

Cybersecurity Education

A web application to support Scottish primary school aged children in learning about cybersecurity issues.

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Note that Information contained in this document is for educational purposes.

Executive Summary

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BACKGROUND

Cybercrime is estimated to cost the world almost \$1 trillion annually (Malekos Smith, Lostri and Lewis, 2020) and as such cybersecurity is now a fundamental necessity of modern living. Good security is a collective responsibility, as individuals need to not only protect themselves but also ensure that they do not become a conduit through which a hacker can attack someone else. A network's security is only as good as the least-secure device after all. One group who are particularly vulnerable to attack are children, who will very likely have access to the internet through some device but probably lack the comprehension to use them safely (Abertay University, 2019). Many parents rightly worry about what their children are doing online and there are scant resources available for children, particularly very young children, to learn about staying safe online.

Dr Suzanne Prior is a lecturer at Abertay University and a specialist in teaching children cybersecurity. Over recent years she has developed several excellent articles and other educational material for children but has lacked a means of distributing them. She approached the Apps Chaps in 2020 to request that a web application be developed with the following features:

1. It must be appropriate for children, easy to use and attractive.
2. It must work flawlessly on tablet devices.
3. It must allow for adults (such as parents and teachers) to manage their children's accounts.
4. It should contain a number of age-appropriate activities for children to complete; such as videos, quizzes, games and articles.
5. Allow for the bulk collection of anonymized data that can be used by Dr Prior for research purposes.
6. Be entirely safe for children and completely secure.

The lessons hosted on the web-application should be inline with Scottish Curriculum for Excellence requirements around cybersecurity and be accessible to even those children who cannot yet read.

CLIENT BENEFITS

The primary benefit of the web application is that it allows a wealth of available materials to be shared with children across Scotland. This should greatly enhance the cyber knowledge and resilience of schoolchildren, supplementing their education and hopefully taking some of the burden of teaching cybersecurity away from teachers and parents.

It is hoped that this web application, with its attractive layout, wealth of activities and careful consideration around presenting complex topics to a very young audience will ultimately help raise the profile of Dr Prior's work and that of Abertay as a whole.

Finally, the ability to access bulk anonymized data should assist in Dr Prior's future research and give unique insight into how well children comprehend cybersecurity at a given age; information that should prove incredibly helpful in refining and perfecting the process of teaching children how to stay safe online.

METHODOLOGY

The Apps Chaps adopted the Agile model for development, aiming to create a working prototype every week with successively more features added with each weekly iteration. To achieve this they split into 4 sub-teams focusing on:

- Front-End development
- Back-End development
- Content
- Quality Control

This parallel approach to development meant that several features could be worked on simultaneously and the QA officer meant that deficiencies were discovered and fixed quickly.

The front-end team consisted of one primary developer who focused on creating fully responsive templates that could be fleshed out by the content team. Their primary concern was ensuring that the web-application would have the same functionality on tablet and phones devices as it does on a traditional computer. To do this they researched various methods and plugins for enhancing the user experience of the web application and utilized bootstrap (Otto and Thornton, 2011) to create smart but flexible mechanisms that allow for further content to be added easily.

The back-end team were responsible for implementing the web application's SQL database (MySQL, 1995), account management and securing the site. The database schema was designed around having 2 types of accounts, those for guardians who would create students and then those student accounts that could be used to browse the web application and record the user's progress. The team implemented 3rd degree normalizations to ensure that the database would be as efficient as possible, storing necessary data only once to optimize its size and enhance security. They designed the UI and underlying back-end code for both types of accounts and implemented sessions to ensure secure access. Once the application began to function as intended they utilized Bcrypt (Provos and Mazieres, 1999) to ensure passwords would be handled securely.

The content team were concerned with the user-interface, site content and accessibility. Their greatest challenge was creating content for very young children, ones who may not even be able to read. To help address this they consulted with a primary school teacher to help understand what kind of language would be appropriate and how to effectively broach new topics. The team used the Scottish Curriculum for Excellence (Education Scotland Benchmarks Technologies, 2017) to ensure teaching material was relevant and ultimately decided to add audio voice-overs to lesson pages, reading out the material so that anyone could access it. They then moved to make the site more engaging by adding quizzes, mini-games and videos. For the user-interface the team implemented the site's CSS and drew on a variety of art assets, some of which came from royalty-free online repositories and others such as maps that they created from scratch using dedicated software.

Finally, the Quality Assurance team consisted of one developer who would inspect the previous week's build and either fix bugs directly or bring them to the attention of their creator. In addition they would also act as an extra pair of hands, assisting other teams as required and temporarily replacing the front-end developer when they were injured.

RESULTS

Ultimately the team was able to deliver the core requested features for the site and create a web application that is attractive, engaging and safe for children to use. There were a few limitations; principally the ability for researchers to easily collect data from the site. While this is possible through use to SQL queries on the application database a more streamlined mechanism would be preferable. A second issue is around testing. While QA was implemented directly into the weekly builds, the team was unable to give the application to target users to gather feedback and perfect the user experience.

The site as it stands though works responsively on almost any device and has a number of fun features to help keep children engaged. The technological solutions implemented are fast, modern and above all safe and secure. The flexible templates developed allow for more material to be added to the site easily in the future or it can be left as is, with minimal need for maintenance. The final product is therefore ready to be deployed to the wider public and will serve as an excellent foundation to host Dr Prior's future work.

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1 INTRODUCTION

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1.1 BACKGROUND

Dr. Suzanne Prior is a researcher at The University of Abertay, specializing in the research of cybersecurity education, specifically on the present education of children and young people. Dr. Prior is concerned about the lack of an accessible platform for children's cybersecurity education, these concerns have been exacerbated due to the need to teach cybersecurity within the Scottish curriculum for excellence, which states, for example, a child of 4 years old should be able to create and memorize secure passwords. Alongside this, 70% of children have encountered inappropriate content online, while completing research online (Kids Online Safety - Internet Safety for Kids [2021] (2019 Statistics) - SafeAtLast.co, 2021).

At present there exists a large amount of educational material, for children, however, the issue lies with the accessibility of this content.

Concerns around children's cybersecurity will only grow, as the world becomes more reliant on computer systems and technology, it's more important than ever that there is access to quality cybersecurity education. Alongside this, children must be taught cybersecurity when they are young and to engender cyber-secure habits. The Scottish Government has released a national action guide for internet safety for children and young people (Internet safety for children and young people: national action plan - gov.scot, 2021), showing the extent of the issues surrounding children's cybersecurity education.

Dr. Prior approached the App Chaps with the proposal of developing a platform, targeted to Scottish children, which would host educational content tailored towards the Curriculum for Excellence. In order to complete this project, the team agreed upon a plan for the development of a web platform. This web platform was to be targeted at primary school-aged children (ages 5-12), and host content appropriate to different age groups, with users being able to access content specific to their age. Alongside this, the content was to be developed in line with the capabilities of young children, so the platform can be used in tandem with school education or be used in an extracurricular capacity to supplement a child's cybersecurity education.

The platform once developed will have a class system, so a single guardian can manage a class of pupils. This is so this the platform can be used in conjunction with traditional classroom-based teaching. The guardian of the class will be able to manage the children's profiles and change their passwords, representative of a class admin. These guardians will need to be registered to the platform. This is to emphasize the integrity of the system, as it will allow all the guardians to be verified and authenticated.

To store the data related to the class system, an SQL database was created. This database was created with best practices in mind, store hashed passwords, and the links between guardians and children. The data within the database was also normalized to the third degree, to ensure that there will be no repetition of data.

Alongside this, the platform must have an attractive, yet simple layout, which can scale across multiple devices. This is due to all the different possible screen sizes and resolutions which modern devices have. This will ensure the platform is accessible on all devices, such as laptops, home desktops, smartphones, and tablets. Along with this the design of the platform must be attractive and engaging for young children. To achieve this, a pirate theme was decided upon for the platform. This is so that the platform is still engaging and entertaining for the children and creates a platform that the target audience wants to use.

Finally, the platform should track and anonymize user's data so it can be used for Dr. Priors' future research about how children learn and understand cybersecurity. This is of relative importance within the project as

it will benefit researchers and allow them to gain a better understanding of how to teach young children cybersecurity.

1.2 AIM

For the successful completion of this educational web platform to happen, there are multiple aims and goals for the project. The aims and achievements for this web platform fall into several categories, the categories are as follows.

- Primary Aims – These are aims that must be hit for the platform to function at a base level and cannot be developed without achieving these goals. An example of this would be the database backend.
- Secondary Aims – These are aims and goals for the additional functionality of the web platform. For example, customizable characters.

The primary goals for the project are.

- The development of a web platform – The primary goal for this project is to develop a web platform that will further and better the education of primary school Scottish pupils. Alongside this, it will serve as a central point for Scottish cyber education.
- Create Content related to the Curriculum for Excellence – Due to the target audience for this project being Scottish pupils, the content will be able to directly tie into the Scottish education curriculum. This will allow the platform to be used hand in hand with regular class teaching.
- Creating a functional backend for the platform – To do this, a SQL database, along with the supporting PHP and JavaScript will need to be created. This will add more functionality to the web platform and make it interactive.
- Ensuring the security of the platform – This is paramount to the platform, as it is holding sensitive data, such as children's names and ages.
Ensure accessibility – Due to the nature of modern devices, the developed platform must be accessible on multiple different sizes and resolutions of devices.
Stored Progression – The platform must be capable of tracking the progression of different users and allow them to pick up where they left off.

The secondary goals for the project are:

- Creating a customizable avatar – This is to keep the children engaged and give them some personalization. It would allow each child to express themselves within the system. It would also allow for individuality, giving each user a unique identifier. Alongside this could be tied into an award progression system.
- Award Progression System – The addition of a system to reward the users with points when after they complete a class or gain an achievement. These points could be used to purchase cosmetic changes to their avatars and be used to fashion a leaderboard system, encouraging healthy competition.

2 METHOD

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2.1 METHOD

2.1.1 Overview

The team began by splitting off into separate sub-teams which consisted of front-end, back-end and content teams; and a quality assurance officer (QAO) who also provided an additional pair of hands wherever assistance was required.

The team decided to adopt an agile approach as the best way to go about creating the website (*What is Agile Methodology?*). The original plan was to produce a website prototype every week. However, later down the line the team would have rest weeks to focus on other projects, followed by sprint weeks where the team met daily and solely worked on the website to get back on schedule. During normal weeks the sub-teams would work on their own sections independently and catch up with one another to discuss what had been done every Monday.

2.1.2 Front-End

The front-end team along with the QAO began by making diagrams of the webpages. These diagrams were to let every team member see how the pages would look and if they had any issues, they could raise them, and suitable alterations could be made before coding began in earnest. An example can be seen in figure 1.

Page 1

https://www.draw.io

Navbar Home Page 1 Page 2 Logout

Intro to the quiz it may give an understanding to the user to how the quiz is played, and what the quiz is about.

Some form of question related to a topic

Option 1 ☒

Option 2 ☐

Option 3 ☐

Some form of question related to a topic

Option 1 ☐

Option 2 ☐

Option 3 ☐

Submit

Figure 1 Original Webpage Diagram

After finishing all the webpage diagrams, the front-end team and the QAO began working on coding the templates. Splitting the workload, they began by coding basic templates for the webpages making use of HTML, PHP, and CSS to create webpages that matched the diagrams. Once completed the front-end team then went about polishing the webpages to be more modular with the use of bootstrap (*Build fast, responsive sites with Bootstrap.*) and other libraries to make them look more consistent, making the code more readable and user friendly. Once a template was fully complete the content-team could then begin adding their work.

This involved researching libraries that would be useful and looking for methods of improving how the code was written to make it more efficient. Making use of in-built features such as includes, to stop repetition of code. While finalizing the templates there were quite a few problems which the front-end team and QAO had to overcome. Specifically with CSS as it was mixing with the bootstraps' CSS. This was overcome by making use of IDs and Divs to make it so they can be edited separately.

Near the end of the development, the front-end member broke their arm, so responsibility was delegated to the QAO to finish the remaining work. This included updating the navbar to be more editable, adding a background to it and making the text larger for the smaller screens.

2.1.3 Content-Team Moses

While the front-end team worked on creating webpage templates, the content-team began researching and consulting with an expert to make lessons for children that are both understandable and engaging. Since younger children do not have a diverse vocabulary simple language would have to be used and a primary school teacher was contacted to help achieve this. While the lessons had to be understandable for the younger children, they also had to follow the Scottish Curriculum for Excellence for each age group getting more technical as they got older.

After creating the lessons along with the other content-team member, the next step was to polish off the CSS for the lesson pages, since each page would be different and had different visual requirements. This would involve making the centre of the screen look like an open scroll to fit the theme of the website and making sure that everything fit well with the content being added. To make the lesson pages more attractive, animation of birds flying over the pirate ship was added to the footer.

Once the visuals of all the lessons was completed the next step was to implement audio and video to the lessons, so children that struggle to read would still find them accessible. The audio auto-plays so children that have poor control with a mouse, or their finger do not need to press a small play button.

After finishing the lesson pages, the next step was to finalise the navigation page, updating the CSS of the navigation page and creating map artwork for the islands. The islands will store the different lessons that can be clicked on by the user to open a modal which contains links to the lessons as well as a pirate themed image.

Once the navigation was completed and working, the last thing added was an entertaining and easy to use game of dressing up a pirate which is located on the navigation page as well. This was created using both CSS and JavaScript to make the pirate respond when the child clicks on the buttons to change the pirate's appearance. This was done to add personalisation to the child's account as they would then have their own friendly pirate that they could see as themselves.

2.1.4 Quality Assurance Officer

The QAO started by doing the same work as the front-end team since at the beginning there was nothing to test. However, once things were completed, the QAO made sure that the feature created was working fully

by rigorously testing said feature. When something did not work the QAO fixed it to save time for the rest of the team.

While testing the QAO also made features for the other teams too. Such as a registration form which allowed for the testing of the PHP code of adding accounts to the databases, the registration form can be seen in Figure 2. But once the code was tested and working, a proper back-end registration process was created.

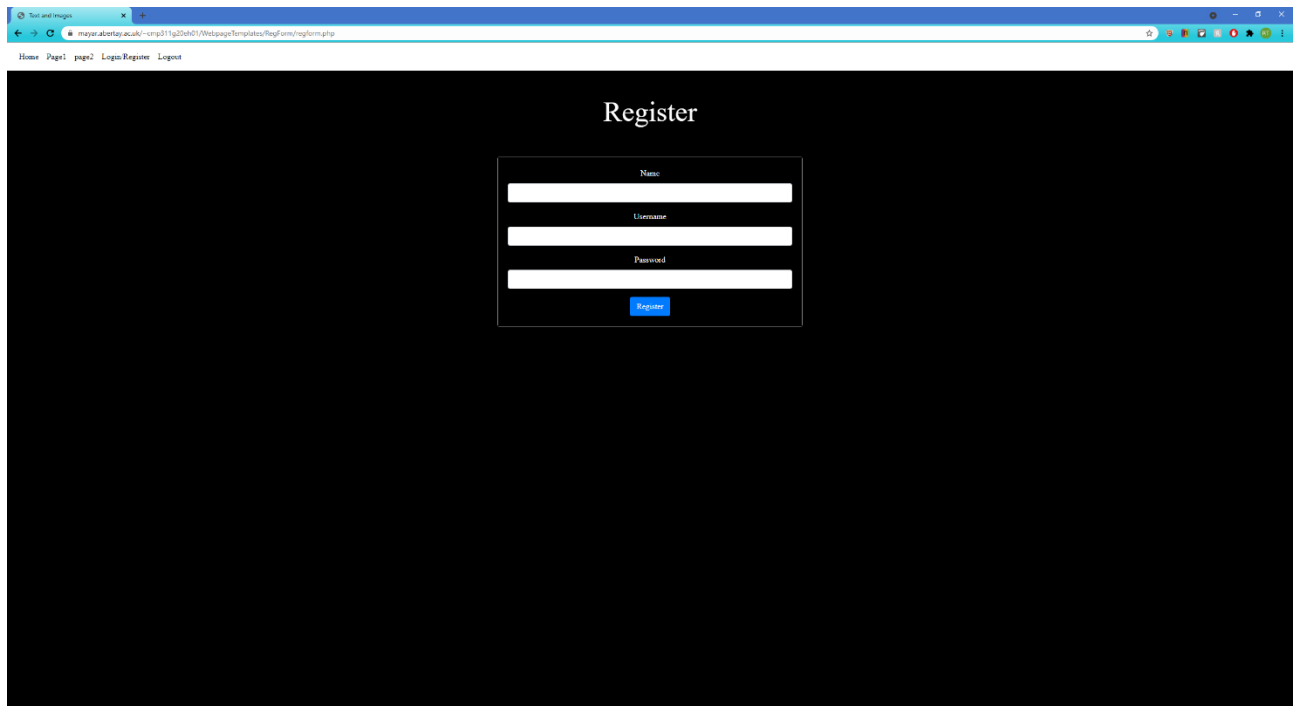
A screenshot of a web browser displaying a registration form. The browser's address bar shows the URL 'maysa.abertay.ac.uk/~comp011/g202001/WebsiteTemplates/RegForm/regform.php'. The page has a dark blue background. At the top center, the word 'Register' is written in a white serif font. Below it, there is a white rectangular box containing three input fields. The first field is labeled 'Name', the second 'Username', and the third 'Password'. Each label is in a small, dark font above its respective input field. Below the 'Password' field is a blue button with the word 'Register' in white. At the very top of the page, there is a navigation bar with links: 'Home', 'Page1', 'page2', 'Login/Register', and 'Logout'.

Figure 2 Original Registration Form

While testing finished features the QAO also analyzed the code to check that the code was implemented using best practices. Making sure code was efficient and readable. If there was a mistake or more effective way of writing the code, the QAO would fix it.

After the injury of the front-end member the QAO took over the remaining workload and polished off the CSS, and code, and made the final adjustments to the website. Such as making sure webpages worked together properly, commenting the code, and adding a background image to the navbar which was a struggle as the CSS clashed with the bootstrap but was overcome by using IDs.

The QAO throughout the whole project made sure everything was working and that there was nothing left untested. All the while making sure to help the other teams while doing so, which included anything from gathering resources and researching potential features to add, to implementing and fixing sections of code.

2.1.5 Backend

The backend team which consisted of Finlay and Rory who initially focused on planning by meeting up and creating and updating a data dictionary while waiting for the Abertay computing space to become available. A data dictionary is critical to making the work the team did more reproducible because it allows others to understand the team's data by explaining what all the variable names and values mean.

Once the Abertay servers became available they split into two sub-teams with Rory starting work developing the database and made a PHP mechanism for registering users into the database and Finlay working on metrics for tracking and updating the data dictionary for the users so they could be worked into the database. This would fit the specification that dr prior was looking for in collection of data towards her research.

In addition, Finlay worked on researching similar tracking to allow him to see the scope of what he could develop but found that google analytics has become the standard for anyone looking to implement tracking into their website so finding information that would help in my development of the coding was difficult.

Once developed all data was anonymised in accordance with Uk data service (Consent for data sharing, n.d.).

The next weeks were spent connecting the work the front ends teams had completed to the backend. In addition, the team decided to do a sprint allowing for the tracking code to be implemented into the website and bug tested and completion of the web statistics by creating a page for all the data that has been collected to be viewed, the page would be stored in the admin section of the site so that only authorized user can view the data.

Rory created an admin section the where registered admins can add child accounts using a form.

Week 10 onwards was spent by both working on polishing the website back end and Rory helped Finlay in fixing the login system and Rory added logic to the admin page and implemented a mechanism whereby admins can assign children to classes. To make the classes secure Rory also implemented the verification that means that if you would not have access to the classes or other restricted areas of the site you be redirected to an error screen.

2.1.6 Content-Team Toby

For the issue of content, Toby spent the first couple of weeks revising the skills he would need to help him develop content in the upcoming weeks. He used sites like Code academy to learn JavaScript and brushed up on MS Visual Studio (microsoft visual studio, n.d.) after he was informed by the front end that it would be the development platform they would be using.

Next in the development was making the content of the learning pathways by researching websites that were like what the website set out to achieve, BBC Bitesize website was a good example of early years classes with language appropriate for younger years and to collect ideas for games and quizzes.

Once the pathways had been showing to the group continued improvement on coding skills in aim to begin the work on a password strength tool allowing to teach children about the importance of password security.

Once development of the password checker was complete Toby began development on the HTML quiz template using HTML, CSS and PHP with the aim that the template can have questions dropped into in allowing for quick implementation across the whole website helping with the workload with both front end and back-end teams.

During the sprint week, Toby made use of the quiz template he made 5 lessons as the template allowed him to work on adding content to the lessons as well as having quizzes as well as using the week to do a comprehensive evaluation and polish all prior works.

After the sprint, the final development of the password strength checker was completed as well as coding contribution into the development by researching modal animations for a scroll opening, once both were complete Toby collaborated with Lindsay for implementing them into the web site.

3 RESULTS

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3.1 RESULTS

The final deliverable for the development of this project is a completed website with the purpose of providing primary school children in Scotland with knowledge on cyber security issues while aiding overall technology skills. Parents and teachers register on behalf of their children or classes respectively, allowing both to view children's progress throughout the site. Once registered, the user comes to a landing screen where they can select what lesson they wish to browse. The lessons are split into several pages, containing different aspects of the selected lessons. The site is heavily themed towards "Pirates", lending to the site name "Pirate Island" and this theme runs throughout the whole site, enabling an engaging storyline to keep users entertained while they learn about cyber security issues.

The brief outlined that the website must be able to be used on devices that our target users will most frequently be using, including tablet devices. Our front-end team worked to ensure that the site was fluid by design, crediting the bootstrap library so that the site functions on all size of screen and devices. The site also has a responsive user interface, containing dynamically loaded content using PHP for implementing areas such as the navigation bar and site footers. This team also created a functional register and login page, linking back to the request from the client that parents should be able to register on behalf of their children. We met this request from the client and decided to further support the use of the site in a classroom setting by creating the ability for teachers to register pupils in their class.

The content team was tasked with creating a vast amount of resources about cyber security issues and general technology knowledge for the lessons on the site, so that we could display this through an interesting storyline, maintaining the pirate theme throughout. We used the theme to support younger users to be able to make connections with real life cyber security issues. The lessons were designed in line with the Scottish Curriculum for Excellence (SCFE) Progress Pathways for Technology, and had an expert consultant to provide oversight on children's education to ensure that the lessons were understandable for the users, considering we are covering a very technical topic. Our client requested that the lessons varied depending on the age of the user, and we have split the site into Early Years and Later Years lessons, establishing different levels of knowledge appropriate for the age of the user. The content team also stepped up to support the front-end team during development when they faced injury and took on tasks including completing templates of the lessons and developing lesson activities such as quizzes and the password strength checker. The team also worked to find art assets for the site, and even created their own, such as the island maps.

The backend team worked to ensure the brief was followed as requested from the client, including that data must be stored securely in the database, which the team met through the implementation of the password hashing tool, bcrypt. This was used as it was the best tool available to us, and we are satisfied this has met the client's request. The database was also designed by the backend team and is created with 3rd degree normalisation, used to stop duplication of data and be as streamlined as possible. The team also set up further analytical research data vectors to support our client to pursue research goals. It does this through showing what lessons users are visiting most frequently and how often they are using the site. The way this has been set up enables the researcher to tailor the function to any additional queries that may be requested. To ensure that the site was secure, the team implemented several security features, including session management through cookies to ensure that there is no session hijacking. Our site is also protected from SQL injection by using prepared statements on our secure login system. (OWASP, 2021) All input on

the site is run through sanitizing of special characters using the built in HTML function so that it stops input based vulnerabilities, like SQL and XSS attacks. All these features result in a highly secure site.

Our team had a dedicated Quality Assurance (QA) team member, and an agreed QA process to make sure that we were maintaining a high standard of work throughout the development of the website. The role of this team was to also ensure that we were sticking to the pre-agreed Key Performance Indicators (KPI's), so that we would remain on track. The KPI's, or milestones, were an important function in our development process. The Agile methodology we chose worked well for the team as we were split into 4 teams, so other methodologies that require a lot of interconnected work may not have been suitable for us, and we used sprint weeks to try to develop as much as possible by collaborating with our fellow team members, and it was in these that we got a large wealth of the work done, so they were very effective. There were 10 overall milestones to indicate performance, including but not limited to "collate SQA guidance", "student UI front-end framework completed" and "secure back-end completed". These provided clear goals for our development teams to follow to remain on track during development. The QA process ensured we were meeting these goals, and once we had, that our designated QA member could test the new features.

Overall, the website we have created forms the perfect platform to teach Primary School children modern cyber security issues, while channelling a pirate theme to help younger pupils make associations of cyber issues to real life. Using our chosen methodology, we were able to work within our team roles and bring our work together for prototypes, aiding us in development. We believe the site meets what the client has requested and went further to aid classroom implementation. The site has been developed with security at the forefront, from the back-end design to the content displayed in lessons.

4 DISCUSSION

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4.1 GENERAL DISCUSSION

Based on the final product that was created the project can be considered a success due to the high level of organisation and communication that was held by all members of the team. The success was made possible through the detailed documentation that was made whenever the team would meet that would ensure all members of the team were aware of their role in the section of work that was currently being addressed. Despite these overall successes the team did face a few hurdles during the project such as a member being unable to work due to an injury which lead to their responsibilities being distributed to other members in the team. Other changes to the schedule were made with certain weeks being dedicated to work other than the project to keep up with the overall workload. During the project we also made use of organised 'stand-up' meetings that would take place in the morning before our main meetings with the lecturers where we would discuss the current progress in our work in order to make sure that no members were behind on work and to check the standard of what work everyone has done.

The web application that has been made meets the criteria of what was expected from the aims of the product such as being secure, suitable for the target audience and works well across multiple view sizes. The application is made secure using encryption when storing passwords in the database, this is required to make sure that the damage of any potential attacks is limited as passwords will be much harder to be stolen. Another important element of the project was ensuring that the content being presented is in a suitable format for people of young ages and that the interface for managing students is easy to use. This was done using simple navigation, responsive elements such as icons that react when they are hovered over, and large colourful or image-based buttons. Finally, the application had to be easily used and navigated on a range of display sizes and devices.

4.2 CONCLUSIONS

The final product that has been created can provide a level of monitoring and manageability that is not found in other solutions to this problem through providing, manageable classes that allow for adding and removing of students, tracking of student's progress through the classes, engaging and interesting learning content that is simple to understand for a range of ages which is entirely expandable due to the template system and a simple interface that makes it easy to use and navigate through the website. The team also made sure to avoid storing large amounts of unnecessary data about guardians and students in order to make the application less of a target for exploitation.

Cybersecurity has become a growing concern for many parents as children are choosing to begin using tablets and phones at a younger age, now is the most important time for a web application like this to be deployed. This will only benefit the current, and future generations through proper education about staying safe online, which is a topic that is important for people of all ages to learn. Without this education it leaves vulnerable children open to exploitation from malicious actors at a young age and into later life.

4.3 FUTURE WORK

Improvements to the product that would be made possible through more time would be implementation of more depth to the tracking of student's progress and the rewards they can be awarded, more tailored artwork to add to the unique look of the website, use of audio cues when the user interacts with the website, version control to better manage changes to the website and create more variation in the designs of the lessons to give the website a more dynamic feel. If no further Content will be added in the future, then a structured plan for maintaining the website in its current state would be developed.

Tracking and awards could be improved by creating more rewards for students to be able to achieve such as completing certain exercises under a certain time or perfecting certain sections of the lessons, which would give more insight into how well the student knows the topic. Tailored artwork is used on the website for the maps already but having a source of more art material or having access to an artist to work on the website that could provide high quality art tailored to the application's theme. To create a more direct feel to the interaction with the website auditorial cues can be used such as pings for alerts and other elements of the website, this would add to the fun feel of the website. Version control would involve having individual releases of the website that could then be tested and analysed for any improvements to further the quality of the program, creating more manageability for exactly where in the development stage the program is. The final piece of work that could be worked on to further develop the program would be more variation in the templates for lessons and other pages on the application. Any dynamic content on the website would also be using a Json file instead of XML as this is the more up to date solution for loading content.

4.4 CALL TO ACTION

This website will further improve Abertay's and Dr Prior's already excellent reputation in the field of cyber security. If further information not contained in this report is require contact the following email for questions.

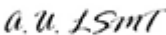
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REFERENCES

- Prior, Renaud, Yee-Yin, Theofanos, 2019. *Case Study – Exploring Children’s Password Knowledge and Practices*. [online] Internet Society, pp.2-4. Available at: <https://rke.abertay.ac.uk/ws/files/15610748/Prior_CaseStudy_Accepted_2018.pdf> [Accessed 23 April 2021].
- Malekos Smith, Z., Lostri, E. and Lewis, J., 2020. *The Hidden Costs of Cybercrime*. 1st ed. [ebook] San Jose, CA: McAfee, p.6. Available at: <<https://www.mcafee.com/enterprise/en-us/assets/reports/rp-hidden-costs-of-cybercrime.pdf>> [Accessed 22 April 2021].
2017. *Education Scotland Benchmarks Technologies*. [ebook] Scottish Government, pp.10-11. Available at: <<https://education.gov.scot/nih/Documents/TechnologiesBenchmarksPDF.pdf>> [Accessed 21 April 2021].
- Otto, M. and Thornton, J., 2011. *Bootstrap*. San Francisco: Bootstrap Core Team.
1995. *MySQL*. Austin, TX: Oracle Corporation.
- Provos, N. and Mazieres, D., 1999. *Bcrypt*.
- Getbootstrap.com. 2021. *Build fast, responsive sites with Bootstrap*. [online]. Available at: <<https://getbootstrap.com/>> [Accessed 27 April 2021].
- Digite.com. 2021. *What is Agile Methodology?* [online]. Available at: <<https://www.digite.com/agile/agile-methodology/>> [Accessed 27 April 2021].
- SafeAtLast.co. 2021. *Kids Online Safety - Internet Safety for Kids [2021] (2019 Statistics) - SafeAtLast.co*. [online] Available at: <<https://safeatlast.co/blog/kids-online-safety/>> [Accessed 28 April 2021].
- Gov.scot. 2021. *Internet safety for children and young people: national action plan - gov.scot*. [online] Available at: <<https://www.gov.scot/publications/national-action-plan-internet-safety-children-young-people/>> [Accessed 28 April 2021].
- OWASP, 2021. *SQL Injection Prevention - OWASP Cheat Sheet Series*. [online] Cheatsheetseries.owasp.org. Available at: <https://cheatsheetseries.owasp.org/cheatsheets/SQL_Injection_Prevention_Cheat_Sheet.html> [Accessed 24 April 2021].
- Sucuri WebSite Firewall [Online]. Available at: digitalnext.co.uk/dn-hub/blog/importance-of-responsive-web-design/ (Accessed: 3 May 2021).
- (2020). UKs internet use surges to record levels [Online]. Ofcom. Available at: www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2020/uk-internet-use-surges (Accessed: 3 May 2021).

APPENDIX A - DELIVERABLES & REQUIREMENTS (REQUIRED)

Agreement Form: Project Deliverables

Group Name, Names of Team Members, and Programme	EH1 App Chapps Finlay Connell, Lindsay Wilson, Moses Keir, Ryan Todd, Rory Leonard, Toby Wilkinson CMP311 Professional Project Development & Delivery
Subject specialist's Name (Client)	Dr Suzanne Prior
The deliverables listed below will be submitted by the team by the due date.	
Part A deliverables	To be agreed by programme specialist and team: <ul style="list-style-type: none">• Web application for hosting educational materials on cybersecurity.• Requirements Specification, signed off by the programme specialist (see overleaf)• White Paper detailing project development and design specification.
Subject specialist's signature	S Prior 
Team members' signatures	Rory Leanord Ryan Todd Finlay Connell Moses Keir Toby Wilkinson Lindsay Wilson

Agreement Form: Requirements

Group Name: EH1 App Chaps

Team members (print): Finlay Connell, Lindsay Wilson, Moses Keir, Ryan Todd, Rory Leonard, Toby Wilkinson

Project Title: **Cybersecurity Education for Children**

Please refer to the attached documentation for full details on the project. The requirements are listed in Table 1. The signatures below indicate that the requirements for this project have been agreed by the project stakeholders.

Any changes to the project documentation should be made using the correct change authorisation procedure agreed with the programme specialist.

Table 1

ID	List of Agreed Requirements (fill in)
1	A web application for educating primary school aged children on cybersecurity issues.
2	Login system that allows for teachers or guardians to create and manage accounts for schoolchildren.
3	Progress tracking system that allows students to return to the web application and see what activities that they have already completed.
4	Different material should be presented to children of different age groups, inline with the learning pathways of the Scottish Curriculum for Excellence.
5	The web application should work across a range of devices and flawlessly on tablet devices.
6	A range of educational activities suitable and accessible for primary school aged children. The length of these should not exceed 10 minutes.
7	An attractive layout that is interesting and straightforward for primary school aged children to use.
8	Secure storage of user data and account credential handling. Retained personal data must be kept to the absolute minimum needed to fulfil the above requirements.
9	The ability for designated researchers (such as the Client) to download bulk anonymised data from the Web Application database for research purposes.

Stakeholders	Signatures	Date
Team members	Finlay Connell Lindsay Wilson Moses Keir Ryan Todd Rory Leonard Toby Wilkinson	3/5/21

Programme Specialist	Dr Gavin Hales Dr Lynsay Shepherd	
Client (if applicable)	Dr Suzanne Prior	3/5/21