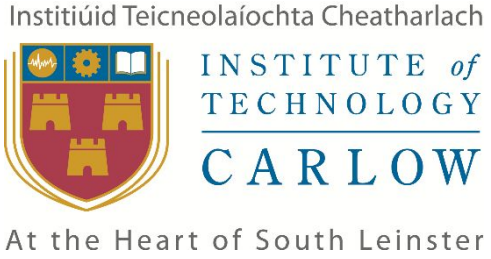

Computer Games Development

Research Report

Year IV

DION BUCKLEY

C00220868

May 03rd 2020

Faculty of Science

Department of Computing and Networking

Open-Book and Remote Assessment Cover Page

Student Name: Dion Buckley

Student Number: C00220868

Lecturer Name: Philip Bourke

Module: Project II (Games)

Stage/Year: Final

Date: 02-05-2020

Declaration

This examination/assessment will be submitted using GitHub/Google Drive as the online submission tool. By submitting my examination/assessment to GitHub/Google Drive, I am declaring that this examination/assessment is my own work. I understand that I may be required to orally defend any of my answers, to the lecturer, at a given time after the examination/assessment has been completed, as outlined in the student regulations.

Contents

Acknowledgements

I would like to thank the following who assisted in completing this project including;

My supervisor here at I.T Carlow, Dr. Joseph P. Kehoe, the rest of the faculty and students tied to this Erasmus+[1] project for giving the opportunity to get involved in such a fantastic opportunity and finally Dr Alfonso plus medical associates for starting the project over a year ago, without this initial kick the product could never have been produced.

Project Abstract

Gamification[2] is increasingly present in the world of mobile application development, more specifically mobile health applications, and this study has explored this statistic attempting to find a correlation between gamification elements and engagement [in app]. This stated in theory that increased engagement with the material would lead to the encouraged behaviour change needed on the project.

Unfortunately due to the recent Covid-19 pandemic the planned study could not go ahead leaving the results of the proposed study as of yet undetermined. However there is a clear plan in sight and this study will look to be picked up by another group next year all going well. Regardless of this fact research has been done and in spite of the delayed results a tentative conclusion can be made (through something akin to a **meta-analysis** of the relevant literature);

While current research in this field (mobile health[3], or mHealth, and gamification) is still somewhat limited (Edwards et al. 2016) we are on the way towards proving gamification to be of significant use in this context;

Gamification has an impact on user engagement in mobile and mobile health apps alike (Edwards et al. 2018). Definitive potential exists for gamification to bridge the gap between mobile health and gamification (Cugelman 2013) and we have already seen gamification elements showing improvement in the similar area of online well-being interventions (Kelders et al. 2018)

[1] http://erasmusplus.ie/

[2] Gamification is the application of game-design elements and game principles in non-game contexts.

[3] Mobile Health, or mhealth, is the practice of medicine and public health supported by mobile devices

Project Introduction and Research Question

This project was chosen for two reasons. Firstly due to it being at the forefront of study into the effectiveness of gamification[1] techniques on long term behaviour change. Viewed here through measuring engagement on a health app and relating that to behaviour change eventually leading to dietary compliance. Leading into reason two; the potential positive impact these findings could have on the lives of struggling coeliac[4] patients.

The overall project was in fact started over a year ago by Dr. Alfonso and the Erasmus+ team. Their goal was to combat the persistent problem which teenage coeliac patients face in struggling to comply with the strict gluten free diet (Roma et al. 2010).

With a clear problem in sight and the only solution being dietary compliance of the patients the team set out to build a health app. The effort here being further education of the patients giving them the tools they need to ultimately help them take better care of themselves and manage this painful affliction.

So, what is aimed at this year is to take the previous work forward seeing if a way can be found to get the patients to engage with this overall health app so that eventually they can have a chance to stick to the all important and strict diet in the long-term.

However, only one element can be focused on in this scope and so what will be done is that some of the best proven gamification techniques will be used in hopes of increasing these patients engagement with the knowledge portion of the app, allowing them to deepen their learning and hopefully start to build a deep behaviour habit of diet compliance.

Research Question (Gamification): Will we see a positive change in engagement from teenage coeliac patients using a quiz after the addition of gamified elements to the quiz?

[4]Coeliac, or celiac, disease is a life-long disorder that adversely affects the small intestine and bones.

Background

Current research in this field (mobile health, or mHealth, and gamification) is still somewhat limited (Edwards et al. 2016) as these are emerging technologies and techniques. But this

research seems to be pointing in a clear direction that yes, gamification does have an impact on user engagement on mobile apps and mobile health apps alike (Edwards et al. 2018).

Now while we are still a long way away from being able to draw a clear correlation between gamification and long term dietary compliance, the current literature does still show a definite potential for gamification to bridge this gap (Cugelman 2013) and we have already seen gamification elements showing improvement in the similar area of online well-being interventions (Kelders et al. 2018)

Literature Review

(Cugelman 2013)

In an overview, this paper does three things. It provides insight into gamification and long term health behavioral change principles, mechanisms and efficacy all from a behavior science perspective.

Next the relationship is explored between frameworks of gamification and those of behaviour change outlining how these are used in the health sciences. Then proven principles for health behaviour change technology are shown to be related quite closely to those used in gamification.

Finally the paper outlines criteria for assessment of potential provided from a gamification framework when used in digital health interventions.

Apart from those primary focuses the paper also outlines how buying too heavily into the hype of gamification can lead developers to implement gamified elements without actually understanding the fundamentals of why these additions could be helpful therefore leading to over saturation of gamified apps which likely did not need to be gamified at all.

Study

Qualitative & Quantitative studies must be done as there are not enough subjects to get solid Quantitative results alone. For the qualitative study we can do that before and after the twenty one day test and will be a questionnaire designed by the health students who are also on the

project. It will essentially ask the subjects how they felt they did, how much they think they learned etc. This all helps to set up in a way in which we can clearly isolate one metric - the effect of gamification on engagement.

To achieve this we will have two groups. Firstly a control group which will be made up of subjects with coeliac disease. The quiz given to this group will not contain any gamified elements. Then there will be a group made up similarly with one major difference. They will be given the quiz with the addition of gamified elements. Both groups are to be tested both before and after the quiz using the qualitative method described above. This will be the most sure way to measure the effect which gamification holds over engagement.

It later came to my attention that we may not exactly have enough participants in the study to test them the way I have outlined above - which would be the best way for me to isolate the metric I'm lookin for. So if we have enough we can split them into groups and I can go ahead otherwise I will need to accept a more broad test and tweak my study to get the best results in that case - this turned out to be irrelevant anyway due to **Covid-19.**

Project Description

The finished product delivered was a native mobile application working on both android and iOS with sections relating to a gamified quiz, resource management with potential real world impact along with a video player using native controls.

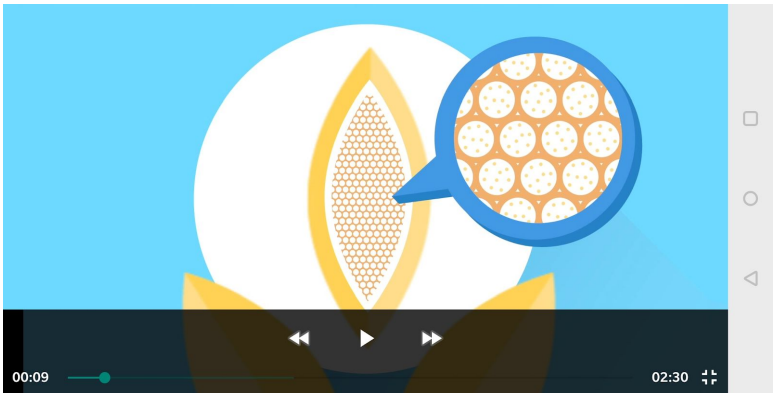

Figure 1 (left): Gamified quiz splash screen showing fuel ready to use as a streak booster

Figure 2 (above): Landscape mode on the video player

The final product matches the spec and design quite closely (at least what things were mentioned from the beginning from all involved with the video player as my main push to be added since day one, thequiz being added and gamified along with some coin / badge system used to purchase and use rewards. All of which made it into the final application.
Some parts of the plan did not make it all the way however. For example using my persisted data (which is used for the coins in the final app) to also log user metrics like login frequency day by day and also use the coin rewards in tandem with this.

Figure 3 (left): Showing potential real world impact for discount using my gamified coins

The reason for this is mostly due to time and also due to the pandemic eliminating the possibility of testing, therefore the user logged metrics taking lowest priority after that point coming into the final stretch.
Other changes were my own personal design preferences taking precedence over the suggested design provided by the Austrian students during the Amsterdam week (reference SRS). While I did use the quiz logo they produced and the overall experience was of great benefit I ultimately designed the app in a more simple and appealing way to myself.
Some of my technical and personal learning / achievements were personal growth due to working as part of this larger team, cooperating and participating in workshops and meetings. Along with a huge bump in my technical portfolio for interviews and all the rest due to having this massive front end React Native project to talk about. Not to mention even the strength this adds to my overall developer skill set.

Project Milestones

The project schedule was adhered to with effective plans for delivery tracked using this format (reached after multiple drafts with supervisor), updating week by week:

▲ Current timeline location ⊡Deliverable ↘/→/↓ Process ⊡ Milestone

Week Begins	Intro	**Draft proposal**	Approved	Spr 1	**Draft research**	Spr 2	**Draft SRS and TDD**	**First code demo**	Ams. week	Spr 3	**Play-test**	Spr 4	**Draft reports and videos**	**Final code**	**Industry day, final docs and videos**	**Presentation & Demonstration**
Sep 11	↘															
Sep 23		⊡⊡														
Sep 30			⊡													
Oct 7				↓												
Oct 14				↓												
Oct 21				↓												
Oct 28				↓												
Nov 4				↘												
Nov 11					⊡⊡	↓										
Nov 18						↓										
Nov 25						↓										
Dec 2						↓										
Dec 9						→	⊡⊡	⊡⊡								
Dec 16																
Dec 23																
Dec 30																
Jan 6									⊡	↓						

Week Begins	Intro	**Draft proposal**	Approve	Spr 1	**Draft research**	Spr 2	**Draft SRS and TDD**	**First code demo**	Ams week	Spr 3	**Play-test**	Spr 4	**Draft reports and videos**	**Final code**	**Industry day, final docs and videos**	**Presentation & Demonstration**
Jan 13										↓						
Jan 20										↓						
Jan 27										↓						
Feb 3																
Feb 10																
Feb 17																
Feb 24																
Mar 2										→						
Mar 9												↓				
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Apr 6																
Apr 13																
Apr 20												↓ →				
Apr 27												↓ →				
~Apr 29												↓ →				
Apr 30												↓ →				

Results and Discussion

N.B: Unfortunately due to the Covid-19 pandemic the planned 21 day challenge was unable to go ahead as planned on March 1st or any other date thereafter during the remaining academic calendar. However I was suggested by my supervisor to state that the original study as shown here was in fact outlined with a clear plan and goal in sight and should be considered as an extreme circumstance meaning another high level study could not be produced within the new timeframe.

Project Review and Conclusions

If I could start over I would prepare a backup study for extreme cases as we find ourselves in today so that I can ensure at least some results failing in person testing. Also I would manage time a little better, doing more incremental additions to the project daily rather than having the finish so much near the end.

What went most right was clearly the Erasmus+ side of the project, meeting students, faculty and even medical practitioners from all over Europe for two whole weeks of fantastic workshops. This really helped to open my eyes.

What went most wrong would have to be the pandemic hindering the well planned study, halting me from getting to test my proposed research question.

For someone attempting a similar project I would say find someone who really knows React. A newer technology like this can be so volatile, difficult to find up to date or essential information and all the rest. If you have someone around who can point you quickly in the right direction it would speed up the technology delivery tenfold.

For the type of project this was, larger team projects all working on individual elements to come together into a larger application I think having the shared React Native frontend and shared backend was definitely the right technology choice, allowing us all to share over components easily and learn together also. The implications however were that we did have to work extra hard to bugfix when certain newer versions of npm packages introduce complex bugs that you wouldn’t struggle with building a game in C++ for example.

My own personal findings from the research side relate to clarification on the benefits of gamification. For example the higher likelihood of user engagement and therefore compliance in important matters such as Coeliac diet. Also I have seen the pitfalls of overusing gamified techniques without suitable use cases; i.e oversaturation of an app. Someone to take up the mantle on similar project here should really look into more conclusive research however on the effects I mention here of gamification as some of my findings are tentative at best.

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Cugelman, Brian. 2013. "Gamification: What It Is and Why It Matters to Digital Health Behavior Change Developers." *JMIR Serious Games* 1 (1). https://doi.org/10.2196/games.3139.

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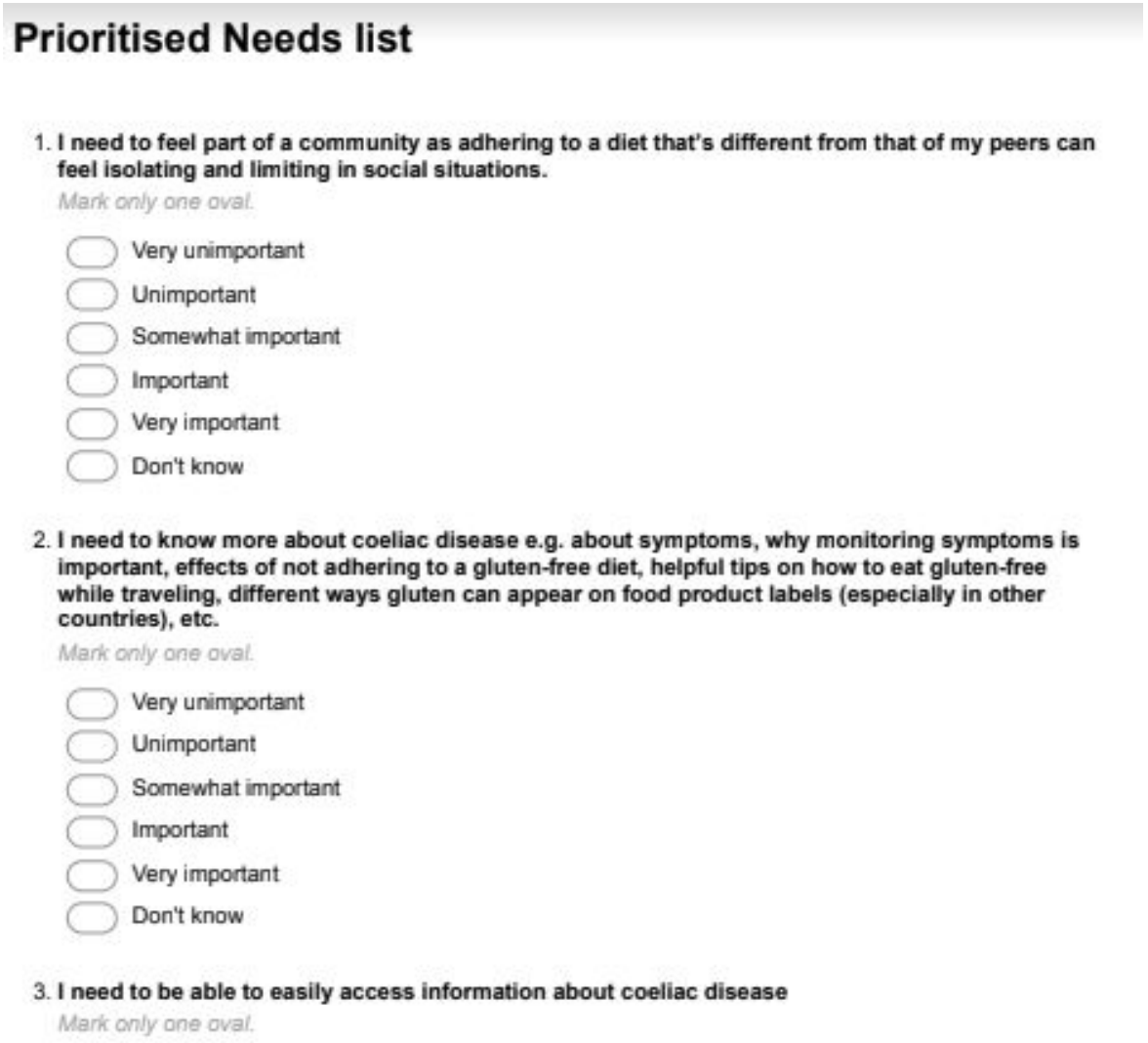
Appendices

Below we can see a shot from the prioritised needs list put together by the I.T Carlow health students; Rachel Shaw and Kaitlin Morris, from data collected by all of us at the empathy needs workshop and thereafter, as you can see (along with all their other work - including feedback and comments from **all of us -** relating to this project and the questionnaires) here



Prioritised Needs list

1. **I need to feel part of a community as adhering to a diet that's different from that of my peers can feel isolating and limiting in social situations.**
   Mark only one oval.
   - ◯ Very unimportant
   - ◯ Unimportant
   - ◯ Somewhat important
   - ◯ Important
   - ◯ Very important
   - ◯ Don't know

2. **I need to know more about coeliac disease e.g. about symptoms, why monitoring symptoms is important, effects of not adhering to a gluten-free diet, helpful tips on how to eat gluten-free while traveling, different ways gluten can appear on food product labels (especially in other countries), etc.**
   Mark only one oval.
   - ◯ Very unimportant
   - ◯ Unimportant
   - ◯ Somewhat important
   - ◯ Important
   - ◯ Very important
   - ◯ Don't know

3. **I need to be able to easily access information about coeliac disease**
   Mark only one oval.