direct users to the correct course on the IBM SkillsShare website. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Implemented. |
| **Justification** | Access to the courses is necessary to fulfil the brief given by the client and ensures the user can efficiently access the correct course. |

| **ID, type and title** | **FR1.6 - Progress Tracking – Progress Tracking through checklist implementation** |
| --- | --- |
| **Description** | Progress tracking uses checkboxes to indicate which of the courses have been completed - updating whenever the quizzes for a course are passed. This acts as a visual depiction of each user’s progress. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Implemented. |
| **Justification** | Progress tracking increases user engagement and complements both the leaderboard and the calendar - giving increased motivation to the user. |

| **ID, type and title** | **FR1.7 - Calendar Integration – Integration of Calendar functionality** |
| --- | --- |
| **Description** | The calendar will help users with organisation - allowing users to schedule the work for their courses and set completion deadlines. |
| **MuShCo - Priority** | Should have - Medium |
| **Implementation** | Implemented. |
| **Justification** | The calendar will encourage consistent use of the web application and progress on the IBM courses - helping to fulfil the client’s brief. |

| **ID, type and title** | **FR1.8 - Gamification – Implementation of educational games and quizzes** |
| --- | --- |
| **Description** | The user takes part in quizzes after the courses are completed and gain points depending on how well they do in the quizzes. They are then ranked on a leaderboard, so that a sense of competition will motivate them. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Implemented. |
| **Justification** | The gamification elements, such as the leaderboard and point tracking, were requested by the client to improve user engagement. As such, they were high priority to implement. |

| **ID, type and title** | **FR1.9 - Social Integration – Social integration with leaderboard feature** |
| --- | --- |
| **Description** | The trophy icon on the dashboard gives access to the leaderboard. The leaderboard tracks points based on the quizzes and helps users keep track of their overall progress compared to their peers. |
| **MuShCo - Priority** | Should have - Medium |
| **Implementation** | Implemented. |
| **Justification** | The leaderboard is a main feature for increasing user engagement and complements the quizzes to provide elements of gamification. |

| **ID, type and title** | **FR1.10 - Course Exploration – Enhanced course search functionality** |
| --- | --- |
| **Description** | Users can discover courses not inside their personalised learning pathway by clicking the "Search New Courses" bar. Users can filter courses by keywords, topic or level of experience. |
| **MuShCo - Priority** | Should have - Medium |
| **Implementation** | Partially implemented. |
| **Justification** | The search bar allows for further exploration - so implementation would be useful, but other features were prioritised. |

| **ID, type and title** | **FR1.11 - Personalized Recommendations – Personalised Course Recommendations** |
| --- | --- |
| **Description** | Personalised course recommendations are given based on the user’s completed courses, level of experience and known interests in order to give the user further guidance. |
| **MuShCo - Priority** | Could have - low |
| **Implementation** | Not implemented. |
| **Justification** | Personalised recommendations were low priority and would require disproportionate time to include. |

| **ID, type and title** | **FR1.12 - Peer Collaboration – Chatbot Peer Collaboration space** |
| --- | --- |
| **Description** | A chat where users could share information, advice on courses and create a sense of community. |
| **MuShCo - Priority** | Could have - low |
| **Implementation** | Not implemented. |
| **Justification** | The collaboration space was low priority, as it would also need moderation to ensure that nothing said in the chat was harmful. The web application works well as an individual guide to learning which includes the ability to make study plans. |

| **ID, type and title** | **FR1.13 - Virtual Classroom – Virtual Classroom Integration** |
| --- | --- |
| **Description** | Allow for live discussions and sessions by integrating virtual classroom tools. |
| **MuShCo - Priority** | Could have - low |
| **Implementation** | Not implemented. |
| **Justification** | The IBM courses have already been developed and are best completed asynchronously, whenever the user has time. |

**1.3.1.2 FR2 - Data Management and Analysis**

| **ID, type and title** | **FR2.1 - Database Management – Comprehensive database establishment** |
| --- | --- |
| **Description** | The MongoDB database will store data about the users and IBM courses, including data provided during interactions with the chatbot, registration and following the learning pathway. The database will also allow for analysis and improvement in the future. |
| **MuShCo - Priority** | Must have - High |
| **Implementation** | Implemented. |
| **Justification** | The database acts are a space to store user and course information, which is necessary to fulfil multiple of the high priority requirements - such as the leaderboard, progress tracking, course access and user authentication and registration. |

| **ID, type and title** | **FR2.2 - Learning Analytics – Learning Analytics dashboard** |
| --- | --- |
| **Description** | User’s performance over time, learning patterns, and areas of strength and weakness is displayed in the Learning Analytics dashboard. |
| **MuShCo - Priority** | Could have - low |
| **Implementation** | Not implemented. |
| **Justification** | The learning pathway and quizzes already provide the user feedback about their performance and where it is advised to focus their attention - although learning analytics may give more detail, it is extraneous. |

| **ID, type and title** | **FR2.3 - Data Analysis for user patterns and preferences** |
| --- | --- |
| **Description** | The system could use data analysis to improve user experience - based on learning patterns, preferences and user feedback. |
| **MuShCo - Priority** | Could have - low |
| **Implementation** | Not implemented. |
| **Justification** | Although this would be useful in the future in terms of gaining feedback and improving the system, it is low priority as it does not directly impact user experience or the functions of the web application. |

**1.3.2 Non-Functional Requirements**

**1.3.2.1 NFR1 - Performance Requirements**

| **ID, type and title** | **NFR 1.1 - Web application optimisation** |
| --- | --- |
| **Description** | The web application should handle user actions and requests within an acceptable time frame and maintain an acceptable performance level with a large number of users. |
| **Implementation** | Partially implemented - response time is acceptable, but the web application hasn’t been tested on a large number of users. |
| **Justification** | The response time is a priority, as a long response time can negatively impact user experience. The web application will be tested by a large number of users, but currently that is a lower priority. |

| **ID, type and title** | **NFR 1.2 - Scalability** |
| --- | --- |
| **Description** | The web application should allow for new features and expansion, and also be able to cope with an increasing number of users and amount of data over time. |
| **Implementation** | Partially implemented - the scalability in terms of number of users hasn’t been tested.. |
| **Justification** | The database allows for increasing amounts of data to be safely stored, which is important to prevent data loss. The web application allows for upgrades and expansions, which is important as areas for growth have already been pinpointed. |

| **ID, type and title** | **NFR 1.3 - Availability** |
| --- | --- |
| **Description** | The web application should be able to handle errors or exceptions. It should also be consistently available for users, with the exception being short periods for maintenance and upgrades. |
| **Implementation** | Implemented. |
| **Justification** | The website is able to handle the exceptions anticipated in the Requirements Specification for particular functional requirements, which prevents frustrations for users. The website has also been launched so that it is consistently available, which means users will be able to work whenever they desire. |

**1.3.2.2 NFR2 - Security**

| **ID, type and title** | **NFR 2.1 - Security** |
| --- | --- |
| **Description** | The user authentication and registration process should be secure. User information should be properly stored, so only those authorised may access the data. |
| **Implementation** | Implemented. |
| **Justification** | Security for user information is important both for legal compliance and for the trust of users, so it was a priority. |

| **ID, type and title** | **NFR 2.2 - Data and Privacy** |
| --- | --- |
| **Description** | Ensure compliance with data regulations and allow users control over how their data is used. |
| **Implementation** | Partially implemented. |
| **Justification** | The web application is compliant with data regulations, as that protects the users. However, the data is only used for necessary functions and there are no vendors, so the users do not have options for data settings. |

**1.3.2.3 NFR3 - User Experience**

| **ID, type and title** | **NFR 3.1 - Usability and Accessibility** |
| --- | --- |
| **Description** | The user interface should allow easy access and be intuitive. Accessibility features, such as alternative text for images, should be implemented. |
| **Implementation** | Partially implemented. |
| **Justification** | The ease of use of the user interface affects the user experience throughout their use of the web application, so it was streamlined. Accessibility features have not been fully implemented. |

| **ID, type and title** | **NFR 3.2 - Cross-Platform Compatibility** |
| --- | --- |
| **Description** | The web application should adjust to different sizes and orientations, as well as working on different mobile devices, operating systems and browsers. |
| **Implementation** | Partially implemented. |
| **Justification** | The web application works on different browsers and operating systems, but does not yet work on multiple mobile devices. The majority of users will access this web application on a personal computer, which is why that was prioritised. |

**1.3.2.4 NFR4 - General Non-Functional Requirements**

| **ID, type and title** | **NFR 4.1 - Integration with IBM Skills Build** |
| --- | --- |
| **Description** | The system should adjust to real-time updates on the IBM SkillsShare website and should be integrated to give accurate course information. |
| **Implementation** | Not implemented. |
| **Justification** | The client indicated that the web application should not be integrated with the IBM Skills Share website and should instead provide links for access. |

| **ID, type and title** | **NFR 4.2 - Compliance and Legal Requirements** |
| --- | --- |
| **Description** | Ensure compliance with applicable laws and regulations for the area. Manage legal agreements, such as by including terms and conditions. |
| **Implementation** | Partially implemented. |
| **Justification** | Although the web application complies with local laws and regulations, there are currently no terms and conditions - as those would have to align with the IBM Skills Share terms and conditions. |

| **ID, type and title** | **NFR 4.3 - Documentation and Training** |
| --- | --- |
| **Description** | There should be guidance informing users of how to use the system. There should also be comprehensive documentation for administrators. |
| **Implementation** | Implemented. |
| **Justification** | The User Manual is an important tool for developers, administrators and users - allowing the best possible use, monitoring and improvement of the system. |

| **ID, type and title** | **NFR 4.4 - Backup and Disaster Recovery** |
| --- | --- |
| **Description** | A data recovery plan and regular, comprehensive back-ups will protect data in case of data corruption or system shutdown. |
| **Implementation** | Not implemented. |
| **Justification** | Currently, the data stored in the database is minimal - either course information from the IBM Skills Share website or example users. |

| **ID, type and title** | **NFR 4.5 - Cost Efficiency** |
| --- | --- |
| **Description** | Minimise the expenditure - in developing and implementing the system, as well as future maintenance. |
| **Implementation** | Implemented. |
| **Justification** | The cost of maintaining and implementing the system has a large influence on whether the project is commercially viable. |