Task 1 – Proposal – Nathan Hannah

Task 1 A (i) Research

Hardware used in the education sector

Within the education sector there are many uses of technology and hardware to support learning through different methods. The most widely used would be the desktop PC. This is used to facilitate research, use software required for various courses and word processing.

Another use of hardware within this sector would be the use of displays and Projectors, this gives teachers the opportunity to display information to students such as presentations, videos and other teaching material. This is a useful application of hardware as it enables digital implementation within the classroom environment.

Hardware is used throughout the education sector for teaching purposes but for also ensuring student data is kept, this would be through the use of a server which would store user credentials of a school system, and the files they store.

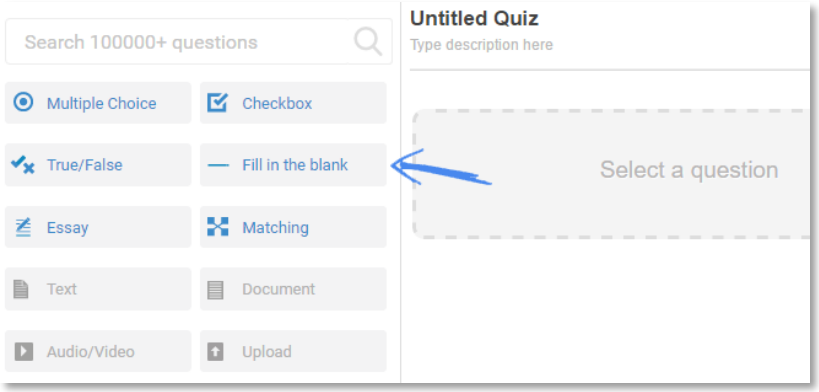
There are many other hardware use cases which include:

- Tablets/ touch screen devices
- Printers
- SMART Boards
- Laptops

Software used in the education sector

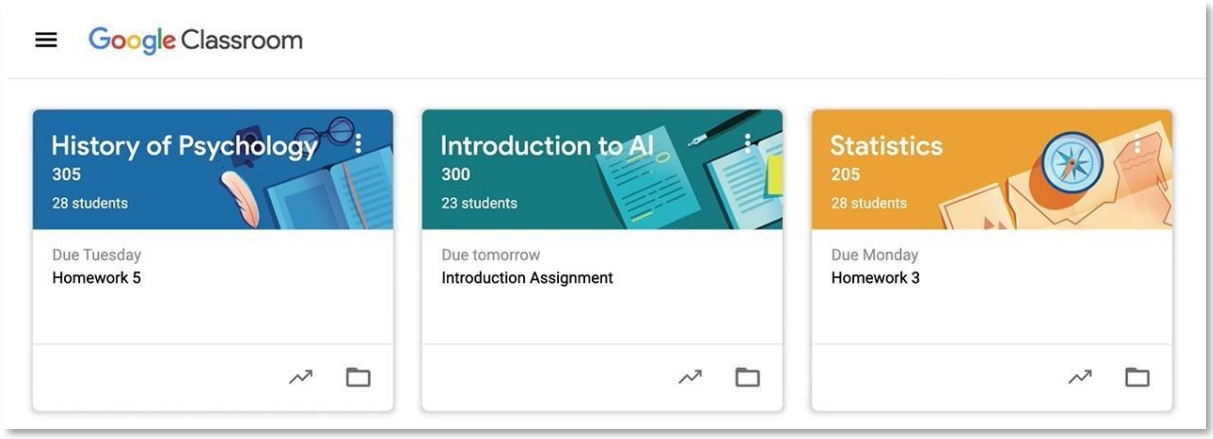
There are many applications to software solutions within the educational sector, from learner management to online teaching resources. These resources all contribute to assist learners and staff to have an efficient way of teaching and learning.

An example of an online solution for learning and training would be ProProfs. This is a LMS (Learning Management System) that allows users to create and share training and quizzes. The applications of this solution allow teachers to analyse student scores with analytics



Above is an example of how a user can create assessment material

Another example of software used is Google Classroom, this software solution allows teacher to create virtual classrooms where they can post materials, comments and assignments to users. This software integrates with other Google applications such as Google Docs and Slides; this can provide access controls for users once an assignment is handed in, it also allows for a god experience for students as they can receive comments, feedback and scores.

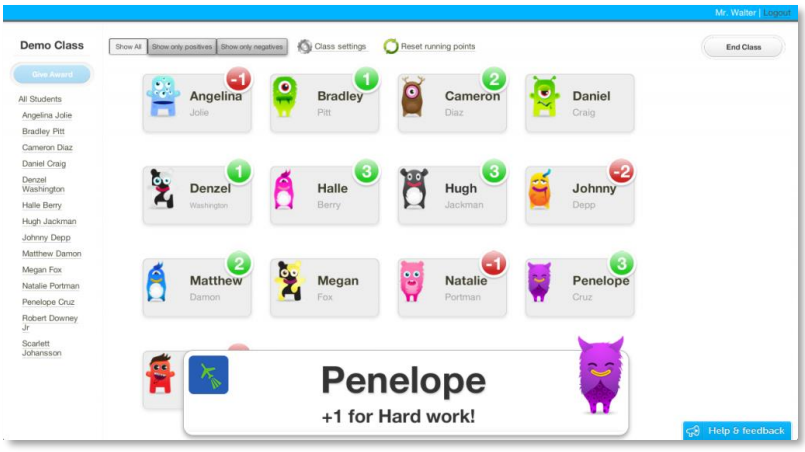


(www.classroom.google.com)

This software solution is one of the most popular online tools with over 150 million users worldwide, this has increased significantly with a larger demand for online teaching during the pandemic.

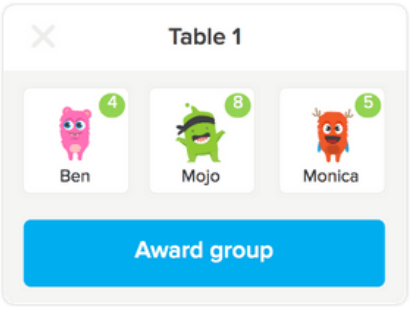
Other Google tools that have assisted the educational sector in delivering teaching is the use of Google Meet, this is one of many different online meeting solutions which allow for video and audio meetings with students to teach online, features such as polls and screen sharing also assist in delivering and showing materials.

Class Dojo is a software solution that allows parents or carers to track their Childs progress, it assists teachers to work with the class remotely, including to provide activities for students, deal out classwork, and share lessons. This software also uses a points based system to allow users to track progress and compare against other classmates



(www.classdojo.com)

There are several other features such as putting students into groups, this promotes group work, a teacher can give points based on teamwork for a certain group.



Newly emerging technologies

There are many new emerging technologies within this sector, as with other sectors which assist the delivering of education to students

One example of emerging technologies is the use of VR (Virtual Reality) within classrooms, this tools can assist learners to view thing in three dimensional space, allowing students to have an immersive experience which they would not be able to have without this technology such as experiencing certain conditions and locations to viewing diagrams and charts. The use of VR makes learning engaging to students and also encourages creative thinking.

AI (Artificial Intelligence) is used within education as with many other sectors to assist teachers or educational providers in many ways these include:

- Automating tasks, such as grading assessments and creating resources
- Providing learning materials for specific learner needs by identifying the areas a learner needs to improve
- Assist with identifying weaknesses with learners and how they can improve, giving up to date information to teachers and educational sector staff
- Create learning materials and assessments for different areas

3D printing, is an emerging technology that can be used to create materials to assist in learning. The use of this technology allows educational providers to produce models and interactive elements to show students items of materials they may have been otherwise able to see. This technology uses filaments such as plastics, metals and resins. Leaners can also use software such as Blender and Fusion to create 3D models.

To adapt to online learning and teaching, and with disruption to learners, one technology that has started to be implemented within classroom is the use of 360 degrees cameras, this allows students and teachers alike to joining a class remotely from home or elsewhere and view the entire classroom environment as if they are within the classroom, this assists in preventing learning disruption if someone is unable to come into the building itself, this also can be used for external visitors to view the classroom without having to travel.

Guidelines and regulations

As with all other businesses Schools and educational providers have to ensure peoples data is kept secure, the implantation of GDPR (General Data Protection Regulation) ensures that educational providers keep the data protector for both students and staff. Educational providers keep information such as user dates of birth, addresses, and exam scores, therefore it is vital for the implementation of GDPR within this setting.

Within this setting to ensure teachers have the correct skills and are qualified to teach they must adhere to The Education (School Teachers' Qualifications) (England) Regulations 2003

Another industry specific guideline is the Safeguarding Vulnerable Groups Act (2006) which provides legislation for safeguarding vulnerable people such as children and young people.

From the ICO (Information Commissioners Office) they have implemented the Children's code known as the Age appropriate design code. This outlines responsibilities and rules when creating applications or systems designed for young people.

(www.ico.org.uk/for-organisations/childrens-code-hub/additional-resources/introduction-to-the-childrens-code/)

Examples of how to conform to this code include

- Not using nudge techniques to encourage children provide more personal data
- Providing a high level of privacy by default

Task 1 A (ii)

As a software developer I have been asked to produce and develop a digital solution for GibJohn Tutoring, this solution requires the several requirements to be met. The client would like a digital solution that:

- Provides interactive teaching and learning resources in a range of subjects
- Provides access to digital content to encourage wider learning
- Supports assessment and monitoring of learner progress

There are also several other additional features that have been identified, in this proposal I will aim to meet all the required features and any additional features that are relevant to the overall solution. These features include:

- Collaborative teaching and learning tools
- Accessibility features to support a wide range of users
- A learning reward system
- Gamified learning

Within the educational sector, there are many implementations of these features across different platforms and systems. This was highlighted from research into other software solutions, therefore it is vital that all requirements are met in order for the business to compete with other systems available. Further demonstrating the need for an easy to use system. If the system is not accessible or easy to use, users are likely to use other systems which would negatively impact the business.

The use of a computational approach to this digital system ensures that features are all relevant to the industry and this will create a successful solution due to various ways of engagement with students and effective learning solutions. In comparison, traditional methods would not have the ability to allow students to instantly access learning materials online and when they require them.

Collaborative teaching and learning tools are important to ensure that students can access resources required, the use of these tools will assist teachers in delivering learning materials which will contribute to an effective learning environment to users of the system.

Accessibility features to support a wide range of users are vital to allow anyone to access the system, certain measures will have to be put into place to ensure that people with any accessibility need can access the system. Certain measures can be implemented within the solution which will allow reasonable adjustments to the system. If this feature was not implemented into the final solution, some users may find it difficult compared to others, this would have a negative effect on their education, as education is vital for younger people it is essential that everyone can access this system so they are not disadvantaged.

A learning reward system can assist users to engage more within learning, the incentive to earn points and earn rewards encourages people to get the most points and ultimately increase the user's knowledge. This would have a positive effect on learning and from research it suggests that this implementation of a reward system is popular especially with younger people.

The inclusion of a gamified learning experience for user will allow users to engage with all aspects of learning no matter the level or difficulty, this is seen with the use of user levels and unlockable components which introduce fun into the learning setting. With the use of this feature users are more likely to use the system compared to more traditional methods as it will be more interesting and engaging to users, one of the main focal points of a digital solution, without feature such as this the user may seek other systems.

User audience has to be considered as learning can be done from all age rages and levels of knowledge, it is important that the solution accommodates users of several types, these including young children, young adults and adults of all ages. To accommodate this the solution certain aspects have to be considered, this could include the content displayed and the various features included.

There are many advantages to implementing this solution for users these include:

- Allowing easy access to learning materials even from home
- Allowing learners to receive a greater range of different materials
- Giving users a better experience through gamified learning to enhance the learning experience
- Gives users additional opportunities to learn through a system, rather than face-to-face

Below outline the and **Functional** and **Non-functional** Requirements for the solution:

Functional Requirements	**Non-Functional Requirements**
The system should provide access to Digital content	Allow for System scalability for an increase of users
Allow users to generate points for the reward system	Provide a certain level of performance expected by a user to use the system in an efficient way
Provide a mechanism to track user progress	Ensure all functions are accessible by all user types across the system
Provide users with learning tools	The system should be available on all device types and systems
Allow users to sign up and create an account	The system should have a reliable uptime to reduce user

Allow authorised users that have an account to sign into the system	The solution should adhere to all regulatory guidelines and standards
The system should allow system admins to manage all users	The solution should be presented in a easy to use way through a GUI
The solution should provide admins the ability to view system analytics	The system should be robust, recovering from all errors the system faces
Provide resources from different subject areas	The system should have readability for all users, devices and systems
Allow user to edit their personal information	

The **Functional** requirements outlines the requirements that are required to satisfy the requirements of the set task, these are the functions the system should provide to the user when the system is complete. Within this project, these are outlined in the task brief, without these functional requirements the solution would not be complete.

The **Non-Functional Requirements** of the brief outline the requirements whether project that are relevant but are not necessarily required to be deemed as complete, I aim to include these functionalities within the system, however these do not directly contribute to the success of the outcome.

One of the functional requirements - The system should provide access to Digital content

One of the main concepts with this solution is providing users access to digital content:

- This should be displayed in a way which everyone can access, in different formats for different learning needs
- The content should be relevant and show different subject areas to the user
- The content needs to be accurate and provide information relevant to the subject to ensure users receive the correct information which is key to the learning experience.

One of the Non-functional requirements - Provide a certain level of performance expected by a user to use the system in an efficient way

This is one of the non-functional requirements highlighted within this solution:

- The performance of the system describes how well the system performs to users such as latency, responsiveness and content delivery to the user
- The performance of the system is important, without a performing system the user will be unable to conduct tasks required in an efficient and effective way

Decomposition

From the requirements set out in the brief I have decomposed the problem into key elements, this assists both the developer and the client to evaluate the sub-problems of the system to get a greater understanding of the overall solution. All of these components need to be considered to ensure the solution is successful as they form the whole system.

Below are the key components of the system:

Security – This outlines how the system is going to be kept secure, the contents should only be accessible by users that have logged into the system, this ensures that records are stored on user access to assist in securing the system, it also makes features such as the scoreboard usable.

Accessibility – This is a key area of the solution, accessibility features are required to ensure the system can be accessed by all, functionalities such as text enlargement and colour contrasts can be included.

Reward system – This allows user to score points to unlock certain rewards, the score system is public so users can compete with one another.

Gamified learning – One of the key areas is gamified learning, users will unlock things if they have read articles or log into the system, a user level will be implemented to track progress.

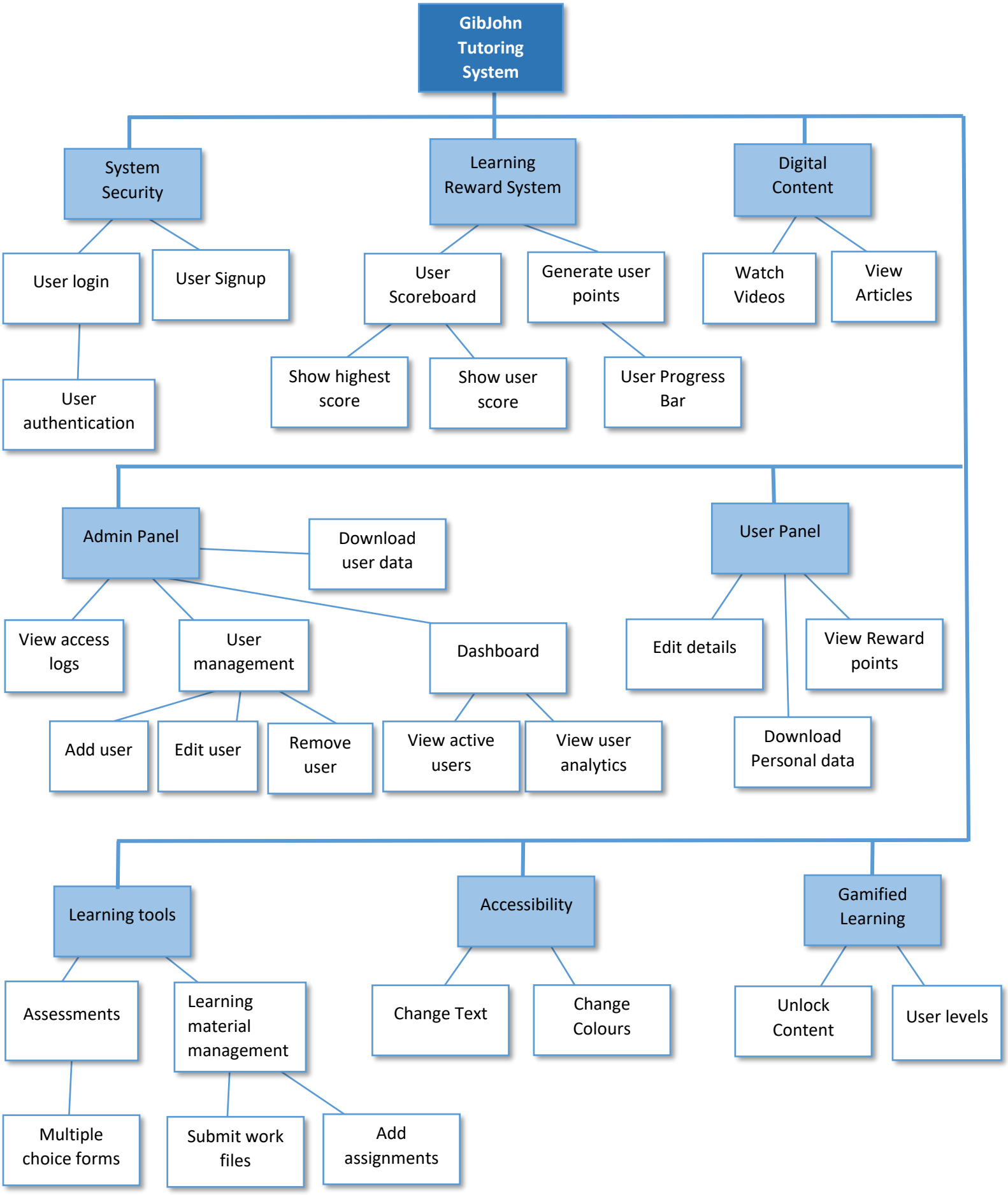
Learning tools- The key area of the system, learning tools will allow users to access materials that they can use to learn, this is done with documents and assignments the tutor can upload, the user will be able to submit their work through File uploads. Assessments can also be included.

Admin panel – This will allow the admins of the system to manage users and view the website analytics such as number of users and login times.

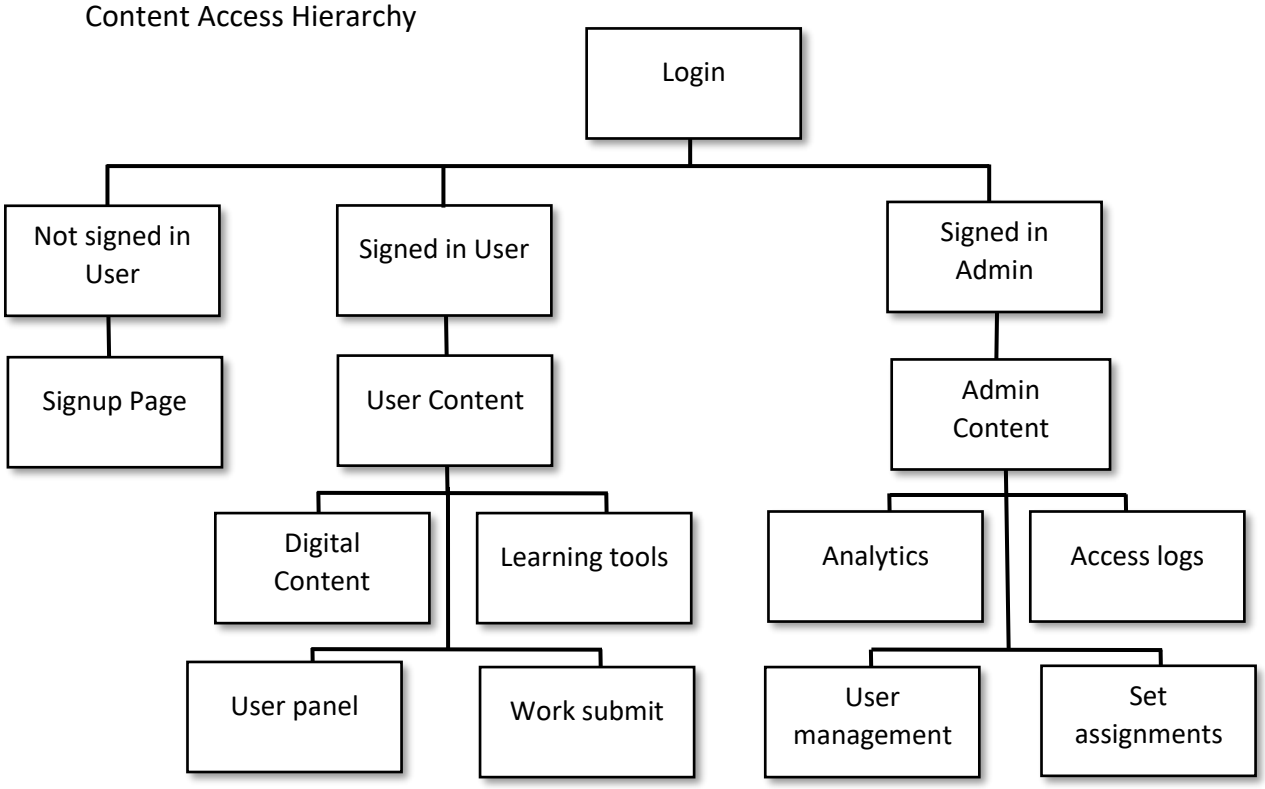
User panel – allowing users to access their information and edit their details, such as email and name.

Digital content – this will display useful videos and articles from trusted sources, this gives users better understanding of subject areas and topics.

Below is a visual diagram of the decomposition:


GibJohn Tutoring System
System Security
Learning Reward System
Digital Content
User login
User Signup
User authentication
User Scoreboard
Generate user points
Show highest score
Show user score
User Progress Bar
Watch Videos
View Articles
Admin Panel
Download user data
View access logs
User management
Dashboard
Add user
Edit user
Remove user
View active users
View user analytics
User Panel
Edit details
View Reward points
Download Personal data
Learning tools
Accessibility
Gamified Learning
Assessments
Learning material management
Multiple choice forms
Submit work files
Add assignments
Change Text
Change Colours
Unlock Content
User levels

Content Access Hierarchy



Above is a hierarchy diagram that defines the access levels for different user states, this shows the areas which different user types should access, further defining the problem and suggesting ways to decompose relative to different users. There are three different users, not signed into the system, signed in as user and signed in as admin.

The two main roles of the system are defined below:

User (Student)	**Admin** (Tutor)
login to the system with the correct user credentials	login to the system with the correct admin credentials
Signup to the system	View access logs and login attempts
View and edit their personal details in the user panel	view personal details and all other users details
View the files that have been uploaded by admins	Upload files to specific users/subjects
Upload files to be submitted	View user progress and levels
View digital content	View a dashboard displaying all user analytics

View learning materials for different subjects	Download user data and analytics
Change accessibility settings to suit specific needs	Set assignment and tasks to users
View and download personal progress and analytics	

KPIs

The Key Performance Indicators (KPIs) highlight the areas of the system that show progress or milestones through the development process. KPIs are used to track the progress of the project to ensure all requirements are met once the project has come to an end. below are the KPIs for this project:

1. Complete the Login system so that authorised user can sign in
2. When all login systems are completed, make sure access control is implemented on all webpages
3. Complete the signup system so that users can enter details and login without any issues
4. Accessibility features to be included into the solution once the main template content is developed, allowing accessibility integration throughout the whole system
5. Check all user digital content form external sources prior to implementation into the solution
6. Once digital content is implemented, develop the user rewards based on the complexity of content to ensure all content is scored in the same way
7. Once the user side of the application is developed develop the admin panel which will allow admins to view user details and interact with the user system through file uploads
8. Introduce gamified learning to the system to increase user engagement through user levels which increase as the user uses the system

These KPIs assist in developing the solution as they detail the key areas that are required to be completed throughout the development process, they give an understanding of the best opportunity to develop certain areas to make the outcome implement all the required features to be successful.

User acceptance

The user acceptance criteria outline the functionalities that has to be met in order for the solution to be deemed as successful and complete, the acceptance criteria assist the development stage of the project by highlighting the areas the software solution requires to include when the project is complete. Below are the acceptance criteria for this solution:

- Provide the option for a user to login or signup if they are not logged in

- Provide interactive teaching and learning resources in a range of subjects when a user is signed into the system
- Provides access to digital content to encourage wider learning to users
- Support assessment and monitoring of learner progress through a progress status that is shown to the user
- Successfully include a range of accessibility features to support a wide range of users by allowing users to customise these settings
- A learning reward system which gives users points for using the system
- Include Gamified learning within the solution by adding different levels when a user uses the system
- Allow a user to manage users when they are signed into the system with admin privileges

The user acceptance criteria are an important part of the project, when these are defined it is the responsibility of the developer to include the criteria within the solution. These key points have to be actioned within the solution for the system to be complete, it details the features and functionalities the system has to include for it to be accepted by the client.

Solution Description

This solution will include two different interfaces, one for users of the system and one for administrators, in this instance the tutor. The system will allow users to login to access the content they require, if a user does not have a login they will be able to sign up to the system.

The system will be accessible remotely through the internet, content will be delivered using HTML, CSS and PHP which are standard for this type of application so all browser types should be compatible with this. Additionally, the solution will incorporate bootstrap this allows the system to be responsive and accessible on different screen resolutions and sizes, allowing users to access the system on devices such as desktops, mobiles and tablets. This enables the system to be inclusive to young people who may only have one device type, within the education sector this is important as all people should be able to access this system and by using this method it allows many different devices to be used. On consideration I have decided to use bootstrap within the solution this is due to the fact it offers a better user experience as it allows webpages to be more responsive compared to the other methods of using static HTML and CSS.

The front end of the system will incorporate HTML and CSS and JavaScript, this will be used to display the content of the site to the user. Certain measures have to be considered when creating the front end of the solution such as accessibility to users and ease of system use through the Graphical User Interface (GUI). The system has to account for users from all backgrounds, ages and technical knowledge.

The backend of the system will use PHP for processing data and an SQL database for storing information such as emails, passwords and other personal details. When implementing the backend security is important to ensure malicious users cannot access personal or business data. The backend will comprise of a sever that can serve data and receive requests from

the client through the client-server model. Availability is of key consideration when it comes to websites, the system needs to have a good uptime, meaning that users can access the site most of the time. Without availability of the system users will have reduced confidence in the system and may decide to use another will better uptime which would negatively impact the business in several ways.

Performance may also be a consideration, especially with the increase of customer base overtime, performance needs to be considered in terms of scalability of the system, this can be achieved with methods such as increased server capacity or the use of multiple servers to respond to requests of the clients.

The user will navigate the solution through the use of a sidebar, this will be used throughout so users have a way to navigate the system easily.

External links will be used within the system to provide users with useful information and videos that are up to date and relevant for the learning process. As a part of the digital content delivery, these links have to provide accurate information to users, all external links will be easily identifiable to users.

Client and user needs

The solution will meet the needs of the client and users as it will implement all the requirements set out in the task brief including:

- Provides interactive teaching and learning resources in a range of subjects
- Provides access to digital content to encourage wider learning
- Supports assessment and monitoring of learner progress
- Collaborative teaching and learning tools
- Accessibility features to support a wide range of users
- A learning reward system
- Gamified learning

By implementing these requirements, it allows users to get a greater educational experience through the use of digital tools, the solution will allow users to learn and assess their progress through any easy to use system, this gives users the opportunity to better understand learning concepts and areas they need to improve, the system will also give users information on these topics to increase their level of knowledge.

One of the features I have decided to include is a login system and the opportunity for users to sign up to the system, this is justified as it allows better control over people using the system and provides the client more information on user progress, engagement and success which can be used to increase assist in making better business decisions and improving services GibJohn Tutoring provides.

Another reason for this is for better security, this will be more difficult for malicious users to identify vulnerabilities within the system if access is limited.

Risks

There are many potential risks when it comes to implementing digital solutions, below are examples of risks faced when creating a solution that deals with user information that faces the internet. As with many other sectors education is targeted to disrupt operations, delete data or retrieve information from people with malicious intent. It is important that risks are identified so that they can be mitigated against when it comes to designing and developing the solution.

Below are the risks identified for this project:

Risk 1 – Unauthorised access – Priority high

A risk to the system is unauthorised access, allowing malicious actors to retrieve user's information.

To mitigate from this risk:

- Ensure access control is enables on all pages
- Sanitise user inputs to prevent attacks such as SQL injection
- User Password hashing techniques to store passwords

Risk 2 – File Upload – Priority high

One of the risks to the system is the ability for both tutors and users to upload files, a user with malicious intent may upload a file that can disrupt the system. Additionally, within the education sector, files need to be checked to ensure they are not harmful, especially to younger audiences and do not contain any inappropriate materials.

To mitigate from this risk:

- The system should only allow files of a certain type or extension
- Only people that are logged into the system can upload files
- Each file uploaded should be logged with the file name and the user
- Files should be monitored to ensure they are legitimate

Risk 3 – Access Remotely – Priority high

The main advantage to this system is that it can be accessed remotely, this allows users to access the site from anywhere. However, this comes with certain security risks as the system is open for anyone to access

To mitigate form this risk:

- Log all access attempt to the system with relevant information such as IP addresses and attempted user credentials
- Only allow users to access the system when they have been authenticated by the login process

Risk 4 – Storing Passwords – Priority high

Another risk to the system is storing passwords, certain measures have to be included to ensure that malicious actors cannot retrieve this information easily

To mitigate from this risk:

- The solution should hash passwords in an encrypted format (SHA512) with a password salt.
- Ensure when password is input, the field is a password type to prevent shoulder surfing.
- Prevent brute force attacks by allowing a certain amount of access attempts in a certain time period
- Ensure users can only use a complex password
- Submit data to the server using the POST method

Risk 5 – Storing information – Priority High

A key risk to the system is storing personal information about people, this information could impact users in many negative ways if an authorised malicious actor gained access to this data.

To mitigate from this risk:

- Personal Information should only be accessible to the individual it belongs to or signed in admins to the system using access control
- Prevent SQL injection attacks by validating and sanitising inputs to the database
- When an admin views information this should be logged with factors such as username, information accessed and the IP address
- Analytics and data about people should only be accessible by the specific user to relates to and administrators of the system.
- Use POST methods to send data to the server

Legal & Regulatory guidelines

The General Data Protection Regulation (GDPR) is legislation that governs how user data is stored and kept and distributed, when developing the solution this is a key consideration that has to be made. I will ensure that user details are stored securely with the use of user access levels, all passwords will be stored using encryption methods. User data will also not be shared with any third party and kept secure within a database.

The Data Protection Act (DPA) is also legislation that is designed to protect personal information stored on systems, this is also relevant to the project as details such as name and email will be stored, it is important to ensure that this is adhered to in the final solution.

Another consideration of the system is accessibility. The Web Content Accessibility Guidelines (WCAG) have been introduces to make the web more accessible to people with accessibility needs, developed by the Web Accessibility Initiative (WAI), it highlights how a developer should make the solution perceivable, operable, understandable and robust.

Within my solution this is important to implement these into the solution, this is due to the fact the solution is aimed at the education, something that should be accessible to all, therefore I have to ensure that I make reasonable adjustments to my solution to make the system accessible these include:

- Adding alt tags to images, videos and graphs
- Display text with standardised fonts and with reasonable font sizes
- Allowing user to navigate the system with voice overlay by adding names for elements such as buttons
- Make use of whitespace and contrast so the content is easy to read
- Allow users to zoom into the webpage for without interference with the content on the page
- Errors will show a message and an icon to identify the error type