

Project proposal - Using Video Games to help learning Key-Stage 4 Mathematics - Ethan Walton-Deaves

by Ethan Walton-Deaves

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Using Video Games to help learning Key-Stage 4 Mathematics Research Proposal

Ethan Walton-Deaves

(2005121)

Gordan Dickens

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1. Introduction

Learning mathematics through the medium of video games.

“Government statistics suggest that 17 million adults – 49% of the working-age population of England – have the numeracy level that we expect of primary school children.”

This is one of the reasons why I think that interaction between games and people will help.



For just under 50% of the working age in England cannot understand mathematics and this is a problem.

“For most young people, mathematics finishes with GCSEs. Unlike most other developed countries where the majority study maths to 18, only 13% of our young people study maths at an advanced level beyond 16.” [2]

“Workplace maths is embedded in specific roles, tasks and goals – it can appear trivial and non-mathematical” [3]

Mathematics can help in various amounts of ways in the workforce its everywhere so why cant we all just embrace it? In doing so I believe that a good understanding of mathematics at around key-stage 4 will help a person not just in there work but in there daily lives.

Games and gaming is a rapidly growing both in its own environment and its popularity. It is fun to play games , so why not take that fun aspect and combine it with learning.

My goal here is to create an interesting and interactive application which allows the user to embrace mathematics and learn though fun and quick games. In doing so hoping to keep the learner active in there learning of mathematics and getting them to keep on coming back. This is where my topic of study will help me as I have already have experience with creating a game using Unreal-Engine [6] as the software

In this project I will need to find and research other sources in order to back up my experiment aim for the creation of an application suited both for being fun and having learnable content inside Study it and collect data in order to specify if games help in teaching mathematics.
Produce these results and compare with other similar experiments.

The creation ,in this case my game, will in-tale a tutorial of how to do a the problems presented in the game the character then shooting the right target after given a equation. This will become faster until they run out of lives and there score presented. The Higher the score the better they are at the subject. The player must show his understanding and try to find the correct target.

2. Background to the Proposed Research

In the study of this topic I will need to look into two main branches.

Number 1 is video games in learning.

Number 2 teaching mathematics at Key-Stage4

When finding evidence about video games in learning I came across various different ideas , experiments and accounts of people trying this theory out.

“there is increasing recognition amongst academics and educators that games can provide challenging experiences that incorporate effective learning principles and sustained engagement. Teachers are now realising that they can harness the power of gaming platforms to promote student learning. “[4]

this topic sounds interesting because it sees that people are show to embrace gaming as a weapon for learning. There is a reason for this as

“ Gaming has been framed in popular media as harmful and addictive “[5]

This statement combined with the previous statement tells us that even though gaming is both popular and can be used in learning it is deemed bad since the main media finds video games as harmful and addictive.

Another reason why this topic is is exciting to do is the hope that this mindset about gaming can change from one of fear to one of learning and knowledge and creating games targeting adults in the workplace may show that games cannot be harmful when used in a setting of learning but on the contrary may help people instead learn more efficacy. Unlike other games that provide learning experiences my target is to provide players with knowledge of key-stage4 algebra. This way I can focus on one aspect and teach the user well unlike the broadness of other learning games in my category such as BBC bite size [7] or IXL Wales[8].

Another point is that in doing the game this way I can gain clear data from the test runs of the game after it is completed. The data will also clearly show if they improve based on time played but I will also do one extra step in my research. This is where they will be provided with a basic test before and the same test afterwards with there results being provided after the experience.

At the end of the project I expect to have clear indication whether or not the application worked.

I will also gain the data from questionnaires that will be asked after the results from the test are shown and I gain the data from the before and after tests. These can then be put into resulting statistics and finding primary results from those statistics.

I will be looking for an increase in test scores with playtime. I will also be looking at the questionnaire for user feedback to answer the question of the quality of the experience and what could be improved for future research which will be listed for any other research that helps others.

3. Aims & Objectives

Aim 1 -

Create a first person shooter application that uses algebra mathematics as a core aspect to teach key-stage 4 mathematics to adults. Then to evaluate what I find after the testing in whether or not video games help in teaching algebraic mathematics.

Objective 1

Research surrounding competition to note down features that can be used on order to improve my design

Objective 2

Research curricula for key-stage 4 mathematics and apply what I learn to inventing questions that can be asked in my application.

Objective 3

Research implementation of key features found in objective 1 using the software called Unreal-Engine[6] to develop these features as well as coding features of my own.

Objective 4

Using features in Unreal-Engine[6] develop objectives that a player must overcome when playing the game. This is the first build of the games layout.

Objective 5

Using research found objective 3 link those algebraic questions to my application so that overcoming objectives in my game will require players to solve algebraic mathematics questions.

Objective 6

Invent questions that are non bias and related to the core problem that I am addressing in this project. Also I will be develop a data extraction methods using the application I have created to produce results.

Objective 7

Produce my results on a simple way to understand and answer my question in if video games can help with key-stage 4 algebraic mathematics.

4. Project Design

Provide an outline of your project design, e.g. product development or experimental evaluation of a device or system

Firstly researching core features from the competition must come first as development of the game without features will prove to be a difficult challenge

After the research has been completed next is the start of development of the game.

Objective 1 and objective 2 -

Research surrounding competition to note down features that can be used on order to improve my design

Research curricula for key-stage 4 mathematics and apply what I learn to inventing questions that can be asked in my application.

These are both data gathering objectives where I must find details that I can add to my application. These details include learning about key-staged 4 algebra and its curriculum as well as finding already made applications that help with mathematics.

Objective 3 -

I will then use what I find and the knowledge from both objective 1 and objective 2 to design and develop a game that will help mathematics with adults. There is no data gathering or data out of this objective as its now the start of the building process of my application

Objective 4 and Objective 5-

These objectives do not have any data collection or data gathering as its main goal is to create the application

Objective 6 -

This objective is where I will start to create and gather data.

The first data gathering method is a questionnaire. It will be a two-part questionnaire and part 1 will include existing knowledge and experience of the mathematics and existing knowledge and experience of gaming as a whole. Part 2 will include mostly the same questions but be given to them after the experience with the application. There will be different questions about their experience with the application such as: was it fun? Was it too easy? What went wrong? Basic feedback question

The second data gathering method is a written test before and after the application experience. This will show a diverse number of questions that will need answering. Then once done the individuals will use the application that has been developed and once finished tested again. This should show the improvement from the time they spent playing the application.

These methods should allow me to find the answer to the question of can video games help in teaching key-stage 4 mathematics.

Objective 7 -

Data that I have gathered will be evaluated and data from these results will be produced and used to answer the question of my project

4.1 Outline of Project Process

Training – Coding language

I will be training in coding language throughout the year in lessons using c++. I will also talking with my tutor and they can give me tips or show me material that will help me in the coding program.

Self-study -

I will be studying c++ in my own time so that I can develop the necessary features for my application

Any development tools I use I must study so that I can operate them efficiently and correctly. I will always be learning about new features to overcome new obstacle in this project so keeping up-to-date with the software I will be using is a must

4.2 Data Collection

My main collection methods will be a questionnaire and a mathematical test.

Generalisability – Since my testing will be local my project will have only be able to cater to those small amount of people who want to try and learn mathematics. My target audience is

17 million adults [1] and at the early stages the testing will not reach anywhere near that target. However if taken further may be able to start reducing that number.

Reliability – Since my developed idea is built by me the only reliability problem is my bias. Any data collection I make must be unbiased and cannot try to sway the individual that is reading's personal view of the subject.

[9]

For example, the questionnaire must have enough questions so that the data I get will be clear and obvious to gain valuable data for my project.

Another point is having a consistent environment when testing individuals so that my gained data is not different when output onto my results. This will help in using tests and the questionnaire as everyone will get the same questions and timed so that everyone gets the same treatment

Validity – My project topic of find out if video games can help in learning mathematics and to do this, I will be using a questionnaire and a test. A questionnaire may have individuals answering with fake information however tin this setting people will want to try my application because it will allow them to improve themselves also part two of the questionnaire will show their improvement and that is the most important thing in this situation. This being the case any data I get though the questionnaire will help support validity.

The test will also help in my validity in that same way the questionnaire does as giving the individuals a test before and after will show raw results after interacting with the application as the test will test the new old and new knowledge before and after the interaction.

4.3 Data Evaluation

- How will you analyse the data/evaluate your results? What types of statistical analysis will be used? Firstly, I will have a prediction before I start the analysis stating what I think should happen. This prediction will be accompanied with graphs explaining the prediction.

I will also use descriptive analysis where I will state the obvious increase or decrease average values for highest rise per individual from first too second test. This means I will be test each rise in an individual scores comparing to pre interaction to post interaction taking that number and inputting it into the average. This should show me if learning though video games is working.

Using my prediction and my descriptive analysis should be evidence enough to see if my project was a success.

However, that is not all as in the questionnaire I will be asking for their experience with the interaction with the application. This data will show me if individuals enjoyed the application or not. This is important as future research may want to take this information and improve using it.

4.4 Risks & Limitations

- Identify risks/limitations/ethical/legal issues and ways that you might deal with those risks.

Risk 1 – headaches

preparations – time-based activity of 30 minutes and then a break will be enforced

Risk 2 – loss of paperwork

preparations – Any information must be secure, and password protected.

Any paper information put be immediately electrolytical recorded saved password protected and the paperwork must be immediately disposed of so no security beaches occur.

risk 3 – electronics and liquids

preparations – Prepare a drinks and food table where the only place in the room that food or drinks are allowed to be consumed will be near that table

5. Resources & Planning

5.1 Resources Required

5.1.1 Hardware Resources

Basic hardware -

Keyboard [11]— basic keyboard low price dose not matter as controls will not differ

Mouse [11] – basic mouse price low price the sensitivity can be adjusted after setup

Monitor[12] – Basic monitor that is big enough for people to see clearly. Set up so text is large enough to see.

Headphones[13] – basic headphones , earphone can work, adjustable head size for multiple individual uses.

Spare mouse[11] - basic mouse price low price the sensitivity can be adjusted after setup. In case of problems with the first mouse the testing may continue

Spare keyboard[11] - basic keyboard low price dose not matter as controls will not differ . In case of problems with the first mouse the testing may continue

Advanced hardware -

All the project needs can be done by this PC specs it is unknown that if the specs are lower if the project will work

Processor AMD Ryzen 5 3600 6-Core Processor 3.59 GHz

Installed RAM 7.95 GB

System type 64-bit operating system, x64-based processor

5.1.2 Software Resources

Computers -

Windows will be completely fine to use. I will be using Unreal-Engine[6] for the development of the application. I will be using Google Chrome search browser[10]for my research. I will be using excel programs to store any data and word to store any research information and there references.

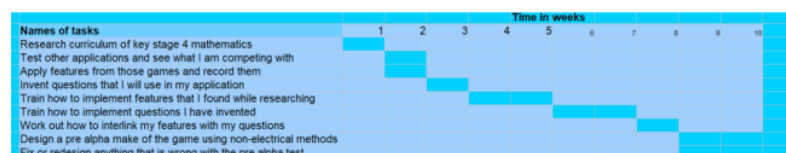
5.1.3 Other Resources

Non-electrical resources -

Any textbooks that I need to read in order to complete the development of my project. Any research papers/books/textbook I find will be transferred over to computer by searching the name of the books and finding the page online. Or if that fails scan in the necessary information so I can reference it in my research.

5.2 Planning Chart

Research planning chart



Development planning chart

List of tasks		Time in weeks																											
Create a list of features that I want to include in the application																													
Train for the implementation of the features																													
Implement features																													
Test feature (cheapest from top until list of features is complete)																													
Final Run-through of the application																													
Create a questionnaire to give participants																													
Create in part 1 and part 2 of the test																													
Create a spreadsheet that will record data																													
Begin testing																													
Record data from tests																													
Find results from the data received from the tests																													
Create documents that connect the data clearly and easy to understand																													
[1]		https://www.nationalnumeracy.org.uk/sites/default/files/documents/nn124_essentials_numeracyreport_for_web.pdf																											
[2]		https://www.researchgate.net/publication/343796328_The_Employment_Equation_Why_our_young_people_need_more_maths_for_today's_jobs																											
[3]		https://www.educationandemployers.org/research/6465-2/#:~:text=Maths%20in%20the%20workplace%20is%20never%20used%20in,workplace%2C%20different%20mathematical%20topics%20are%20applied%20in%20parallel.																											
[4] [5]		http://gettingsmart.com/wp-content/uploads/2013/05/edMangahigh_exec_report.pdf https://www.unrealengine.com/en-US/unreal-engine-5?utm_source=bing&utm_medium=Performance&utm_campaign=an*3Q_pr*UnrealEngine_ct*Search_pl*Brand_co*UK_cr*exact&utm_id=398466224&sub_campaign=&utm_content=existing&utm_term=unreal%20engine																											
[6]		https://www.unrealengine.com/en-US/unreal-engine-5?utm_source=bing&utm_medium=Performance&utm_campaign=an*3Q_pr*UnrealEngine																											

	_ct*Search_pl*Brand_co*UK_cr*exact&utm_id=398466224&sub_campaign=&utm_content=existing&utm_term=unreal%20engine
[7]	https://www.bbc.co.uk/bitesize/topics/z4f3cdm
[8]	https://uk.ixl.com/standards/wales/maths/year-10
[9]	https://www.questionmark.com/six-tips-to-increase-reliability-in-competence-tests-and-exams/#~:text=Here%20are%20six%20practical%20tips%20to%20help%20increase,weed%20out%20ambiguous%20or%20poor%20performing%20questions.%20
[10]	https://www.google.co.uk/?gws_rd=ssl
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[12]	https://www.amazon.co.uk/LG-Electronics-Monitor-22MP410-B-21-45/dp/B0B1J6KC7J/ref=sr_1_12?crid=UAH7E5YN7XYT&keywords=monitor+pc&qid=1666279338&qu=eyJxc2MiOiI2LjM1IiwicXNhIjojNS43NCslnFzcCl6ljQuODcifQ%3D%3D&srefix=monitor+pc%2Caps%2C81&sr=8-12
[13]	https://www.amazon.co.uk/EKSA-Headphones-Microphone-Comfortable-Computer-Red/dp/B09Y19G5ZR/ref=sr_1_4?crid=1ZG77SEHU70DG&keywords=headphones+pc&qid=1666279378&qu=eyJxc2MiOiI1LjYzIiwicXNhIjojNS40MilslnFzcCl6ljQuOTkifQ%3D%3D&srefix=headphones+pc%2Caps%2C65&sr=8-4

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GRADEMARK REPORT

FINAL GRADE

65/100

GENERAL COMMENTS

Instructor

Ethan,

Your proposed project is reasonably well defined and you have identified some clear goals. The motivation for the project is clear and supported by evidence - well done. Your discussions could be helped by, perhaps, including linking sentences between paragraphs and on occasion expanding upon a statement. Eg, sometimes you include bullet point like comments that need some further qualification or explanation.

Regarding the related work and lit review, you have identified some important supporting published papers, etc. but please also look at related work - eg existing games/maths apps, well respected resources - eg bbc bitesize, etc to inform your project.

Include further references and discussions of key stages and why key stage 4 is relevant to your goals/ supports your ideas.

Explain further why the use of C++ is relevant.

Use the Schools agreed standard here. You need to review how to use references, in particular the formatting of your references needs work. This part of your proposal needs to be re-considered.

Gantt charts included. Also explain your choices here. Eg why place questionnaire design after you've designed/implemented your app?

Risks - time limitations?

Some minor typos and structural editing would help improve readability, but overall a good effort

Are there any ethical concerns here?

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Comment 1

How so?

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