ROBERT GORDON UNIVERSITY ABERDEEN

School of Computing

Honours Report

eLearning Application/Game on Bagpipe Musical Theory

Lewis Maitland 2022

This report is submitted as part of the requirements for the degree of

BSc (Hons) in Digital Media Computing

at Robert Gordon University, Aberdeen, Scotland

I confirm that the work contained in this Honours project report has been composed solely by myself and has not been accepted in any previous application for a degree. All sources of information have been specifically acknowledged and all verbatim extracts are distinguished by quotation marks.

Signed .....  ..... Date.....29/04/2022.....

Abstract

In this final report, full coverage on how the project excelled, from start to finish, including how each individual document worked in partnership with the continued support from the team, and how it did not work well due to personal pressure and other reasons supported within this assignment. Also, all documents, files and resources will be available in the GitHub Open repository which will be available with the following link, as well as submitted in the comments section in the submission area. Overall, the project was a success in some cases but not in many ways as predicted.

Acknowledgements

Firstly, thank you to Yang Jiang, my project leader for all the helpful and constructive advice throughout the project, without her wisdom on the project, how to better myself and research as efficiently as possible this project wouldn't have happened at all.

Thank you to John Issacs, for the continual support through multiple lectures and advice on how to both improve my project as well as enrich it further. John has helped with other projects in the past and has given me the confidence to build up my reputation and continue to benefit my own wellbeing and growth as a student.

Thank you to all the students who took part in helping with the project from advice to help within the creative field to bring this project into reality.

Finally, a big thank you to my bagpipe instructors, players and students that have helped build my reputation as a bagpipe instructor and allowing me the opportunity to create a product that would benefit the world. Although the project has not finished and is still in testing phase at the end of this honours project, I am still very grateful for all the continual support from everyone that I have received from during and throughout the project.

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Chapter 1

Introduction

The project goal was to create an application/game that would benefit individuals when learning the complicated and intricate theory behind bagpipe music, how to pronounce the lettering in the form of a communication form known as Canntaireachd. While also being able to view it on sheet music as both individual notes and as a sequence of notes, as well as identifying how to play that note on the practice chanter. This style of application would provide users with a universal guide on how to learn musical theory using techniques that have been passed down through the generations. Adapting it into the modern-day reality since mobile applications are the road forward for any theme or learning style. With the Covid Pandemic causing a significant influx of mobile and internet users at an increase of “50% and 70%”(Beech, M. 2020) where around “184563 apps released in the time window of July 2019-May 2020” (Samhi, J. Allix, K. Bissyande, T.F. & Klein, J. 2021) from the Google play store alone, from Figure 1.1.

Chapter 2

Design

Design was the principle to how the application was going to look and flow throughout the project, based on extensive research made from the literature review, on colour theory design, application design trends of both 2021 and 2022. Also, product design, promotional design, how to create musical notation onto a computer and be appealing to a growing audience of both young and old.

2.1 Flash Card design

As all students learn any language, equation, or passage of text, they will tend to use flash cards, with a question on the front then the answer on the back, one of the best ways of learning. Some instructors will use the same style of teaching for their bagpipe learners for Bagpipes especially for younger students. Using the design concept of a flashcard is the main reason to create an eLearning application that would reflect the same teaching style; however, the difference would be that this one is digital. This style of flashcard is shown in Figure 2.1, showing the way these flashcards were created and used from 2004 till today.

2.2 Adobe XD

Adobe XD is an application used to design software, websites, and games for multiple applications. With its simple design style, varied ways of creating content and building up a design portfolio this is the simplest way to draft the main design of the application. When building the application on Adobe XD, as seen in Figure 2.2, the application allows designers to create a prototype version which allows them to fully see it work, as in view it on a phone and click buttons to activate and therefore show how the application will work. This was the simplest way to ensuring that the application worked perfectly and could then be created using Unity.

Chapter 3

Development

The development of the application was created first from Adobe XD as stated previously, since I was more experienced in that field than in Unity, due to the overall project needing Unity to style, develop and create the game, this was a key application to explore and therefore grow in this field. With more time in researching how the game engine worked, the application would have fully grown more, than it did during the project.

3.1 Unity

In Figure 3.1, the reason behind using Unity as explained through the literature review, this application was chosen and is currently being used for the application in the project and after as it is the easiest and most widely accessible platforms for create an eLearning application/game. With the design of this scale, full development was created on Adobe XD and then using the prototype section, this was used to create the development section in Unity. Due to a lack of experience with Unity, more help was needed to find exactly how to create the application and ensured that it worked as intended.

Chapter 4

Testing

When testing an application like this, multiple theories of how to test and successfully evaluate the tests was mentioned both online and through past experiences. The two methods used for the project were to test using students which did not work due to the lack of content for the application. However, the main testing was using an approach all if not most web designers use.

4.1 Ethics Forms

In Figure 4.1, the first page of the ethics form details why we need to be careful when creating an application for users who may need additional resources to help them understand the application further and therefore learn more about the application and then use it efficiently. As stated in the ethics form the possibility with working the children was a main factor in creating an eLearning application based on Musical Theory for the Bagpipes, as most of these users are children. A PVG was then needed, however due to being a teacher myself, I already have a PVG and continuously require it for work. Therefore, was no issue. Within the testing phase, only myself was used as the application was not fully completed.

4.2 Application testing

Due to the unfinished project as it is, testing the project was a key ingredient in ensuring that the main project was still working constantly, with the methodology of Agile for the project as seen in Figure 4.2. The testing was carried out at the end of each design, continuously testing the result to ensure that the application was working perfectly. This same style of testing is used by web developers to ensure that each element of the application works as it is intended. Due to my lack of knowledge on creating applications or games on Unity, this was the easiest and by far best way of ensuring that the project would not fail.

Chapter 5

Promotion

With promoting the application, focus was primarily on the poster rather than the demo of the application due to the main issue of the application still in development phase, known as Alpha Stage. Meaning the application is still in its main development stage and mid testing phase. Continuously testing and developing at each stage following the Agile Methodology stated in the Literature Review based on how this project would be completed and managed.

5.1 Poster and Demo

The poster was the primary focus in ensuring that the application was well detailed even though, the game was not finished. All statements made in the poster are true and due to the concept of the poster being more word oriented than picture, this through the experience off as most posters about a new application or game would involve images of the main game itself. However, in Figure 5.1, the full poster can be seen, within the GitHub Repository, the poster can be found here as well as the code .tex file can also be found.

As part of the requirements for the project, a demo was to be filmed and sent as part of evidence for the project, however none was sent and instead only the poster was sent. The reason behind this was the recording continually failed when showing off the project, due to the timing of this which was not properly organised the film was not priority only the poster was. The demo would also have showed the application go from a main menu to a starter screen and not show anything else of due to the lack of commitment to creating the project. The main game is completed but not tested. The elements, sound, development is created and working, however due to the lack of time management as I stated there would be in Figure 5.1 and 5.2, this would not have proved how effective the application was.

Chapter 6

Conclusion

The first half of the project, although the late submission of the literature review, was a resounding success, the passion for the project and the style of creating an application that would be used for people across the world was a revolutionary idea. However, after the start of 2022, production grinded to a halt. All motivation was gone. The application was not completed, still in testing phase and not good enough to even show it due to embarrassment of the project. However, within failure comes realisation, the way to progress forward, how the application will ensure continual learning becomes a reality. The project, therefore, was a success in more ways than just building an application that seems too good to be true.

6.1 Evaluation

The project had a high expectation, as stated in the Literature Review and in Figure 6.1, 6.2 and 6.3, with the right drive and passion, due to complications of illness, mental health and overall stress, the project went downhill at the start of 2022. If illness, loss of family members and potential war was not a factor during the time at university, while also not staying fully isolated at home due to high risk, stayed indoors for 2 years, the project success rate would have been higher. With the constant support of lecturers and other students, socially as well. Due to the lack of this, after literature review and the main documentation the main bulk of the project plummeted due to a lack of inspiration, need to complete tasks and an unwillingness to ask for help.

6.2 Future Work

As stated, this application was not fully completed and with the lack of evidence to provide throughout the project due to illness, mental health and overall worry, the steppingstones to ensure the success of this application are still in place. Continual development and testing will proceed after the end of the project. This application will be given more allocated time and training to ensure that the product is a success, not only for my own students but for students across the world. Funding would be the next issue, promoting this application will be possible with help from other companies within the similar bagpiping world. Contacts from these companies are already planned for, but more development of the product is required before approaching investors.

Overall, the project was a success in some ways, a success for the ability of not giving up even though very little was achieved, due to the stress of everything inside and outside of university, this project ensured that anything is possible and that all aspects of life must be taken into consideration before going through with any fully planned strategy.

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Appendices and Figures

Figure 1.1 – Literature Review – Introduction in Mobile Applications

Applications have been a modern solution to an ever-growing and developing society with unique problem-solving characteristics, from games to learning. This invention has capitalised on the global market allowing users to be entertained, learn a new language, create, and share new ideas across social media. The Covid Pandemic created a surge of new applications due to more people working from home and self-isolating as required by governments to keep people safe. Therefore, a spike in internet usage has increased by "between 50% and 70%"(Beech, M. 2020)[1] during the Covid Pandemic, with "184563 apps released in the time window of July 2019-May 2020" (Samhi, J. Allix, K. Bissyande, T.F. & Klein, J. 2021)[2] in Google Play alone. With a focus on education and health, demand for new and intricate learning applications is required to create an online approach within this Covid World.

The timescale for application development is a long process as multiple elements are required to design, create, and maintain applications for the global market. All applications are designed in similar formats:

- Planning stage using Business Analysis to extract the relevant market research;
- Application Design stage which will create User Experience and User Interface design;
- Application Development to create all elements of the application structure including back-end development, front-end development and testing then launching the product;
- Finally, an ongoing process of Support, Maintain and Update accordingly based on real-world client information.

This methodology is beneficial to its overall success, as stated by Existek 2019, "Complex and sophisticated apps will need 40+ weeks of development depending on the scale of the project and ambitions of the business" [3] (see Figure 1). Applications are therefore built to be relevant and reliable sources of information, promote operability, and maximise intelligent interface.

Figure 2.1 – Original Concept Flashcards – Poster

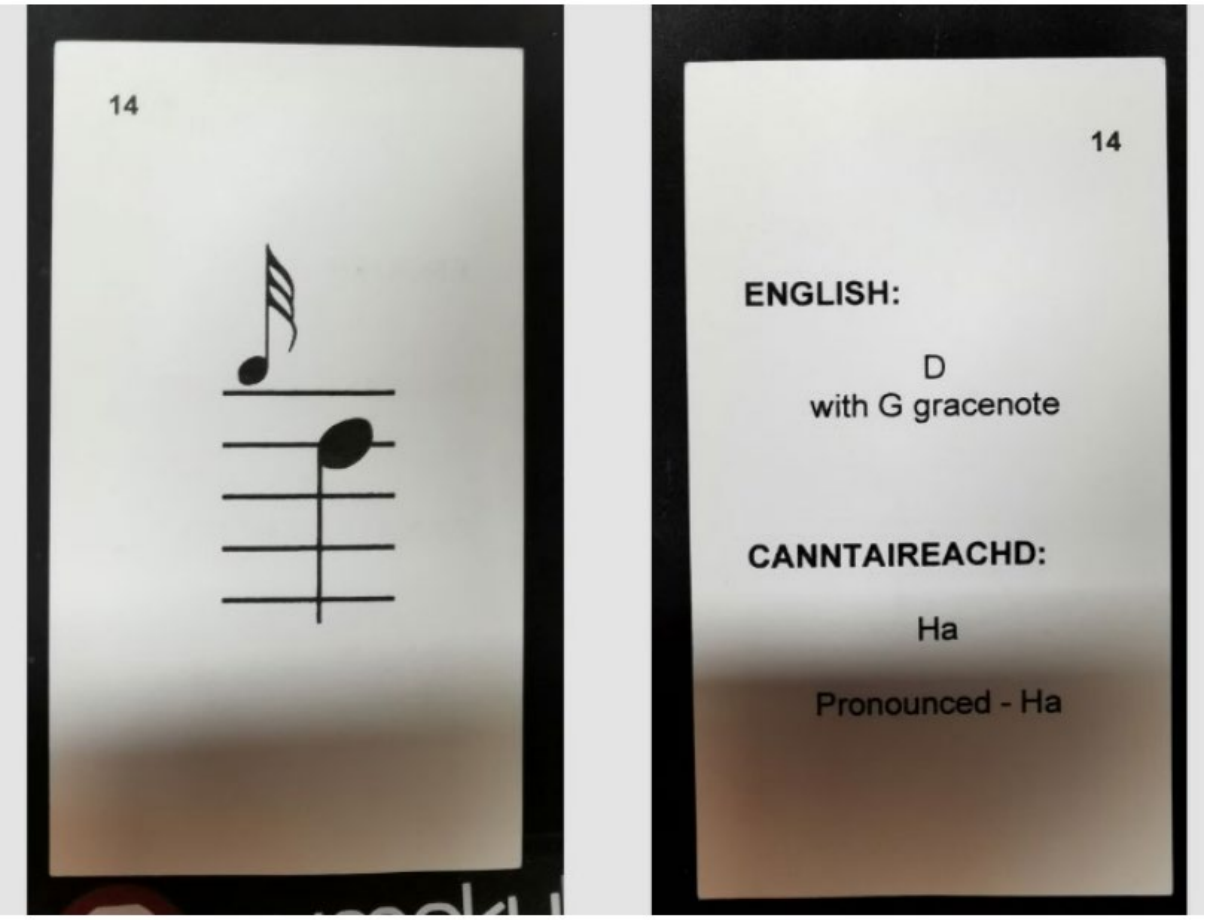

Figure 2.2 – Concept Design of the Application Notes – Poster/Adobe XD

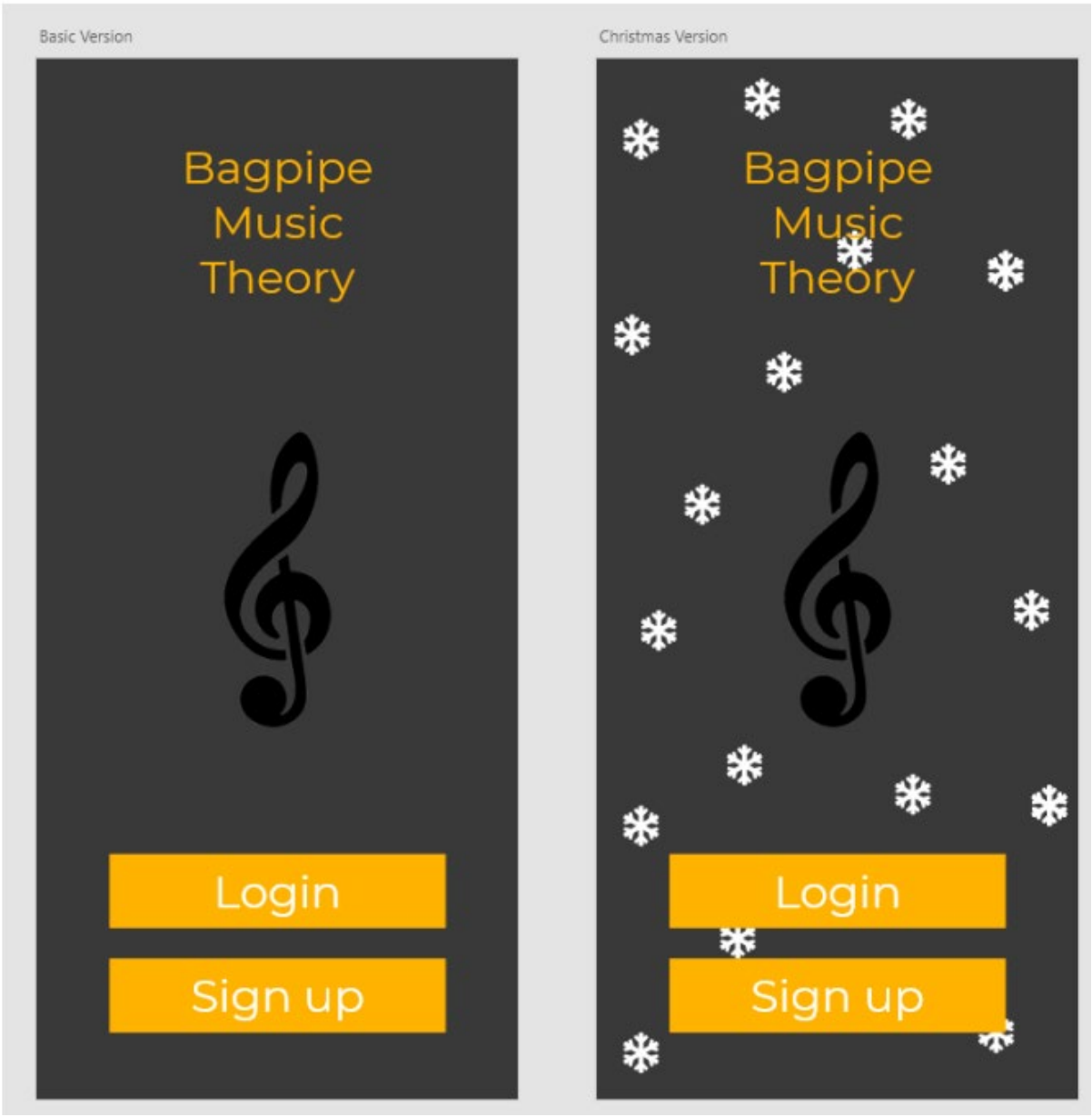

Figure 3.1 – Unity Description – Literature Review

3.1.6 Unity

Unity is development software that allows for the creation of 3D and 2D games and apps, with the ability to utilise C# scripting for implementing game styled scenarios and systems, creating environments as well as the structure of the game and importing multiple icons, character models or sound scripts allows for ease of use and effective implementation. Creating an application that can be used on multiple devices is important to ensure this music application can be accessed globally. The application will be fully created using Unity while all the resources from other software will be implemented, Unity will create all the functionalities, playability and display the full creation of the application. Flexible development that allows developers to create applications and games for multiple platforms from Windows and Xbox to Oculus Rift and iOS. Allowing for cross-platform development, access to create and develop high-quality graphics for all systems. When creating any application or game with this software issues with potential lag or crossing between different foundations can result in difficulties when creating any application. Unity will be the main application in creating the intricate eLearning application for this Bagpipe Musical Theory project.

Figure 9: Unity used for creating games and applications[9]

Figure 4.1 – Part of the Ethics Form - Ethics Form

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STUDENT PROJECT ETHICAL REVIEW (SPER) FORM

The aim of the University's *Research Ethics Policy* is to establish and promote good ethical practice in the conduct of academic research. The questionnaire is intended to enable researchers to undertake an initial self-assessment of ethical issues in their research. Ethical conduct is not primarily a matter of following fixed rules; it depends on researchers developing a considered, flexible and thoughtful practice.

The questionnaire aims to engage researchers discursively with the ethical dimensions of their work and potential ethical issues, and the main focus of any subsequent review is not to 'approve' or 'disapprove' of a project but to make sure that this process has taken place.

The *Research Ethics Policy* is available at
www.intranet.rgu.ac.uk/credo/staff/page.cfm?pge=7060

Student Name	Lewis Maitland
Supervisor	Yang Jiang
Project Title	Bagpipe Music Theory App
Course of Study	Musical Theory Education
School/Department	School of Computing

Part 1 : Descriptive Questions			
1	Does the research involve, or does information in the research relate to:	Yes	No
	(a) individual human subjects	X	
	(b) groups (e.g. families, communities, crowds)	X	
	(c) organisations	X	
	(d) animals?		X
	Please provide further details:		
	The research will target all audiences who either have an interest in learning the bagpipes or are returning users to learn music theory. Organisations that could get involved with the final product may include schools, universities, or bagpipe bands/schools.		
2	Will the research deal with information which is private or confidential?	Yes	No
			X
	Please provide further details:		
	The Application will only hold a username and password, as it will need the user to sign in to have an account, this will be an option, or they can sign in as a guest. However, their progress may not be kept.		

Figure 4.2 – Agile Methodology

The chosen methodology that will be incorporated into the project is Agile, focusing on the key components that allow the project to continuously develop. This methodology allows for the designer to continuously update the project plan accordingly if required by following the steps shown in Figure 14 below. These steps include

- Plan – In this section, all planning stages of the project are implemented, with objectives for each stage of the Agile cycle to achieve;
- Design – Creating all templates, documents and prototypes will be required in this stage of the Agile methodology;
- Develop – Implementing all the design aspects to create the application will be required in this section;
- Test – At each stage of development, any new function would be tested using the techniques discussed;
- Deploy – Within this stage, this would either add the new functions to the existing developed application which at this stage would be live in a testing phase;
- Review – At the end of each cycle all elements of the project would be evaluated and reflected, any unachieved work would be noted and if the project needed to repeat the stages, then the cycle would repeat;
- Launch – Once the application has met its requirements it will be complete and launched into the online market.

Each cycle will repeat if design or development changes, as this methodology focuses on quick and efficient work that can provide extensive feedback from clients and testers. These stages are reflected in the Gantt Chart as they main headings to highlight the importance of the project.

Figure 5.1 - Poster

Bagpipe Music Theory Application Prototype

Online Platform Friendly, teaching made easy!

Lewis Maitland & Yang Jiang

Introduction

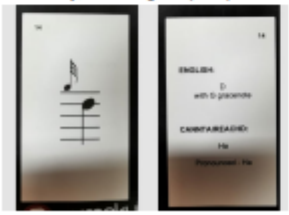
Everyone wishes to learn, whether it is a new language, new skill or something that would boost their ability to live their life better. Applications were developed to enhance this need for online learning of new languages and learning musical instruments for the following, English, French, German or Guitar, Piano and even Singing. Focusing on individual words, phrases and notes. One instrument, which is fairly popular around the world, which does not have a huge online Prescence as stated "it is simplify too difficult to fully learn online".
Bagpipe Music Theory.
From the complicated language surrounding it of Canntaireachd, change of key from other instruments and even time differences with multiple embellishments, which all can be played from 9 notes. Only passed down from generation to generation, teacher to student, the Musical Theory of Bagpipes is a tricky subject for beginners and experienced players which is hard to master. This application/game will fill the online gap in the market to bring a simple guide to learning Bagpipe Music Theory.

Project Aim

Creating an application/game that allows users to effectively learn Bagpipe Music theory. From the complicated singing method of Canntaireachd, a form of how bagpipers would learn their music. As well as, learning sheet music through continuous learning, compared to flash card learning.

Methods

Within the building of the application, the steps to building and achieving this goal was to create a simple platform based on a Flash Card method used to teach for generations. This method, was incorporated into the process of learning each individual not one stage at a time, then practicing each not continuously, with the given prompts.



Figures and Results

On further testing of the application, various survey's were carried out and send across the world. These were ANOMONUS to ensure that the individuals data was safe. The information from these surveys allowed the development of the application to continue, prioritising what was suggested by the participants in relation to what was said about similar applications.

All survey questions and answers will not be shown here due to GDPR reasons and for quality control. Based on comments made by the Users on other applications, all comments were derived by the importance of colour theory, design choice, clarity in pronunciation and the depth of field in how the application can verify how it achieve success. From the way of teaching individuals and their own teaching styles, to giving clear instructions to individuals who need extra assistance.

As a result of the continuous development of the application, design structure, sound production and video quality has allowed the application to reach all new heights. The development from basic elements using Adobe XD to now the key components in Unity 2D games/application development, has ensured that the product will maintain its standards. Therefore, will ensure that the aim of creating an application to teach individuals how to learn musical theory will be a success.

The design of the application, how it currently works within the testing phases reflects on the research taken from the comments of both the participants from the surveys and continual development based upon the literature review. Full focus on the way the application has been developed and whether it will work for the target demographic and target audience, currently still in it's beta stage, the application will allow users to enjoy the simplistic teaching style of learning Musical Notation, Theory behind the music and the complicated language of Canntaireachd.

The ability of choice is a key factor raised in the research and survey questions for the application. Allowing users to chose how they can be taught, toggle between classes and continually learn to either improve their score or build there own confidence up which is the main purpose of the application.

Conclusion

The full application, is currently in a beta stage of both development and design. With creating the application, so much time was needed to research the best possible way to both test and create it. Since, similar applications about language learning development exist in the market. Ensuring that the design, sound and game style is different from these similar applications, extensive research was needed. This application will continuously evolve through time, to ensure its users can feel more involved with the application and gain more interest into the meaning behind it. Features will include, links to social media and themes surrounding different holidays.

Acknowledgments

The game is still in development and will be until the right amount of development is needed for the application to work globally. As in, ensuring that the application works with different Languages, cultures, and other pipe bands. The designs and sounds implemented in the application may be edited or changed varying on design trends and appealing to other companies, schools or pipe bands. All sounds, designs and elements were created and implemented as their own unique elements, created for the purposes of this application.

References

All Images are created for the application based on Trial Phases and Design stages of the application on Adobe XD. All images are based on the current design trends and may not be fully displayed in the main game.

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Figure 5.2 – Adobe After Effects – Literature Review

β.1.2 Adobe After Effects

Adobe After Effects software creates videos using drag and drop methods capable of creating high-quality videos. At the end of the project, a video displaying the completed application will be created using After Effects, highlighting the main functionality of the bagpipe music theory application. Also creating multiple short introduction videos used as tutorials on the application itself and creating advertisement friendly videos used to promote the product for the global market. These tutorials will demonstrate to the student the position of the fingers on the practice chanter and recreate the sound of a particular note or embellishment. As this software is run by Adobe, After Effects can achieve complex editing, use plugins that would elevate the video and have a multitude of helpful tutorials online which can accommodate any project. However, this software can run into RAM, Random-access memory, issues due to the size of any project; may cause crashes as per the size of the project or difficulties with other plugins. Videos of the final design and pitch for the project will be created using this advanced software.

Figure 5.3 – Adobe Media Encoder – Literature Review

3.1.5 Adobe Media Encoder

Adobe Media Encoder is a software that is needed to extract and encode video files, used for partnering software such as Adobe After Effects or Adobe Premiere Pro, as well as uploading videos and changing their format to images, mp3 or gifs. Media Encoder will allow for bagpipe videos that will have a high quality of sound and performance format to change from mp4 to mp3 while ensuring that any completed videos created in supporting software can be created. Other videos can be converted into still images, this would generate multiple high-quality images taken from each frame in the video. Therefore, images of a bagpiper marching can be cut out of the video and implemented into the application as an image. This software is free with the pairing software as mentioned, this allows for ease of use, steady process and allowing multiple files to be converted at one time. Rendering can cause an issue with how long this may take to implement; to ensure the maximum quality, speed, and potential of the software the developer's hardware must be high end. In function with Adobe After Effects, this software will be required to ensure video formatting is successful.

Figure 6.1 – Introduction of Literature Review

1. Introduction

1.1 Introduction to applications

Applications have been a modern solution to an ever-growing and developing society with unique problem-solving characteristics, from games to learning. This invention has capitalised on the global market allowing users to be entertained, learn a new language, create, and share new ideas across social media. The Covid Pandemic created a surge of new applications due to more people working from home and self-isolating as required by governments to keep people safe. Therefore, a spike in internet usage has increased by "between 50% and 70%"(Beech, M. 2020)[1] during the Covid Pandemic, with "184563 apps released in the time window of July 2019-May 2020" (Samhi, J. Allix, K. Bissyande, T.F. & Klein, J. 2021)[2] in Google Play alone. With a focus on education and health, demand for new and intricate learning applications is required to create an online approach within this Covid World.

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This methodology is beneficial to its overall success, as stated by Existek 2019, "Complex and sophisticated apps will need 40+ weeks of development depending on the scale of the project and ambitions of the business" [3] (see Figure 1). Applications are therefore built to be relevant and reliable sources of information, promote operability, and maximise intelligent interface.

Figure 6.2 – Introduction of Bagpipe Music Theory – Literature Review

1.2 Introduction to Bagpipe Music Theory

Music theory is one of the main concepts in learning any musical instrument. Music breaks down into two components, practical and theory. In practical teaching, an individual will be shown the instrument, how to play it, hold it and start the learning process. Music theory (or music notation) is the written form of music and is essential to allow the player to create, perform and learn effectively. With the complexity of learning bagpipe music theory, students will need to learn the main components of music notation and how to pronounce, read and recognise each note and embellishments using Canntaireachd (pronounced – "can-ter-acht"). Earliest published a tutorial on bagpipe music theory was "as early as 1760"(Bissell, C. 2017)[2] using a complex language within bagpipe music, Canntaireachd the earliest method of teaching bagpipe notation.

1.3 Concept idea – Old vs New

The dynamic of creating a new bagpipe music theory application will create multiple paths for the bagpiping community. Pre Covid, most instructors would teach music theory in person, either at a school or face to face, allowing for interactive and immediate communication between teacher and student. This style of teaching has been passed down through generations, ideas for revolutionising learning musical theory included flashcards which one side of the card would have the note as presented on sheet music, while on the other side the name of the note(s) would appear and pronunciation for that note in Canntaireachd. The application would recreate this flashcard technique and become available

Figure 6.3 – Conclusion of Literature Review

5. Conclusion:

Post-Covid, there has been a transition away from traditional learning techniques of the bagpipe. Instructors have been forced to teach remotely which has reduced the quality of teaching, particularly musical theory. There is currently no eLearning application available which covers music theory remotely. This literature review has identified a significant opportunity to create an application that allows students to learn complex bagpipe music theory without the need for one-to-one teaching in a safe environment. This concept can be expanded and possibly become a benchmark for other musical instruments as the world progresses towards a seemingly more digital and online world.

This project focuses on the creation of a Bagpipe Music Theory Application, the design process is key for its continual development. The software covered in this literature review is beneficial in creating an intricate application designed for a Covid world since this software is simple to use with free tutorials online that will provide clarity when designing and developing. In the application development phase, the software allows the developer to create an intricate application, exploring the themes that were covered in this literature, which in turn will create an interactive and engaging experience.

This literature review has created a dynamic overview of what is possible within the bagpipe industry, allowing for newer techniques to emerge as the push for more online orientated methods are in demand. Within this project, an application allowing students to learn music notation and Canntaireachd will be developed and will continuously test their knowledge. Continuing the passion to learn, inspire others to develop similar applications to advance the industry, connecting more people who need the support. With the creation of this application and the project has been completed, continual work of this application will continue to add more content and become more popular within the community. Sparking a new online development platform, growing the bagpipe world.

Appendix 1: Ethics Form

Appendix 2: Literature Review

Appendix 3: Poster

Appendix 4: Project Proposal

Appendix 5: Project Requirements

All appendices are in the GitHub Folder.