

Educational Cycling Game for Younger Audience

Final Year Project



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# ABSTARCT

# ACKNOWLEDGMENTS

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# INTRODUCTION

## Problem Definition

According to statistics (Ukie, 2018), more than 32 million of the United Kingdom residents regularly played video games in 2017, making UK the 5th largest game market in the world. Children form a significant part of this phenomena. 66% of 8-11-year-olds play console games at home on weekly basis (Statista, 2018) and even more participate in PC and mobile gaming (Prigg, 2014).

It is debatable whether playing video games has positive (Chuang & Chen, 2009) or negative (Skoric, et al., 2009) impact on children, however criticism often stresses that gaming prevents children from getting “enough active play and exercise” and negatively affects “how well kid does in school” (Kids Health, 2014).

The aim of this project is to combat these stereotypes and use gamification in order to improve both activity level and school results of children. A successful prototype must be a fun to play video game demo, which provides exercising opportunities and learning outcomes.

## Scope

The project will not focus on maximising physical benefits, but rather use exercising aspect to increase engagement and concentration among players. Cycling hardware will be used as the main interface due to its availability at the university.

The success of the project will be determined experimentally and at this stage will not involve testing with the focus group. The assessment criteria will be obtained via a literature review. The game will be aimed at Year 4 school children.

# METHODOLOGY

## Tools

The research utilises both hardware and software tools.

#### Hardware

The set of hardware equipment consists of a mini exercise bike (Oypla, 2018) and a sensor with appropriate SDKs (Cyberbiking, 2016). Available output includes pedalling information of going forward, but not backwards. Controller, mouse or keyboard can be used in parallel with the sensor.

The mini cycle has a display which shows key workout data, such as …. . This data cannot be accessed by software due to the sensor’s limitation but can be used during life testing to obtain information about physical activity level during the play. The mini cycle allows manually modifying the resistance to make cycling harder or easier. Resistance cannot be changed via software.

#### Software

This set of hardware was chosen due to its availability at university.

The game demo is developed in Unity3d (Unity 3d, 2018) utilised the 2D framework (Unity 3d , 2015). All the scripts are written in C#. Visual Studio 2017 (Visual Studio, 2017) was used as an IDE.

In addition to programming software, Adobe Photoshop (Adobe, 2018) was used to create some of the visual assets for the game. Throughout the development GitKraken (Axosoft, 2018) was used as a source control.

## Process

As shown on figure Blah there are six main elements of the project development, which can be divided into three stages: research, planning and implementation.

Literature review

Design

Modify plan

Implementation

Testing

Refactoring

Bug testing

Alternatives,

Suggestions,

Clarification

*Research stage*

*Planning stage*

*Implementation stage*

Design testing

The research starts with the literature review, which helps to identify best practices and approaches of creating an educational exercise game for children. All the literature findings are reviewed during the planning stage. It starts with the design so that the changes of the game concept, mechanics, goals, and other components are decided. After the design was modified, the plan needs to be adjusted with regards to deadlines and available resources.

Once requirements are clearly defined the implementation stage starts. The initial goal is to produce working code as quickly as possible, even if it means efficiency compromise or hardcoding. This approach allows reaching the testing stage relatively fast to examine whether the theoretical design solution works in practice. After the initial test the refactoring process starts to optimise the code. It is followed by another testing with the main focus being errors and bugs. At any point during the testing an extra literature review can be required. In this case the cycle starts over.

Top-down modular approach

Initially the problem was broken into smaller self-contained modules which were then broken again. This approach was synonymous with object oriented paradigm and unity component system.

Pretty diagram GOES HERE

ds

# RESEARCH

## Introduction

## Educational Games

This area covers a design of educational game and a possible connection between a game and school curriculum.

## Exercising Games

Research suggests that regularly playing active video games can result in positive effects on children’s overall physical activity level. (Cliona Ni Mhurchu, et al., 2008)

Active video games with narrative show greater physical activity than non-narrative games among 8-11-year-old children (Lu, et al., 2016).

## Games for Children

The elements of games that provide motivation include engaging graphics, onscreen rewards and progress feedback (Prensky, 2007).

Practice and feedback learning can be an excellent way of learning things that require lots of repetitive practice. This form of learning is often criticised for not being engaging with users. (Prensky, 2007)

Evaluation? – test appendix

A game rather than a learning app

What makes digital games so engaging?

They give us enjoyment and pleasure (fun)

They give us intense and passionate involvement (play)

They give us structure (rules)

They give us motivation (goals)

They give us doing (interactivity)

They give us flow (adaptive)

They give us learning (outcomes and feedback)

They give us ego gratification (win state)

They give us adrenaline (conflict, challenge, opposition)

They spark our creativity (problem solving)

They give us social groups (interaction)

They give us emotion(representation and story) (Prensky, 2007)

# DESIGN

## Goals

## Concept

The game consists of the two main scenes which are avatar creation and maths quiz.

Single player

## Backstory

Because narrative is essential (REF) there was an extra effort to develop an appealing backstory.

The game is aimed at 7-9 year old children to use at home or at school.

Key decisions were identified

Testing game (REF)

Maths – questions can be procedurally generated

## Avatar Creation Component

Fun part

Reward, motivation

## Maths Quiz Component

Maths

Inspired by student books

Questions are randomly generated

Code snippet (implementation?)

# IMPLEMENTATION

## Overview

* Unity
* C sharp

## Extensibility

* Avatar elements loaded
* Procedural question simulation

## Persistence

* Between scenes

# EVALUATION

## Prototype evaluation

The final product was analysed using an Activity Theory-based Model of Serious Games (ATMSG) to provide a comprehensive view of the structure of the game, including both its high-level purpose and concrete implementation. The original model was modified by adding an “exercise” category to match project’s goals. Figure BLAH represents the game sequence and implemented components. Table BLAH shows the way gaming, learning and exercising are integrated into the key stages of the game in a greater detail.

No

Yes

More rounds?

More

puzzles?

More

levels?

No

Yes

No

1. Main Menu

2. Avatar Creation

3. Puzzle

4. Reward

5. End of round

6. End of level

Anytime

Yes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Game Node | Gaming | Learning | Exercise | Comments |
| 1. Main menu | Standard game element. Provides access to options, credits, start of the game and exit from the application. | - | Player navigates through the menu by cycling from one option to another. This provides a warm-up prior to any gameplay. | Main menu is a safe place to adjust the equipment and ensure that player’s position is comfortable. |
| 1. Avatar Creation | Player creates a character by choosing elements from given categories, such as hair colour or face shape. Unlocking new elements requires spending in-game currency. Avatar is visible in later stages of the game. | Game simulates real-life shopping experience. Player has a limited amount of money and can choose how to spend it. Interface prevents players from purchasing items unless they have enough coins. | To apply a new element to the avatar, player must deliver it by bicycle. Bicycle moves as the player cycles forward. | Interest to avatar creation among children and teenagers is outlined by multiple researches (Kafai, 2009). |
| 1. Puzzle | Player answers a series of quiz questions. If the answer is incorrect, the player has to try again. | Puzzle after puzzle, player’s arithmetic skills are testes. Questions gradually become harder with each level. | The question is only visible if the player is cycling. If cycling is stopped, then the questions fades away. | Questions are procedurally generated, which aids replay ability. |
| 1. Reward | Correct answers open treasure chests which contain a certain number of coins and a quest item e.g. part of the map. Sound and visual effects empathise the importance. | - | - | Rewards vary depending on the player’s level. |
| 1. End of round | Chests change colour and become are harder to open, more correct answers are required. Player’s progress is saved. | Player is pushed to solve multiple questions at a time before taking a break. This is similar to test conditions. | - | Difficulty is increased via gaming rather than learning element. |
| 1. End of level | At the end of the level player is offered to level up by completing a special challenge. Player can choose when to do it. Successful completion grants great rewards and story progression. Background picture, music and the quest change. | After answering ten questions player is offered to complete a test. The same skill is tested as during normal puzzles, but the wording of the question is different. There is a 30 second time limit. If unsuccessful, the player can try again. | - | Wording of the questions is taken from the student book. REFERENCE |

There is a number of conclusions which can be made based on the ATMSG diagram.

Most of the game stages provide outcomes of different areas.

## Applications

Schools

## Future work

#### Persistence

The application can be expanded by introducing a database to save player’s progress and achieve persistence between gaming sessions. This functionality was a part of the project proposal, however after careful consideration, it was decided that implementation of this feature should become a separate independent research. Successful design must consider various computing aspects including security, authentication algorithms and server creation, which are not a part of my project.

In order to make future work simpler, all the information which must be persistent was separated into four classes. The result was tested by successfully keeping track of player’s progress after scene transitions.

#### Live testing

To obtain better results a testing with a group of children is required.

#### Next step

# REFLECTION ON THE PROCESS

# CONCLUSION

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# APPENDICES