Designing Children-Friendly Gaming Website Using Gamification

***This report is submitted in partial fulfilment of the requirement for the degree of Software Engineering***

**by**

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**Date: 4th December 2023.**

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**Abstract**

This dissertation explores the design and implementation of a children-friendly gaming website utilizing gamification techniques to enhance early childhood education. The project focuses on developing interactive and engaging games to reinforce fundamental arithmetic and alphabet skills in children aged 3 to 8. Drawing inspiration from the proven benefits of gamification in education, the aim is to create a safe and enjoyable digital environment for young learners to interact with games that would assist in acquiring knowledge needed for their educational growth and development in a more enjoyable manner.

So far, the project is still in its early stages and more research is being done to deliver a promising solution to learning without interest, but currently only research needed for the project and a few game prototypes have been developed but there is a lot more to come by the conclusion of this project.

**Chapter 1: Introduction**

The increased interest in utilising interactive digital platforms for early childhood learning is a result of the effect that gamification is having in education. Recent research has demonstrated impressive gains in student participation and performance when gamified components are included into learning environments[[1]](#endnote-1). Reflecting on personal experiences and the observed impact of gamification during my secondary school education, this project's purpose stems from the conviction that gamified learning may greatly aid in the early development of foundational abilities. The beneficial impact that these early years may have on task retention and engagement highlights the potential advantages that a well-thought-out educational gaming platform can provide.

Using this framework, the goal of this dissertation is to develop a children friendly website with a primary focus on improving fundamental abilities like counting, number sequencing, and letter recognition for kids between the ages of 3 and 8. The objective is to assist in the enhancement of children's basic arithmetic and alphabet skills by using gamification techniques. This entails creating entertaining activities for a dynamic and safe learning environment. A strong desire to provide young children with a pleasant and fun learning experience is the driving force behind the investigation into the creation and implementation of a children-friendly gaming website. This project holds potential to solve problems associated with kids' disinterest in conventional teaching approaches[[2]](#endnote-2), offering a workable way to improve kids' development and engagement.

Understanding the constraints and scope of the project is vital for its successful execution, with one major constrain holding back the progress of the project. Time constraint poses a major impact on the project's trajectory, affecting various aspects of its development. With a deadline for completion and as a student taking in several other modules with their own assessments, it is critical to carefully schedule and allot time for every stage, from design and research to implementation and testing. Time restraints may also restrict the extent of user testing and feedback integration, which might influence how interactive features are refined for the best possible engagement. Developing a suitable children-friendly gaming website requires finding a balance between the project's lofty goals and the time constraints.

Further into this report we will explore the important part of the literature review. We investigate the need for a technological assessment and an analysis of related websites where gamification approaches have been researched and implemented in a similar manner and for a similar purpose, acknowledging the possible difficulties in locating relevant information. A well-written literature review is intended to demonstrate a deep comprehension of the background literature, starting with showing a broader context involving children-friendly gaming website which implement gamification. The story then goes on to provide a thorough analysis of the most relevant research in that field while stressing the need of using current and correct references. Then we will shift our focus to the thorough analysis of the goals and objectives of the project. This entails a thorough investigation of each component separately, with the understanding that the analysis may cover more ground than what is ultimately implemented. The chapter helps us to clearly define the project's scope by outlining what will be implemented and what won't be implemented, along with the rationale for these choices. Furthermore, the assessment method is well thought out, with a focus on how important it is at the beginning including thinking of experiments or tests that may be used to determine the project's success. Following will be a review of the journey thus far, offering a forum for summarising the successes and outcomes obtained thus far, its main objective is to clarify the observable results and project advancements. Lastly, we provide a brief overview of the primary accomplishments to date. Together with a thorough project plan that is illustrated using a Gantt chart, this offers a clear road map for the project's remaining phases. This chapter provides a thoughtful summary of the project, summarising the strategic actions that need to be carried out to move forward with the project's conclusion and providing insights into what has been accomplished thus far.

**Chapter 2: Literature Survey**

When implementing a website for a purpose such as one that is used to assist in the early educational development of a child, it is important to consider some information or facts which would be critical to making sure that the website does not just allow children play games but it should help them develop the expected educational skills, that is why a reflection on past or already created similar gaming websites has to be conducted to make sure that the required properties of the game are functional because without these properties the game is mindless. Previous researchers and scientists have already performed studies on the necessary properties of an educational websites which would have a positive effect on the children who play it, those necessary properties have been passed on the website developers who have successfully implemented them into fully functional and official educational gaming websites for children. It is common sense for any web developer seeking to develop a new website of similar purpose to consider and evaluate the previous similar website to seek techniques and styles used in educating the children who will play use their website.

The platform aims to employ gamification techniques from already established similar educational websites to transform educational activities into engaging games, fostering a positive and interactive learning environment. In this case we will analyse not only non-technical but technical methods used such as the programming languages, by understanding the tools, technologies, and educational strategies utilized in existing platforms, the project seeks to identify innovative approaches for effective learning.

A similar website identified is called turtlediary.com[[3]](#endnote-3) which is a child friendly website primarily developed to teach children in the range from preschoolers all the way to those in their 5th grade, but in this case only the aspects and technology applied to the section for preschoolers to those in their 2nd grade will be evaluated and considered as these fits into the age range 3-8. The website has a large range of games from letters, numbers, shapes, and geometry, but due to the fact this project only focuses on number and letter games the scope of this review would be draw to that. Technically speaking the website was developed using basic HTML 5 as the main markup language used for structuring and presenting the content of the website. Representing the styling and designing of the website CSS was implemented on the website as this is one of the most common and basic languages used to style HTML, finally the scripting and complex functionalities like the available games where all developed using JavaScript. The technologies where identifies using the inspect code feature accessible by Google Chrome[[4]](#endnote-4) using this it is not difficult to delve into the code which was written to implement the features of the website and identify the languages used.

Now considering the non-technical aspects of the website regarding user experience and learning impact, the website's gamification features and rewards programmes make a big difference in creating a stimulating and instructive atmosphere. By adding a Points and Scoring System, users are incentivized to perform well on their responsibilities, which in turn creates a competitive atmosphere and drives ongoing progress. Levels and Progression make sure that users feel like they've accomplished something when they overcome obstacles, which encourages a positive learning curve. An additional layer of recognition is added by rewards and badges, which foster a sense of competence and accomplishment. Instant satisfaction is provided by prizes and feedback for accurate replies, which strengthens desirable behaviour and improves the learning process. In addition to encouraging healthy competition, the Competition and Leaderboards feature increases drive to improve performance. Time constraints add a sense of urgency and enthusiasm that makes learning more dynamic and interesting. Users are motivated to strive for greatness by the added goals that Achievements and Challenges offer. Additionally, the integration of storytelling and narrative components enhances the immersion of the entire learning process, stimulating users' attention and inspiring them to continue the learning path. The user's feeling of advancement and success is further enhanced by the incentive system, which includes Points, Level Unlocking and Achievements. The website possesses the basic and some advanced requirements of gamification elements and reward systems, I believe this makes learning engaging and powerful.[[5]](#endnote-5)

As a website for children, it possesses several visually appealing features which may attract the likes of children[[6]](#endnote-6) such as bright and colourful pages with cartoons and animation, large and highly visible text and fonts and each game possessing an animated theme showcasing the main task or a preview of what task to perform in them, these are necessary to attract the right audience. A test was also performed on accessing the website on smaller screens such as tablets or iPad which is most likely the device children would use to access the website, in this case the screen size, fonts, all images and features in the website adapt to the suitable and relative size and arrangement for that device giving all users a clear view regardless of the device they are using to access the website.

Based on my research and experience, I believe this similar website possess the necessary features of an educational website which is implementing gamification methods to assist learning in young children, it has checked several boxes in my list of features which are critical to fulfilling its purpose. Now I intend to use this website as a role model for this project, applying techniques and methods they have used to develop their website and attempt to implement similar techniques in this project.

In conclusion, this chapter has provided insightful information on the crucial factors to consider while creating an educational gaming website, particularly one that is geared towards children's early educational development. The analysis of a similar comparable websites, such turtlediary.com, highlights how important it is to include essential elements that enhance kids' educational experiences. The study examined both technical and non-technical elements, emphasising the application of JavaScript, HTML5, and CSS in the creation of turtlediary.com. The website's ability to create a dynamic and captivating learning environment is further demonstrated by its emphasis on gamification aspects and reward systems. Points, levels, incentives, and rapid feedback are all included to help create a positive learning curve and drive for further development. The website is even more child-friendly due to its eye-catching elements, which include vibrant colours, animations, and a responsive design for various screen sizes. Overall, the literature review gives the project a strong starting point by revealing effective tactics and technological advancements used in current platforms to promote user engagement and learning.

**Chapter 3: Requirements and Analysis**

In this chapter, the requirements of this project will be stated, and a deep analysis will be conducted to understand the requirements for this project and to be successful in delivering the educational assistance it is due to deliver.

The requirements for the project include ensuring that the design is age-appropriate for kids between the ages of 3 and 8 while incorporating visually appealing elements, vibrant colours, and animated themes for the games[[7]](#endnote-7). This is vital to develop a successful and captivating learning platform. Young children are drawn in by the visually appealing features, vibrant colours, and animated designs, which provide an engaging and dynamic learning environment. By considering the target audience's level of cognitive development, this design technique makes sure that the interface is user-friendly, intuitive, and age appropriate. The focus on a child-friendly design improves the website’s value and user experience overall while also increasing its potential to assist children learning basic abilities like counting, number sequencing, and letter identification. Age-appropriate design is ultimately necessary to create a productive and joyful learning environment for younger users.

Games that improve basic abilities like counting, number sequencing, and letter recognition are the focus of the project. For the project to be compatible with the learning objectives of the target age range, it is imperative that games that improve basic abilities like counting, number sequencing, and letter recognition be given top priority[[8]](#endnote-8). This emphasis on education guarantees that the games created for the website accomplish two goals at once: they keep kids entertained with entertaining activities while helping them build critical fundamental and cognitive abilities. The initiative aims to contribute to the early educational development of young learners by coordinating the content with educational objectives. Incorporating precise learning objectives into the games guarantees that every game contributes to the development of reading letters or numeracy abilities by giving the design and development process a defined direction. Although there are various other topics which the games could cover that would assist in developing the cognitive abilities of children such as geometry[[9]](#endnote-9) and colour recognition[[10]](#endnote-10), the scope of the projects limits the range of games to number and letter games due to the limited time the project must be completed within, therefore they would not be included in this project. The necessity for an educational focus is essentially a calculated move to ensure that the project serves as a useful resource for the learning journey of the intended age group, in addition to being enjoyable.

The website will be made primarily for tablets and iPads, with a focus on making it compatible with as many devices as possible. This is another essential requirement to ensure the website is accessible and available on a range of devices, especially tablets and iPads which kids frequently use[[11]](#endnote-11). Young children frequently utilise portable devices to interact with educational materials, thus having a responsive design that adjusts to diverse screen sizes ensures a consistent and ideal user experience. Because they are touch-enabled devices, tablets and iPads need special attention when it comes to interactive design, so the user interface is simple and straightforward for kids to use. By making the website responsive to different screen sizes, accessibility is improved, and kids may interact with learning activities on desktop, laptop, tablet, or iPad with ease. This stipulation recognises the diverse technological environment and the necessity of accommodating various devices to optimise the reach and impact of the educational content.

To make learning interesting and inspiring, continual improvement of the gamification strategies like points, scoring systems, levels, and rewards should be used[[12]](#endnote-12). To improve the website's learning experience, gamification approaches must be used. For kids in the target age range, the educational platform hopes to make learning exciting and motivating by incorporating features like levels, prizes, scoring systems, and points. Gamification adds an element of excitement and fun to educational activities, creating a dynamic and interactive environment that captures and sustains children's interest. Users are encouraged to do well on instructional assignments by the introduction of a sense of success and competitiveness through point and scoring systems. The incorporation of stages guarantees systematic advancement, permitting kids to move progressively as they grasp ideas, cultivating a positive learning curve. Incentives serve as rewards, giving successes concrete acknowledgment and promoting ongoing participation. The overall purpose of incorporating gamification aspects into the curriculum is to make learning engaging, motivating, and successful in reaching the learning objectives for the intended age range.

The technological viability of the project is further ensured by considering the technical features, such as the usage of programming languages like HTML, CSS, and JavaScript in other comparable successful platforms[[13]](#endnote-13). This emphasises how crucial it is to evaluate and consider the technical requirements for the project's proper execution. It stresses the analysis of programming languages used in other successful similar systems, such HTML, CSS, and JavaScript. This study is necessary to make sure that the selected technology stack supports compatibility and simplicity of development by being in line with industry standards and practises. The project looks at the languages that well-known children's educational websites use to utilise tried-and-true technologies that improve platform performance, stability, and maintainability as we have seen in the previous chapter. It is important to guarantee technological viability from the start to ensure seamless website development and deployment, reducing potential obstacles and expediting the entire implementation procedure. In addition, other useful languages including My SQL will be implemented in the development of the project[[14]](#endnote-14), although it was not stated in the previous chapter when evaluating a similar website due to the website using another language to represent its database, is it a useful and structured way to represent databases and will be implemented in this project. This criterion lays the groundwork for a proactive approach to technical considerations, ensuring a robust and effective educational platform.

Evaluation techniques, including as feedback surveys, user testing, and performance measurements, are critical to determining how well deployed features contribute to the attainment of learning goals[[15]](#endnote-15). Evaluation procedures are necessary to assess how the implemented elements have contributed to the project's educational goals. It highlights how important it is to organise and carry out methodical ways of evaluation all the way through the developmental process. By interacting with the intended audience and making sure the website satisfies their requirements and expectations, user testing provides real-time feedback. User views and preferences may be formed through feedback surveys, which offer insightful information about the platform's advantages and shortcomings. Performance metrics provide quantifiable information on how well the educational elements are working. Examples of these indicators are user engagement and learning outcomes.

These tests and surveys are the best way to determine the success of the project and to confirm the project is delivering its intended outcomes which is to assist the children in learning, but unfortunately due to the time constraints affecting the project this section will not be included as the procedures would be too complex to achieve in the available time after concluding the project. Secondly the implementation of performance metric into the project is not in scope of the project and would also be too complex to perform in the available time left and a potentially a waste of time as the project would most likely not be launched therefore the metric would not record any activity besides it being tested after submission. These would be implemented if the project was industrial or is an official research project being conducted with a budget and with intent to be developed continuously. Instead, how the project implements the gamification elements and other critical requirements would be used to test how successful it is in delivering its purpose, as the research done has proven, if the website implements the important properties which other similar and official websites have succeeded in implementing, assuming it implements all these properties correctly and accurately, in theory it should successfully assist its users in developing their cognitive and fundamental abilities as well as or at least almost as well as its more professional counterparts.

**Chapter 4: Progress**

In this chapter the overall progress made so far in this project will be discussed and an overview of the completed tasks will be given. Relative to the overall completion of the project not much has occurred but in terms of the research and relevant knowledge needed to complete the website accurately, a lot has been covered.

Before any line of code has been written the first task to complete was to perform full detailed research into the project and the resulting website, to enable us to determine the requirements the website needs to have for it to be effective. This research took little over a month to complete and it included investigating gamification elements other popular and similar game website possess which made their website effective in attracting the right users and keeping those users interested long after welcoming them. These gamification elements have already been discussed in previous chapters of this report and included topics such as points and scoring system, levels and progression, reward systems and input feedback[[16]](#endnote-16) as these are some important factors required by any website attempting to implement gamification techniques to not only attract the target audience but keep them interested in their website. Next stage of the research which was done was to discuss reward systems, this is a gamification element which dives deeper in its own path as there are several ways users can be rewarded and each of those methods would each have a different result on their satisfaction and accomplishment for that game, this is the result of the method the user is rewarded during or after their game[[17]](#endnote-17), showing the necessity for investigating the different reward systems and how it will affect the resulting website. Some of these reward systems are point giving, badges or achievements and virtual currency earning.

After concluding the research phase, the next task which was the first technical task was developing prototypes for the games which would be implemented into the main website. The point of this is to use the research which has just been acquired and begin developing prototypes for the games following those techniques discovered during the research and using feedback from tests to make iterative updates and fixes to perfect the games from the start as this could be the most tasking section of the development, it is best to begin as early as possible to avoid unexpected drawbacks. Currently there are 4 planned games for the website but only 2 of those 4 have already developed prototypes, after the conclusion of this report more time would be devoted to developing the remaining 2 prototypes, then the project will continue as planned.

In conclusion, this chapter has addressed the progress so far in this project, including the research done on the gamification elements and rewards system, all the way to the development of prototypes for the planned games to implement. Although the project is still in its early stages, the already drawn-out plan is intended to guide the development process in a steady and comfortable pattern for a successful completion by the project deadline.

**Chapter 5: Conclusions and Project Plan**

As the project progresses it is approaching a critical turning point where it is necessary to evaluate its accomplishments to date. The journey started with an intense belief in the potential of gamified learning for the development of young children[[18]](#endnote-18), spurred by the profound experience I had using gamification of class tasks during my time in secondary school. The clear objectives were to develop a kid-friendly website that targets children between the ages of 3 and 8 and uses gamification to assist in developing fundamental abilities. Chapter 2 which was the literature review examined important facets of developing educational websites, gaining knowledge from already-running sites such as turtlediary.com[[19]](#endnote-19) to facilitate well-informed choices. The requirements and analysis of the project which were outlined in Chapter 3, highlighted its key requirements which were limiting the scope of educational areas to cover, gamification approaches, age-appropriate design, educational focus, device compatibility, and assessment procedures for determining the level success of the project. Lastly, chapter 4 discussed the actual progress so far in delivering the fully functioning website for its intended use, this progress is being guided by a well-structured plan to ensure the projects successful conclusion in time by the established deadline. This plan will be analysed in this chapter.

The plan of action is broken down into many crucial stages. First, a thorough investigation of the current child-friendly gaming platforms is conducted. Next, gamification techniques are analysed and strategies for rewards systems are gathered. These ideas will be turned into interactive prototypes in November, along with the first gamification components, and continuous iterations will be done based on feedback from previous tests. As December approaches, the emphasis switches to creating the fundamental frontend, which includes every page of the website, using tools like React, HTML, CSS, and Bootstrap. Basic game features are integrated simultaneously, and continual design improvements are made in response to feedback from tests and the interactive prototypes. January will be devoted to improving frontend functionality, putting responsive design into practise for a range of devices (particularly tablets), and including any unfinished, intricate game elements. February is the focus of majority of the backend development, using PHP or JavaScript, configuring an effective MySQL database, and adding a login feature. The next few months will be spent testing for security, usability, and implementing functions, iteratively improving game concepts in response to feedback from tests and evaluating device and cross-browser compatibility. Final website inspections, paperwork preparation, and preparation for the project presentation and demonstration in May mark the project's completion.

| **Month** | **Tasks** |
| --- | --- |
| **October**  **(approx. 1 to 2 week)** | - Research existing child-friendly gaming platforms. Analyse gamification techniques. Plan gamification elements and reward systems. |
| **November (approx. 2 to 3 weeks)** | - Create interactive prototypes based on designs. Implement gamification elements and rewards. Refine designs based on user feedback. |
| **December (approx.4 weeks)** | - Develop basic frontend including all pages of the website using React, HTML, CSS, Bootstrap. Implement basic game functionalities. Refine designs based on interactive prototypes. |
| **January**  **(approx. 2 to 4 weeks)** | - Enhance frontend features based on feedback. Implement responsive design for various devices but focus on tablets. Integrate complex game mechanics or pending functionalities if applicable. |
| **February**  **(approx. 3 to 4 weeks)** | - Develop complex backend functionalities using JavaScript or PHP. Set up MySQL database for efficient data management and implement login feature. |
| **March**  **(approx. 3 to 4 weeks)** | - Conduct testing: functionality, user experience, security. Iterate game designs based on feedback and fix bugs. |
| **April**  **(approx. 1 to 2 weeks)** | - Conduct cross-browser and device compatibility testing. Finalize documentation: project report, design decisions, outcomes |
| **May**  **(approx. 1 to 2 weeks)** | - Conduct final checks on the website. Prepare for project presentation/demonstration. |

(The numbers 1 to 8 in the plan of action represent the 8 tasks in the table above in order)

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