Project 4 – Design Document
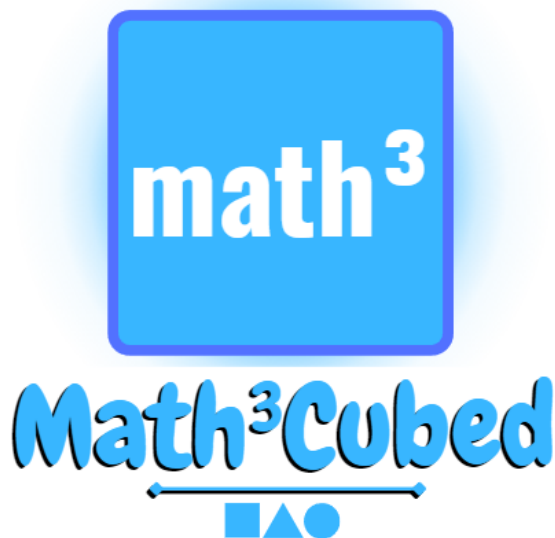
Project Name	Math Cubed
Genre	3D First-Person Educational Puzzle
Language	English (UK)
Platform	PC

Game design document

Lewis Whitham

Table of Contents

Document History

Version	Details
1	First Draft

Introduction

A client has requested for me to create a commercial 3D game for a specific audience. I have been tasked with researching, planning, and designing an educational game which aims to teach secondary-school students any of the following subjects; Science, Technology, Engineering, Mathematics (STEM), English or History.

Audience Research

Research Planning

Grouping customers based on different things will help me find a target audience. Here are a few ways I can group them:

Demographic

This means putting customers into groups based on things like age, gender, how much money they make, education, family size, religion, and job. It is common because it is easy to see and measure. For example, you could make a game that is easier or harder for players in different grades, or for boys and girls, or for players with higher or lower incomes.

Psychographic

This is when you group customers based on their personality, attitudes, interests, values, and how they live their lives. It helps you understand what your customers like and why they like it. For example, you could make parts of your game different for players who like learning in separate ways, or for players who feel differently about math.

Geographic

This is when you group customers based on where they live, like what country, state, city, or neighbourhood. It helps you sell your product in various places. For example, you could make your game in different languages or with different money for players in different countries.

Behavioural

This is when you group customers based on what they do or how they act. It helps you see if customers like your product and how much. For example, you could give different rewards or challenges in your game depending on how much a kid plays or how well they do.

Target Audience and Statistics

Finding a target audience is a key element in ensuring the success and effectiveness of my math game. By identifying a specific group of individuals who are most likely to benefit from and enjoy my game, I can tailor the gameplay experience to meet their unique needs, preferences, and learning styles. This targeted approach allows me to create content that resonates with my audience, fosters engagement, and maximizes the impact of the educational elements within the game.

Understanding my target audience enables me to adjust my marketing efforts more effectively, reaching the right people with the right message and increasing the likelihood of success in the competitive gaming market. Ultimately, finding a target audience helps me create a game that not only meets the needs of players but also delivers meaningful educational value in an engaging and enjoyable way.

Characteristic	2013	2014	2015	2016	2017	2018	2019	2020/21	2021	2022
Male	46%	47%	44%	41%	41%	44%	46%	61%	63%	55%
Female	38%	41%	39%	32%	31%	32%	32%	63%	56%	56%
16-24	71%	73%	66%	67%	70%	65%	73%	92%	88%	88%
25-34	62%	62%	63%	50%	49%	59%	52%	82%	79%	76%
35-44	45%	51%	44%	42%	40%	36%	41%	76%	73%	67%
45-54	43%	39%	42%	27%	29%	35%	40%	62%	62%	54%
55-64	28%	26%	25%	23%	23%	23%	24%	43%	47%	41%
65+	-	-	-	-	-	-	-	30%	-	21%
65-74	13%	19%	17%	21%	16%	23%	-	-	26%	-
55+	-	-	-	-	-	-	19%	-	-	-
75+	4%	7%	9%	13%	14%	9%	-	-	-	-

"A September to November 2022 survey of UK adults aged 16 years and older found that 88 percent of respondents aged between 16 and 24 years played video games, down from a 92 percent gaming penetration among the same age group in 2020. Overall, gaming uptake increased in 2020 due to the global COVID-19 pandemic."

This means more people played video games in 2020 because of the COVID-19 pandemic. When people had to stay home more, they often turned to video games for entertainment and to stay connected with friends. So, even though fewer young adults played games in 2022 compared to 2020, gaming was still really popular, especially among younger people.

More than half the working-age population has the numeracy level expected of a primary school child

Based on the results from a five-question multiple-choice test of people's everyday maths skills, **56%** of the population scored less than 3. The questions are everyday maths questions from the National Numeracy Challenge and are all roughly equivalent to those within a GCSE maths paper. The most recent Government-commissioned survey of adult skills[1] saw 49% of those surveyed achieve Entry Level 3 or lower, which is roughly equivalent to the level expected of a primary school child.
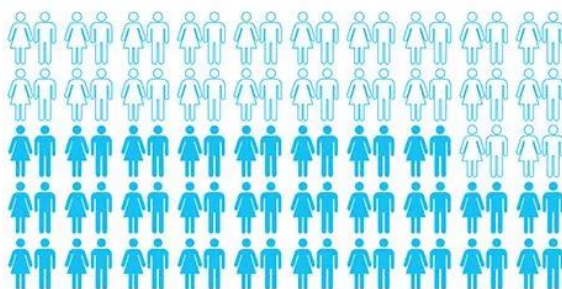
Research shows that more than half the working-age population in the UK has the numeracy level expected of a primary school child.

More than half of British girls lack confidence learning maths, compared with 41% of boys.
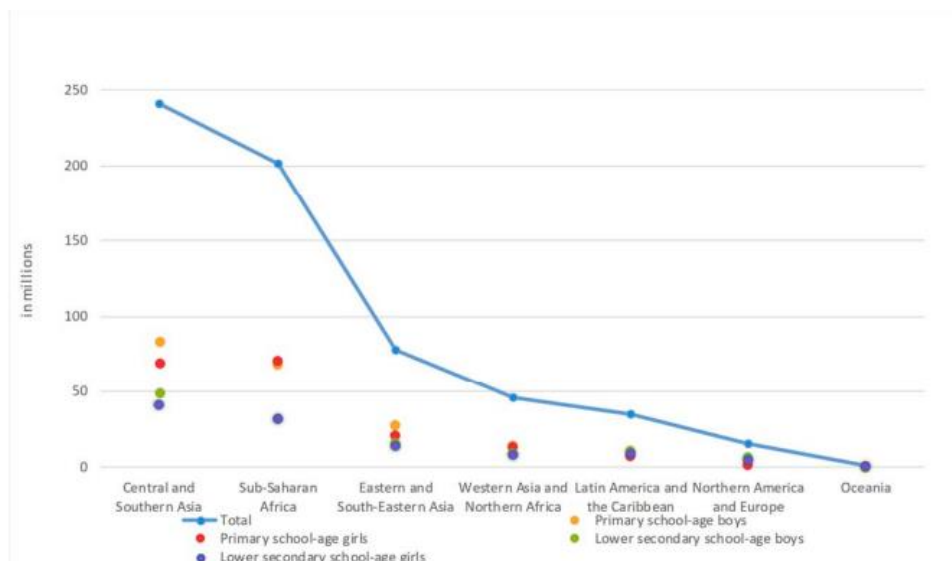
More than 617 million children and adolescents globally are failing to attain minimum proficiency levels in mathematics, underscoring a significant challenge in educational outcomes and skill development. This statistic highlights the widespread need for effective and engaging educational tools to address this issue.

In 2022, 88% of young adults in the United Kingdom aged between 16 and 24 years participated in video gaming activities, indicating the pervasive popularity of digital entertainment among this demographic. This prevalence of gaming presents an opportunity to leverage video game platforms as vehicles for educational content delivery and engagement enhancement.

A survey conducted in the third quarter of 2023 revealed that 89.6% of female internet users aged 16 to 24 worldwide engaged in video gaming across various devices. Similarly, 92.6% of male respondents in the same age group reported gaming activities. This gender-neutral interest in gaming suggests that educational games can appeal to a diverse audience and potentially mitigate gender disparities in math proficiency.

Notably, data indicates a disparity in gaming habits between genders, with four-in-ten boys aged 13 to 17 expressing concerns about excessive gaming, compared to only 11% of girls. Additionally, a higher proportion of parents reported daily gaming habits among teen boys compared to teen girls, emphasizing the need for responsible gaming practices and balanced leisure activities.

Despite these concerns, video gaming remains a prevalent pastime among children, with approximately nine in ten children engaging in gaming activities. This widespread

participation underscores the potential reach and impact of educational games targeting younger demographics.

Furthermore, most households with children aged 0-18 had access to the internet in 2022, facilitating the dissemination of educational gaming content to a broad audience. Leveraging online platforms for game distribution can maximize accessibility and reach, ensuring widespread adoption and impact.

These statistics suggest that there is a significant audience of young people who are learning math and playing games. It's important to note that while boys tend to play games more frequently, girls also represent a substantial portion of the gaming audience. Therefore, a math game could potentially appeal to a wide range of young people.

Player Preferences

Understanding the preferences of different age groups is crucial for designing a math game that appeals to a wide range of players. Here's how preferences might differ between younger and older players:

Visual Preferences

Younger people are often attracted to bright and vibrant colours. Using a colourful and visually stimulating design can capture their attention and make the game more appealing. Simplicity is key for younger players. They prefer straightforward gameplay mechanics and easy-to-understand visuals that allow them to dive into the game quickly without feeling overwhelmed. However, older people might appreciate more sophisticated visuals and environments. They may prefer a cleaner and more refined aesthetic that reflects their maturity and sophistication.

Gameplay Preferences

Younger players tend to enjoy fast-paced and addictive gameplay. They are drawn to games that offer instant gratification and rewards, such as earning points or unlocking new levels. Simple gameplay mechanics that are easy to grasp but difficult to master are popular among younger audiences. They enjoy games that provide a challenge without being overly complex. However, less experienced players may prefer a more relaxed and strategic gameplay experience. They might enjoy games that require critical thinking and problem-solving.

Content Preferences

For younger players, engaging storylines and characters can enhance the gaming experience. Incorporating elements of adventure, exploration, or fantasy can capture their imagination and keep them invested in the game.

Older players may prefer games that offer educational value and real-world relevance. They might appreciate math games that tie into everyday scenarios or practical applications of mathematical concepts.

Accessibility Preferences

Younger players are often more tech-savvy and comfortable with using various devices and interfaces. They may prefer games that are accessible across multiple platforms, such as mobile devices, tablets, and computers.

Older players may have different accessibility needs, such as larger text size, adjustable difficulty levels, or compatibility with assistive technologies. Offering customizable settings and options can accommodate a wider range of players.

Cognitive Abilities

Cognitive abilities play a significant role in how players engage with and learn from a math game. Here's how cognitive abilities might differ between younger and older players:

Younger Players

Younger people typically have a lower cognitive threshold, meaning they may require more assistance, guidance, and positive reinforcement to promote learning. To support younger players' cognitive development, the game can incorporate interactive tutorials, hints, and tips to help them understand new concepts and mechanics. Positive reinforcement, such as rewarding correct answers with praise or virtual rewards, can motivate younger players to continue learning and progressing through the game. Simple and intuitive gameplay mechanics are essential for younger players, as they may struggle with complex instructions or multitasking. Providing clear objectives and feedback can help them stay focused and engaged.

Older Players

Older people often have more developed cognitive abilities compared to younger players, but they may face challenges related to cognitive decline or slower processing speed. While older players may require less assistance than younger players, they can still benefit from clear instructions, explanations, and examples to support their learning process. Offering adaptive difficulty levels can cater to the varying cognitive abilities of older players. For example, providing options to adjust the speed of gameplay or the complexity of math problems can accommodate different skill levels. Providing opportunities for self-paced learning and practice can be beneficial for older players, allowing them to revisit concepts and reinforce their understanding at their own pace.

Learning Patterns

Younger Players

Younger people often prefer an easy learning experience that gradually introduces new concepts and builds upon existing knowledge. Implementing repetition and patterns in gameplay is essential for younger players to reinforce learning and maintain engagement. For example, incorporating a series of progressively challenging levels that repeat key math concepts in different contexts can help solidify understanding. Balancing progression and difficulty are key for younger players. The game should gradually increase in complexity as players advance, providing opportunities for mastery while avoiding overwhelming them with overly difficult tasks too soon. Utilizing familiar themes and characters can enhance the learning experience for younger players, making math concepts more relatable and memorable.

Older Players

Older people may have different learning preferences and patterns compared to younger players. They may prefer a more structured and systematic approach to learning, with clear objectives and milestones to track progress. While repetition can still be beneficial for older players, they may prefer a more varied and intellectually stimulating learning experience. Incorporating diverse gameplay mechanics, challenges, and activities can keep older players engaged and motivated. Older players may appreciate opportunities for deeper exploration and reflection. Providing access to additional resources, such as supplementary materials or extended learning modules, can cater to their desire for continued growth and development. Flexibility and customization are important considerations for older players. Offering options to personalize the learning experience, such as choosing specific topics or adjusting the pace of progression, allows them to tailor the game to their individual preferences and needs.

Audience Personas

An audience persona is like creating a detailed character profile for a specific group of people who might be interested in your game. It is a way to understand your players better by imagining their age, interests, preferences, and behaviours.

When making a game, audience personas help developers tailor their game to fit the needs and desires of their target players. For example, if your persona is a young adult who loves fast-paced action and competitive gameplay, you might design intense multiplayer modes or challenging levels to cater to that preference. If your persona is a casual gamer who enjoys relaxing gameplay experiences, you might focus on creating soothing visuals and simple mechanics.

Audience personas guide game developers in making decisions about gameplay mechanics, art style, story elements, and marketing strategies to ensure that their game resonates with the people they want to reach.
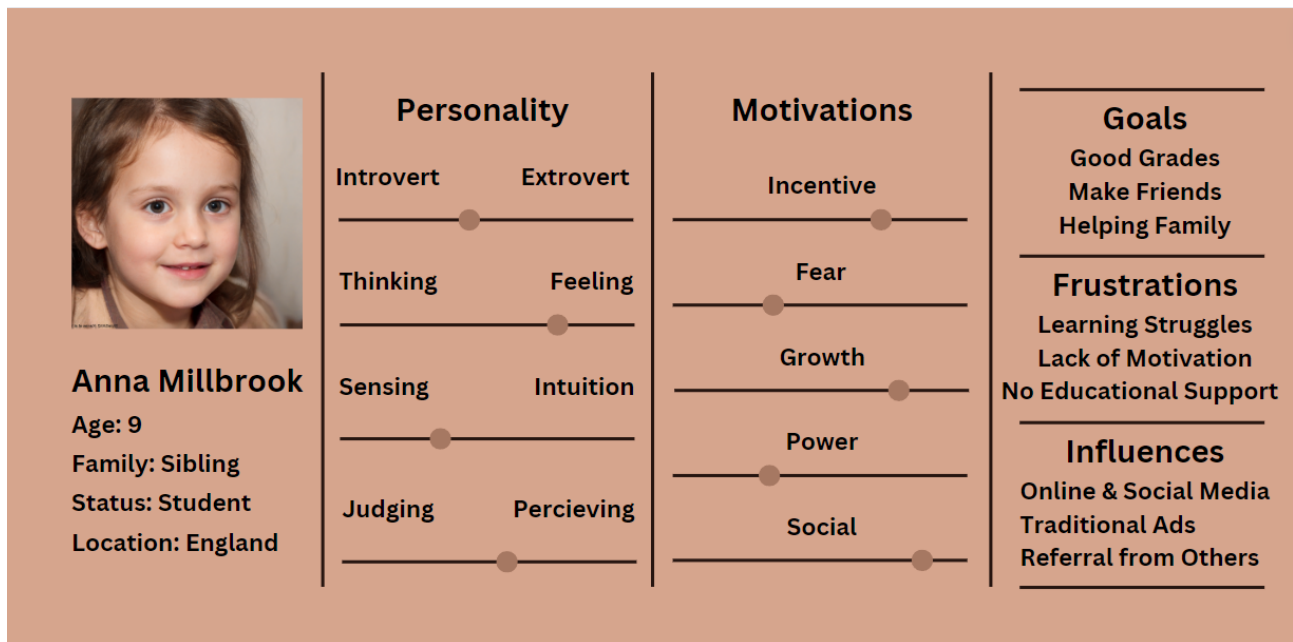
Audience Persona 1

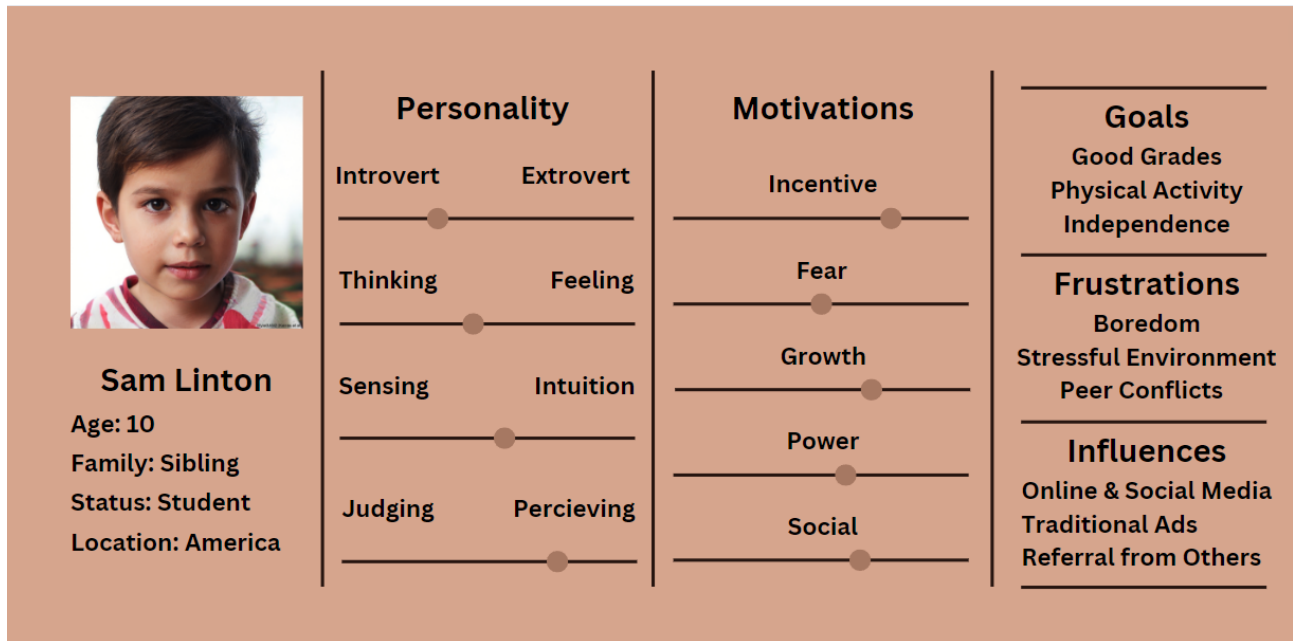Anna Millbrook (Not a real person, for example purposes only)

Anna Millbrook is a 9-year-old student who lives in England. She enjoys spending time with her family, especially her siblings. Anna goes to school and works hard to get good grades. She also likes making friends and helping her family. Understanding Anna's personality and what motivates her helps us create things that she will like and find useful. It helps me know what might make her happy or what might make her feel frustrated. By knowing these things, I can make sure that my game experiences are enjoyable and helpful for Anna and others like her.

Anna is a mix of being shy and outgoing, but she loves being around people. She cares a lot about how others feel and is very friendly. She likes to use her senses to understand things but also enjoys being creative. Knowing that kids like Anna enjoy making friends and helping their family, I can make my math game more social and cooperative. For example, I could promote teaming up with friends or family members to solve math puzzles together. This way, Anna can have fun with her friends while learning.

Anna is motivated by things like doing well in school, making friends, and helping her family. However, sometimes she feels frustrated when learning is hard, or she doesn't feel like doing her schoolwork. Since Anna cares about how others feel and is friendly, I can make sure the game is encouraging and positive. I'll include lots of praise and rewards for doing well in the game. This will make Anna feel good about herself and motivate her to

keep playing and learning. Since Anna might feel frustrated if learning is hard, I'll make sure the math questions start off easy and gradually get harder as she progresses. This way, she won't feel overwhelmed, and she'll feel proud of herself as she improves.

Anna is influenced by things she sees online, like social media and ads, as well as what her friends and family say. Finally, because Anna is influenced by what she sees online and what her friends say, I'll make sure to share the game on social media and encourage players to tell their friends about it. This will help more kids like Anna discover the game and enjoy learning math in a fun and interactive way.

Audience Persona 2

Sam Linton (Not a real person, for example purposes only)

Sam Linton is a 10-year-old student from America who goes to school and has a sibling. He likes hanging out with his sibling and enjoys being active. Sam wants to do well in school and become more independent. Knowing that kids like Sam enjoy being active and independent, I can make my math game more interactive and give players more control. For example; I could add a feature where players can explore different areas and complete math challenges to unlock rewards or progress in the game. This way, players like Sam can have fun while learning and feel like they're in charge of their own learning journey.

Sam is a mix of being quiet and outgoing, but he likes spending time with others, especially when doing things like playing sports. He wants to do his best in school and be able to do things on his own. Since Sam wants to do well in school, I'll make sure the game includes clear learning goals and progress trackers - This will help players like Anna see how they're doing and feel proud of their achievements as they improve their math skills.

Sam likes to be rewarded for doing well and wants to keep getting better at things. But sometimes, he worries about things and feels stressed, especially if he's in a tough situation with his friends. Because Sam sometimes worries about things and feels stressed, I'll make sure the game is encouraging and supportive. I'll include helpful hints and tips to guide players through challenges, and I'll make sure to praise them for their efforts and progress.

Sam is influenced by what he sees online, like social media and ads, as well as what his friends and family tell him. Since Sam is influenced by what he sees online and what his friends and family tell him, I'll make sure to share the game on social media and encourage players to tell their friends about it. This way, more kids like Sam can discover the game and have fun learning math in a supportive and engaging way.

Understanding Sam's personality and what motivates him helps us create things that he will enjoy and find helpful. It helps us know what might make him happy or what might make him feel stressed. By knowing these things, we can make sure that our products or experiences are fun and supportive for Sam and others like him.

Empathy Maps

Empathy maps are a concise way of describing how an average person from a group of people thinks, feels, hears, says, and does things. This can be used as a psychological baseline to design the game around, keeping in mind all the things this person experiences in day-to-day life. They are a technique used in product design and marketing to understand a customer's current problems, which allows a designer to specifically address issues to build a solution that hopefully fixes them and makes sales. They can be split into 7 sections: who is the customer being empathised with, what does this customer need to do, what do they see, what do they say, what do they hear, what do they do, and finally, what do they feel

I will use empathy mapping to identify my target audience—whether it is students struggling with basic arithmetic, parents seeking educational games for their children, or adults looking to improve their math skills. Understanding who my players are will help me tailor my game mechanics and content to suit their needs and preferences.

What will players do?

I will think about the actions I want my players to take while engaging with my math game. For example, they might need to solve math problems, make strategic decisions, or navigate through various levels. I will ensure that the gameplay is intuitive and encourages active participation to keep players engaged.

I will think about the actions and behaviours my players might exhibit while playing my math game. Do they become frustrated when they cannot solve a problem? Do they enjoy

competing with friends or collaborating with others? I will design gameplay mechanics that cater to different play styles and motivations, such as solo challenges, multiplayer modes, or cooperative learning experiences.

What will players see?

I will consider the visual elements of my game. I will create a visually appealing interface that is easy to navigate and understand. Using graphics, colours, and animations, I will make math concepts more engaging and accessible. Visual cues can also help players understand instructions and feedback more effectively.

What will players say?

I will explore the language and vocabulary my players use when discussing math. Are there specific terms or phrases they struggle with? I will incorporate clear explanations and provide hints or tips when players get stuck on certain concepts. I will encourage positive reinforcement through encouraging messages and praise for correct answers.

What will players hear?

I will pay attention to the auditory experience of my game. I will use sound effects and background music to enhance the gameplay atmosphere. Providing audio feedback for correct and incorrect answers will reinforce learning outcomes. I might consider incorporating voiceovers or narration to guide players through tutorials or story elements.

What will players feel?

I will consider the emotions and feelings my players may experience while interacting with my game. I aim to create a positive and supportive environment that encourages learning and experimentation. I will celebrate achievements and milestones to boost player morale and motivation. I will address any potential sources of frustration or anxiety by providing clear instructions, adaptive difficulty levels, and opportunities for practice and improvement.

By addressing each of these sections in my empathy map, I can gain valuable insights into my players' needs, preferences, and behaviours, allowing me to design a math game that is engaging, educational, and enjoyable for my target audience.

Marketing

Promoting on Social Media

I can use platforms like Instagram, Snapchat, and TikTok, where lots of young people hang out, to advertise my game. This way, I can make sure my game gets seen by the right people.

Partnering with Influencers

Teaming up with influencers who are popular with young people can help spread the word about my game. This works even better if the influencer likes math or games, because they'll be a good fit for my target audience.

Making Marketing Fun

I can add parts of my game to my ads to make them more interesting. By including challenges, contests, or rewards, I can give people a taste of what the game is like and get them excited to try it.

Working with Schools and Programs

Getting my game into schools, tutoring centres, or educational programs is another way to get it in front of my target audience. This not only helps promote the game but also shows that it's a useful learning tool, which makes it more appealing to players and their parents.

Building a Community

Setting up a place where players can talk to each other, like an online forum or social media group, helps keep them engaged and interested in the game. By giving players a way to connect, share stories, and give feedback, I can build a loyal fan base for my game.

Game Research

Similar Games

I have researched similar games that my target audience plays that have similar game mechanics and goals of my game.

Prodigy

Prodigy is an online math game made for kids in elementary and middle school. It is like going on a fun adventure in a fantasy world, but to keep moving forward, the player must solve math problems. They make it colourful and exciting, so it is easy to get into, and the more you play, the better you get at math. If the player is having a tough time, the game adjusts the math problems to your skill level, so the player is always learning without feeling overwhelmed. And when you do well, you get rewards and prizes to keep you motivated.

After looking into games like Prodigy, I see that they make learning math feel like an exciting adventure in a fantasy world. I can use this idea to make my math game more fun and engaging. By creating a colourful and exciting environment, I can make it easier for players like me to get into the game and enjoy learning math.

I also noticed that Prodigy adjusts the math problems based on the player's skill level. This is a great idea because it helps players like me learn without feeling overwhelmed. I can use this feature in my game to make sure that players always have math problems that match their abilities, so they can keep learning and improving at their own pace.

Another thing I like about Prodigy is that they give rewards and prizes when you do well. This is a great way to keep players like me motivated and excited to keep playing and learning. I can include similar rewards and incentives in my game to make it even more fun and rewarding to learn math.

Overall, looking at games like Prodigy has given me some great ideas for my math game. I can use these insights to create a fun and engaging experience that makes learning math feel like an exciting adventure.

Kahoot
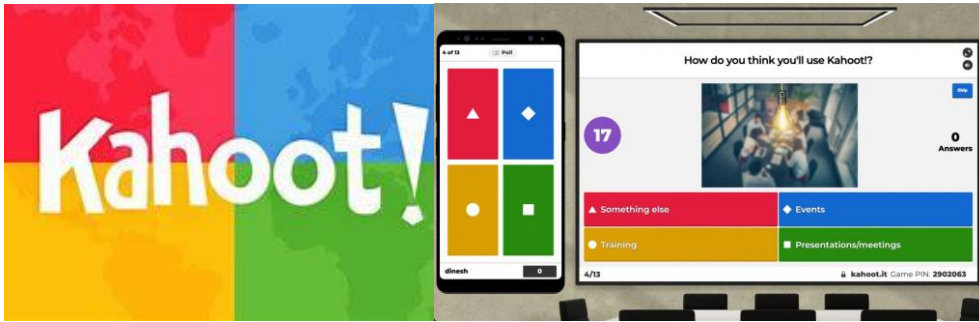
Kahoot is an interactive learning platform where you can play quizzes and trivia games with your friends or classmates. Teachers often use Kahoot to make learning fun and engaging. For example, they might create a math quiz where you must answer questions quickly to earn points. Kahoot uses bright colours, catchy music, and a leaderboard to keep you motivated and excited. It's a great way to review what you've learned in class and compete with your friends to see who knows the most.

Looking at games like Kahoot, I see how they make learning feel like a fun activity you can do with your friends or classmates. I can use this idea to make my math game more interactive and enjoyable for players like me.

Kahoot uses quizzes and trivia games to review what you've learned in class. I can do something similar in my math game by creating quizzes or challenges that test players' math skills. This way, players like me can practice what we've learned while having fun.

I also like how Kahoot uses bright colours, catchy music, and a leaderboard to keep players motivated and excited. I can include these elements in my game to make it more engaging and rewarding to play. For example, I can use colourful graphics and upbeat music to create a lively atmosphere, and I can add a leaderboard to encourage friendly competition among players.

Overall, looking at platforms like Kahoot has given me some great ideas for my math game. I can use these insights to create a fun and interactive experience that makes learning math enjoyable and exciting.

DragonBox Algebra

DragonBox Algebra is a puzzle game that helps you learn algebra by playing. It is not just for kids; adults like it too. It starts off simple and gradually teaches you more complicated algebra stuff. They keep it simple and easy to understand, and you can play it on your phone or tablet. It is a bit like a story, and as you play, you get better at algebra without even realizing it. It is a fun way to learn math, and you can do it at your own pace.

DragonBox Algebra is a game that makes learning algebra feel like solving puzzles. I can use this approach to make my math game more enjoyable and accessible for players like me.

I like how DragonBox Algebra starts off simple and gradually teaches more complicated algebra concepts. I can do something similar in my game by introducing math problems that start easy and get harder as players progress. This way, players like me can learn at our own pace and feel challenged without feeling overwhelmed.

I also like how DragonBox Algebra keeps things simple and easy to understand. I can use this idea to create math problems that are clear and straightforward, so players can focus on solving them without getting confused.

Another thing I like about DragonBox Algebra is that you can play it on your phone or tablet. I can make my game accessible on mobile devices too, so players like me can learn math anywhere, anytime.

Overall, looking at games like DragonBox Algebra has given me some great ideas for my math game. I can use these insights to create a fun and engaging experience that makes learning math feel like solving puzzles.

Portal Series

Looking at games like Portal, I see how they make problem-solving feel like a fun adventure. I can use this idea to make my math game more exciting and rewarding for players like me.

Portal is famous for its clever puzzles and interesting story. I like how it challenges players to think and explore different solutions. I can do something similar in my game by creating math puzzles that require players to use their problem-solving skills and try different approaches until they find the solution.

I also like how Portal uses physics and cool gadgets to solve puzzles. I can incorporate similar elements into my game to make it more interactive and engaging. For example, I can create math problems that involve manipulating objects or using special tools to find the answer.

Another thing I like about Portal is that it feels like solving a mystery. I can use this idea to create a sense of excitement and anticipation in my game. By designing levels that feel like a puzzle waiting to be solved, players like me can have fun figuring out the solution and feel a sense of accomplishment when they finally solve the puzzle.

Overall, looking at games like Portal has given me some great ideas for my math game. I can use these insights to create a challenging and rewarding experience that makes learning math feel like solving a mystery.

Angry Birds Series

Angry Birds is not exactly a physics game like Portal, but it does use physics in a fun way. It is a game for anyone who wants to have fun on their phone or tablet. You use your finger to launch birds at targets and knock them down. It is easy to play, but as you go through

the levels, it gets trickier. The best part is that you can play with your friends and see who can get the highest score. It is a simple game, but it keeps you coming back for more.

Looking at games like Angry Birds, I see how they make playing games on your phone or tablet enjoyable for everyone. I can use this idea to make my math game more accessible and fun for players like me.

Angry Birds uses physics in a fun way, even though it's not exactly a physics game like Portal. I like how it's easy to play but gets trickier as you progress. I can do something similar in my game by creating math challenges that start off simple but become more challenging as players advance. This way, players like me can learn math at our own pace and feel a sense of accomplishment as we improve.

I also like how Angry Birds lets you play with your friends and compete for the highest score. I can include similar multiplayer features in my game to make it more social and engaging. For example, I can add leaderboards or multiplayer modes where players can challenge their friends to see who's the best at math.

Another thing I like about Angry Birds is that it's a simple game that keeps you coming back for more. I can use this idea to create a math game that's addictive and enjoyable to play. By designing levels that are fun and challenging, players like me will want to keep coming back to improve their skills and beat their high scores.

Overall, looking at games like Angry Birds has given me some great ideas for my math game. I can use these insights to create a fun and engaging experience that makes learning math enjoyable for everyone.
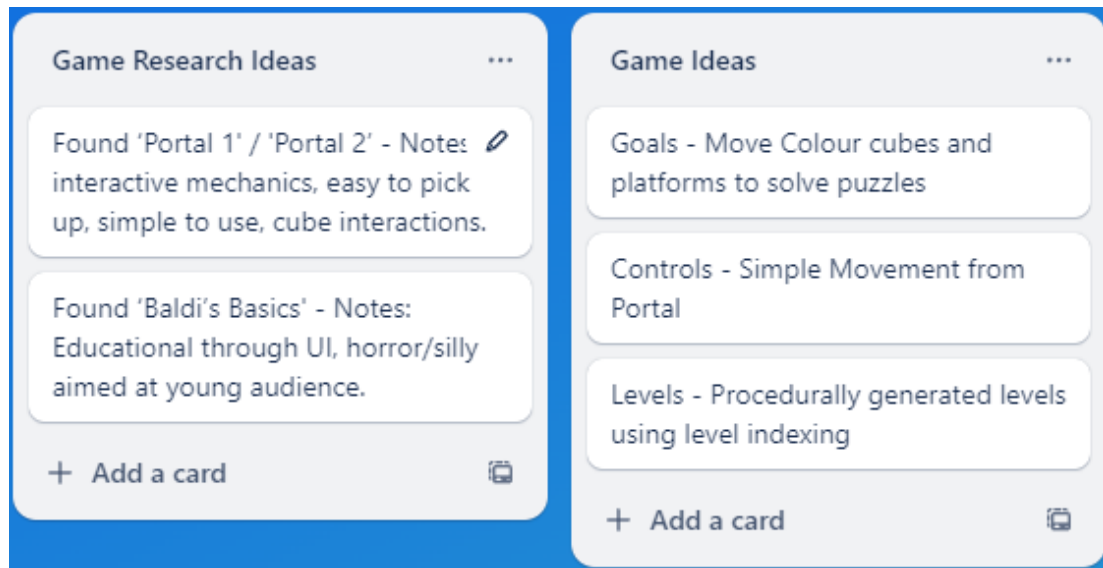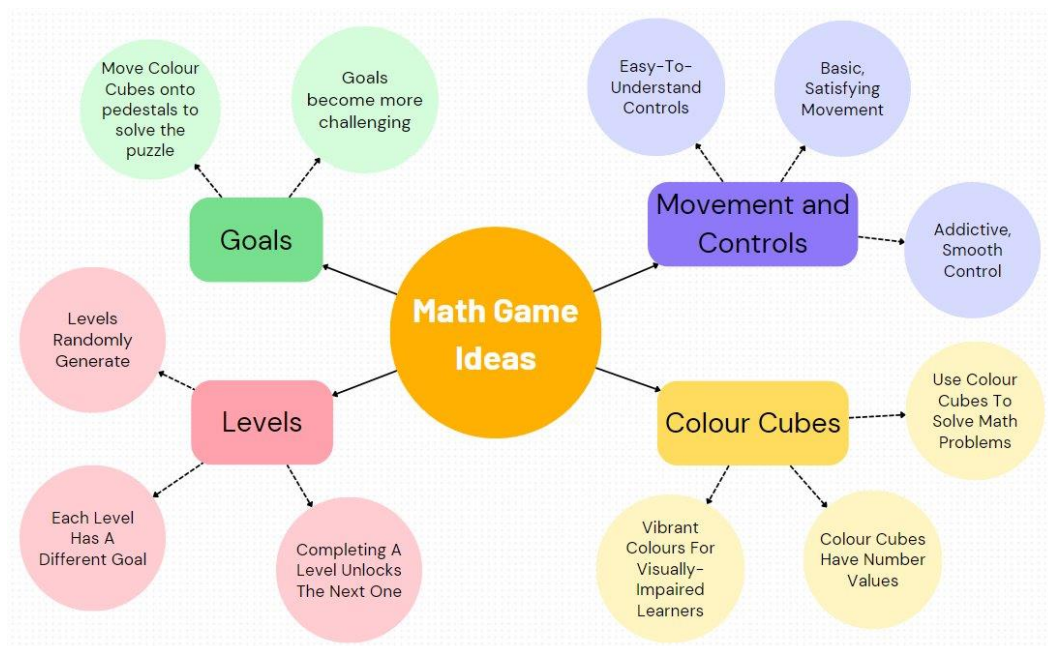
Game Concept

Description

The client has allowed me to choose a core subject to teach about within my game. Based on my initial research, 40% of students aged 13-17 found Math harder than other subjects. Therefore, I have chosen to create a game which aims to teach Core Mathematic principles to these students.

Initial Planning and Stimulus

When the brief was given to me, I began thinking about and researching some game ideas. I documented my research on Trello and noted down key elements I was inspired by. I researched the Portal series and other educational games like Baldi's Basics. I tried to find games that were both popular and easy to play.

Next, I made a mind map to organise my notes and create a framework to follow during development.

A visual representation outlining various creative concepts and game features, serving as the foundational framework for the educational math game's development

Then I created a simple mood board for the game style, this would give me a clearer idea of what style I wanted to present within the game, I took some images from portal, Baldi's basics, and other related games to get the visual colours and designs I wanted to replicate.

Concept

A first-person perspective, puzzle-solving game, where players move coloured cubes to solve math and logic challenges and progress through increasingly challenging levels.

Platform

I have chosen to develop this prototype on PC as it is the most accessible to young people in schools and at home. I aim to make the game run well on lower end devices like Macbooks or Chromebooks, which schools use commonly, as well as phones and tablets which most younger people have too.

Unique Selling Point

This project offers a unique platform designed for students that utilises both learning and fun to create an enjoyable experience that promotes learning through fun interactive puzzles and challenging levels.

Key Features

This project will need some key features which will make the game interesting and fun. I have chosen to make a game aiming to teach mathematics to secondary school students, so keeping the learner engaged is a key factor to consider and is what I aim towards with this project. I can achieve this by considering the target audience's psychology and cognitive abilities, this will help create a balanced learning experience - specifically for people who want to learn.

Dynamic Level Progression
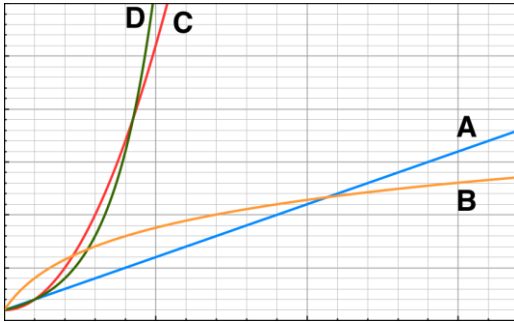
I want to offer a challenging but educational journey for the learner with a difficulty curve that follows their cognitive abilities in math, as well as their logical reasoning and puzzle solving skills. The first key feature I want to implement is **Dynamic Level Progression**. Levels will be dynamically generated using a simple algorithm which will record the players time taken to complete a level within the game, compare it to the difficulty of that challenge and then generate a room which will hopefully match their abilities – not too easy or too difficult. This dynamic level generation algorithm aims to make the game seem like it is learning with you and is a straightforward way to make level progression unique to each learner. By allowing the player to take their time with the puzzles, they can feel more confident and less pressured to learn, then when they get the hang of it, I will allow them to play faster to get more challenging levels recommended for them through the algorithm. This feature aims to prevent overwhelming the learner whilst also balancing the difficulty to keep them engaged.

Variable Level Difficulty Curve
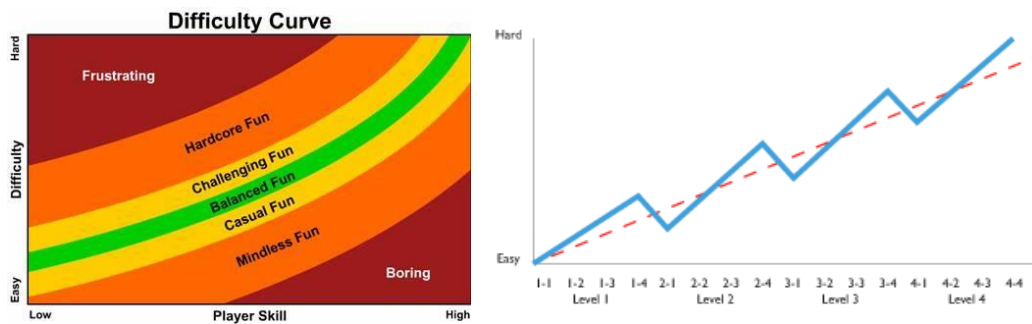
Learning through interactive games can get very repetitive, especially while playing a static game that never changes, that is why I want to make a dynamic game that is fun and makes the learner feel they are making progress. Therefore, I have chosen to implement a **Variable Level Difficulty Curve** that directs the learner towards gradually more difficult challenges as the game continues, improving their math skills and making their learning more effective. The simple algorithm for generating levels will use information about the player to create a baseline for the difficulty curve, this will be presented by how challenging a given level is, for example how many options the player is given. I will think about how many colour cubes I could allow the player to use in a room, the more options the player has, the easier it will be to find a solution. Of course, this depends on the difficulty of the

numbers chosen for the cubes and what mathematical operation is chosen by the player or algorithm, so finding the right balance is important to consider. This feature is used by the dynamic level algorithm to suggest a difficulty for the next level that matches the learner's abilities as mentioned before.
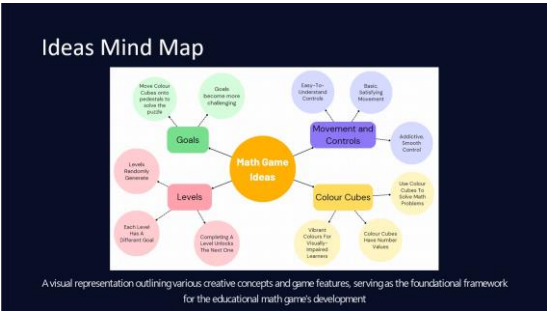
Intuitive Gameplay Interaction

Through my research of other similar games, I have noticed that they use simple controls to interact with elements in the game. Interacting with the game needs to be intuitive and easy to pick-up for inexperienced players. So, **Intuitive Gameplay Interaction** will be the next key feature I want to add. My game will have 2 actions the player can do – grabbing and interacting. I can achieve this by making the controls simple and familiar, researching, and comparing other similar games to see what controls they use and testing the game with others to see how easy it is to use.

Concept Pitch Presentation

Slide 1 Intro		Introduction to my plan
	Math-Cubed **Pre-Production Overview** A presentation outlining the pre-production plans of an educational math game specifically designed for young children. This game aims to enhance their mathematical and logical skills through a fun and interactive gameplay experience.	
Slide 2 Concept Idea		One-line hook sentence explaining about the game
	Concept Idea Concept Overview A first-person perspective, puzzle-solving adventure, where players manipulate coloured cubes to solve math and logic challenges and progress through different levels	

Slide 3 Ideas Mind Map		Explaining my ideas on a mind map
Slide 4 Background and Mood board		The background explanation of why I chose this and a mood board to get ideas
Slide 5 Initial Audience Research		The initial audience research like preferences, abilities and learning patterns
Slide 6 Gameplay Overview		The gameplay overview detailing things that will be included in the game prototype
Slide 7 Game Mechanics and Goals		Explanation of game mechanics and goals

Slide 8 Progression and Difficulty		Noting the difficulty and progression
Slide 9 Level Design and Challenges		Explanation of the general Level Design and Challenges
Slide 10 Planning		The Planning phases I will use to organise and execute my game
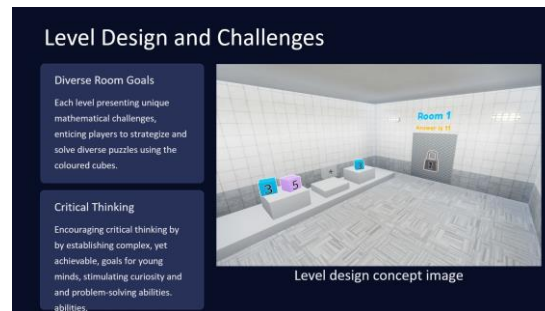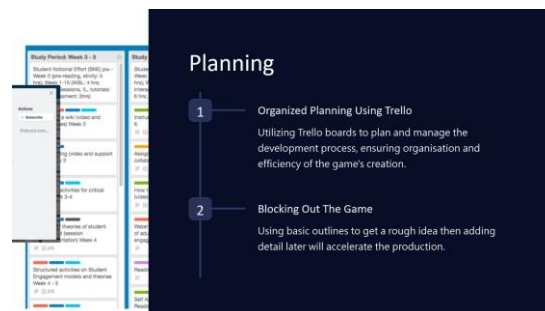
Concept Feedback and Data Analysis

I created a feedback form to gather feedback from my concept pitch presentation. This feedback will provide me with varying opinions and perspectives about my concept and allow me to see what my target audience wants in the game.

The first question is about the genre of the game, I wanted to collect information about how the genre impacts how that target audience plays my game. A first-person puzzle game made sense to me at first, but having other people's opinions will help me confirm this. I found through testing the concept level I made that a first-person perspective will be the

most intuitive method of both viewing and interacting with the game world.

1. My game is about teaching young people math using coloured cubes. I have chosen to make the genre of the game a first-person puzzle game.

   Do you believe this genre suits the game?

   More Details

● Yes	10	
● Maybe	0	
● No	0	
● Not sure	0	
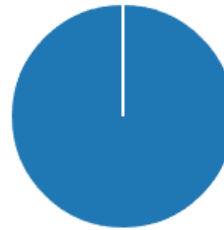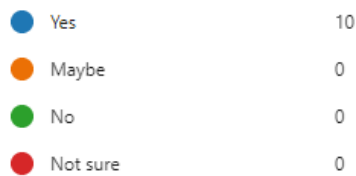
All the respondents said that the genre suits the game, this data confirms that my testing in the concept level reflects how intuitive the game will feel for players.

Next, I wanted to collect more in-depth open-ended responses about how players should interact with the game world. This data will give me more detailed opinions on how players should view the game world and interact with it.

2. I chose a first-person puzzle game because many games i researched featured a first-person perspective as if you are the main character. If any, what would be a better genre...

7 Responses

ID ↑	Name	Responses
1	Archie Holmes	I quite like the first-person perspective, so I think it's fine as it is.
2	Christianna Collins	i think it fits well
3	Fabian-Ioan Cretu	no I don't think so
4	Alfie Middleton	nah the genre is great would be great for young people my youinger sibling would be very interested
5	Ali Gleeson	Perhaps adding exploration? It would be enjoyable to look for the cubes before aligning them to sum-up the answer.
6	Aston Gleeson	I think this is the best genre to select from.
7	Carla Helbert	I feel first person perspective is best as the player themselves are learning as they progress through your game.

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Most the respondents said they think the genre is suited to the target audience. One noted that exploration, where you explore to find the colour cubes, would add interest and more enjoyability. I agree with this, and plan to expand the level generation algorithm to include more diverse shapes of levels with more of a platforming focus.

The next thing I wanted to find out about is my concept idea in general. I asked about what they thought of moving coloured cubes to solve math problems, is that idea engaging and would they like to play a game with those mechanics. I gave an example in the question to make it more clear about the goal of the game.

3. In the game, you move around levels where there are coloured cubes with numbers on them. The goal is to grab the cubes and put them on platforms so that they sum to the...

10 Responses

ID ↑	Name	Responses
1	Archie Holmes	I think it's original and entertaining.
2	Christianna Collins	i think it will be very engaging
3	Fabian-Ioan Cretu	Yes it is
4	Aiden Bijak	I think its entertaining and sounds educational too
5	Alfie Middleton	yeah do the colours match the numbers or are the seprate/random asigned colours
6	Ali Gleeson	I am very interested to see how you pull this off, it's very unique and I find it entertaining.
7	Evelyn Garrett	It seems simple but quite fun for a younger audience to learn
8	Aston Gleeson	It's an interesting concept, though I imagine the concept can get repetitive quickly if not expanded upon.
9	Carla Helbert	This helps the player interact more with the game and have more control of how the play the game.
10	Jude Cameron	i like it

The respondents all said that they like the idea and found it engaging, entertaining and fun for a younger audience. One person noted that it could be repetitive if the game has no expanding features.
To counter that point, I plan to implement the Dynamic Difficulty Adjustment system I will talk about later, which aims to make the game interesting by balancing difficulty based on

multiple factors about the player in real time. This system has been proven to make learning more enjoyable and engaging by aiming to keep the player in a state of flow.

On that point, I asked about what they thought about progressively harder difficulties as the game continues. I asked this because I wanted to know their opinions on procedurally generated levels from their experience in other games. This could be used to shape my own opinion on that.

4. The game will have levels that progressively get more difficult and challenging, Each level will be unique and randomly generated. What do you think of this level system?

10 Responses

ID ↑	Name	Responses
1	Archie Holmes	I like the idea of it, and I think it makes sense.
2	Christianna Collins	it works well
3	Fabian-Ioan Cretu	Its good
4	Aiden Bijak	I think its quite a good idea and adds to the replayability
5	Alfie Middleton	good you could start of with basic addtion and subtracion and then move onto things likle mutiplcation and divsion
6	Ali Gleeson	I like it!
7	Evelyn Garrett	It seems like an interesting way to make sure the game is not overly repetitive.
8	Aston Gleeson	Perfect. A nice difficulty curve with a touch of randomness to keep the player's mathematical knowledge on their toes.
9	Carla Helbert	By progressively becoming more difficult and challenging it will help the learner better their own maths and understanding of mathematical problems and how to resolve them.
10	Jude Cameron	seems very cool and adds a fresh bit of revision each play through

Everyone had good responses to the use of difficulty in my game, some thought it was interesting and adds to the replay ability. Someone mentioned that it helps the learner

better their own maths skills, I agree with this and plan to have a heavy focus on implementing it into my game because of these benefits.

Game mechanics are an essential element to any game and making them easy to use and interact with is necessary, especially in a game that young people with lesser experience

will play. I wanted some thoughts about how young people might find these mechanics when playing.

5. The game will allow the player to grab cubes and move them around, similar to Portal. What do you think of this game mechanic? Do you think young people will find this easy...

10 Responses

ID ↑	Name	Responses
1	Archie Holmes	I like the game mechanic and I think the younger audience won't have any difficulties.
2	Christianna Collins	definitely
3	Fabian-Ioan Cretu	Yes
4	Aiden Bijak	I think with a tutorial it will be great and simple enough for them to understand
5	Alfie Middleton	great mechanic, when i made something similar i could stand and fly around on the blcok just be carefull of that
6	Ali Gleeson	I like it! Will the player have a 'portal gun' like the game Portal, or maybe a hand to show that the Player is picking up the cubes?
7	Evelyn Garrett	I think this is in interesting way that can be entertaining to watch.
8	Aston Gleeson	Yes. Although with Unreal Engine, this gimmick of grabbing and moving stuff can be a little janky.
9	Carla Helbert	Yes, younger gamers are a lot more advance now in game playing abilities as touch screen/smart pads etc are used starting in pre-schools.
10	Jude Cameron	yes extremely simple

Everyone said that the game mechanics will be easy for young people to pick up and play with. One even noted that technology is being given to younger and younger people over time which is definitely beneficial for education.

One problem with the grabbing mechanic was found, this being the ability of standing on a cube while grabbing it and flying around because of the cube acting as a floor for the character while the grabbing action pulls it closer to the player.

I can fix this by using ray casting, or in Unreal Engine terms, line tracing, to trace a pretend line in 3D space. This can be used to check for collisions with a surface and position the cube on that collision point so that it does not intersect with any objects, and orientated along the hit surface's forward vector so that the cube aligns against the surface. This approach, combined with a max trace distance to improve performance and prevent cubes

from being grabbed across long distances, is a simple method to solve the problem of the player flying around by using the cube.

Next, I wanted more information about what age range would be best for learning the core math skills like addition, subtraction, multiplication and division. This information will inform me about a suitable target audience and who would be likely to play.

6. This game is about teaching young people core math concepts like adding, subtracting, multiplying and dividing numbers. What age range would best fit this game best?

10 Responses

ID ↑	Name	Responses
1	Archie Holmes	As stated in the presentation, around 8-15.
2	Christianna Collins	10-15
3	Fabian-Ioan Cretu	6-10 years old
4	Aiden Bijak	I think anyone in school or taking a maths related course so the younger to younger adult age range
5	Alfie Middleton	4-16 at 4 they can understand numbers and at 16 they can work out complex equations
6	Ali Gleeson	11-16.
7	Evelyn Garrett	6+
8	Aston Gleeson	Definitely a Younger Audience, as it's a much simpler side of maths. I'm thinking around 12 - 15.
9	Carla Helbert	Year 2/later stage of Key Stage 1, and in Key Stage 2 (end of infants/during junior schools).
10	Jude Cameron	kids in year 5 or 6

The feedback I received gave me a rough estimation of the target age range that would most likely play my game. It ranged from 6 years old to 16 years old.

Finally, I wanted an overall opinion on the concept.

7. What are your overall thoughts on this game concept? What do you like or dislike?

10 Responses

ID ↑	Name	Responses
1	Archie Holmes	I like the game concept as it is, personally, an original concept towards the math's side of games.
2	Christianna Collins	i really like it, i like how it shows the answer but you have to do the equation yourself:)
3	Fabian-Ioan Cretu	Its very good
4	Aiden Bijak	I think its quite a fun game concept
5	Alfie Middleton	great concept cant wait to see the final product
6	Ali Gleeson	I like everything demonstrated. You should think about a colour scheme fit for your target audience. Something I disliked is how plain the rooms seem to be - At the same time, it's good they're not overly complex.
7	Evelyn Garrett	It's seems interesting and fun for a younger audience. To be honest, depending on the presentation 8 might find the game interesting myself.
8	Aston Gleeson	It's a great concept, with alot of thought put into it's ideas and how you're going to implement them. My only nitpick is that because the topics in question are very simple (i.e., Multiplication, Addition, etc), the game can get boring if the same topics are used constantly.
9	Carla Helbert	Good idea, games like these are always constructive in aiding the player with their learning and understanding of the subject.

Everyone really liked my concept idea overall. They said it is fun and constructive in the learning process which I intended for.

In conclusion, the feedback I received from the feedback form helped me inform my decisions about the concept idea and target audience. It also informed me about potential problems within the game so that I could pre-emptively plan and fix it before testing.

Making a Successful Educational Game

Player Engagement

Designing an educational game that engages the target audience requires a focus on motivating them. When students are motivated, they tend to be more involved in the game and, therefore, learn more effectively. There are several ways to motivate learners, including providing incentives, creating a sense of progress, and offering challenging yet attainable objectives. A successful educational game must be created in a way that encourages high school students to continue playing and learning. This approach will help students remember and apply the knowledge and abilities they acquire while playing the game.

Maintaining player attention and engagement

In the world of game design, getting people interested in your game can be tough because there are so many games out there. But once you get their attention, you want to keep them interested and having fun the whole time they are playing. One way to do that is by making sure the game's difficulty is exactly right—not too easy, not too hard. This keeps players in a "flow state" where they are totally absorbed in the game.

Some games use what is called Dynamic Difficulty Adjustment (DDA) to keep players engaged. With DDA, the game changes as you play based on how well you are doing. So, if you are struggling, the game might make things a bit easier, and if you are breezing through, it might make things tougher to keep you challenged. This helps keep players focused and having fun.
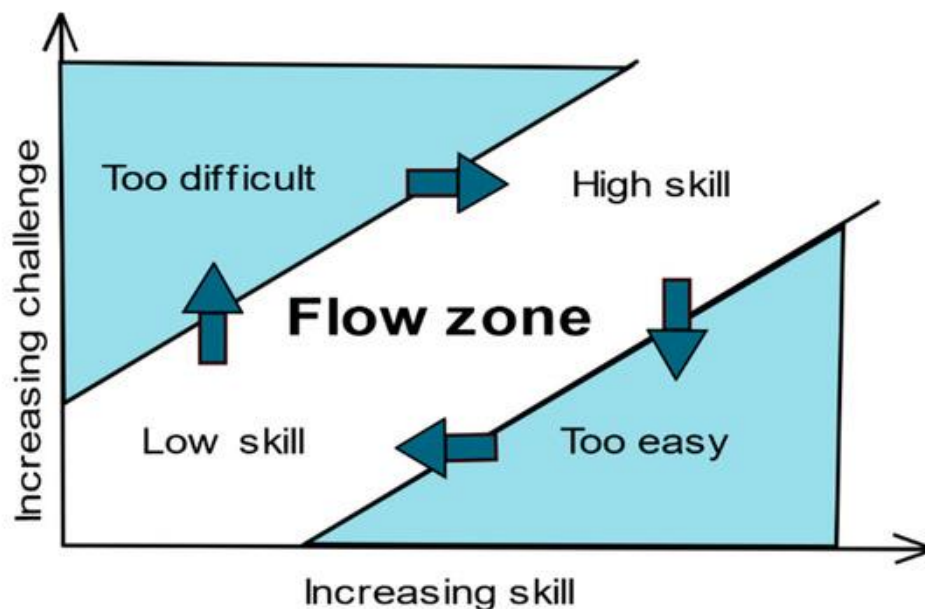
In a paper by David Kristan (Paper here), it talks about how finding the right balance between skill and difficulty can keep players in that flow state. It is not easy to keep players interested in a game for a long time, but games that use DDA have been proven to be successful at it. The paper concluded:

"When balanced, competition drives humans to improve their skills and abilities. In games, player engagement is partly achieved by delivering competition with the right amount of difficulty. The use of Dynamic Difficulty Adjustment techniques allows the game to, dynamically and in real time, adjust the challenge level to the player performance therefore keeping him/her always immersed and active. In Serious Games, this makes the user more prone to acquire new information, develop new skills and improve existing abilities."

I have learnt a lot from research on difficulty and player engagement. By looking at what has been studied and trying out different ideas, I can make a more fun and engaging game; making players come back for more.

How Other Games Engage Players

Games usually engage and motivate players by providing them with a sense of accomplishment and achievement. They do this by breaking down complex concepts into smaller, more manageable tasks that can be completed within the game. This creates a feeling of progress and satisfaction as the learner continues to move forward.

An example of an educational game that successfully motivates students is the game "Kahoot!". This game creates a sense of friendly competition and progress through the leaderboard, where students can see their progress and compete against their classmates. Additionally, the game offers achievable goals and rewards for correct answers, which motivates students to keep playing and learning. The fast-paced nature of the game also keeps students engaged and interested, making it an effective tool for teaching and learning.

Games also engage learners by providing an immersive experience that captures their attention and holds their interest. They do this by leveraging the power of storytelling, graphics, sounds, and other multimedia elements to create a compelling and memorable experience.

Finally, games encourage active participation by providing learners with opportunities to make decisions, solve problems, and apply what they have learned in a safe and controlled environment. This allows learners to experiment and try out different strategies without fear of failure or negative consequences.

How I Will Engage Players

I can create a sense of achievement and accomplishment by designing the game with a progressive level structure where players start with simple and achievable goals and gradually move to more complex challenges. Each successfully completed level serves as an achievement, motivating the player to advance further and experience a sense of accomplishment.

Types of Fun

Easy Fun

This type of fun comes from simple and straightforward activities. It is like the fun you get from playing a game of tag or catching a ball. Easy fun is about immediate gratification and does not require much thinking or effort. Games that provide easy fun often have clear objectives and quick rewards, making them accessible and enjoyable for a wide range of players.

Hard Fun

Hard fun is the satisfaction that comes from overcoming challenges and obstacles. It is the feeling you get when you finally defeat a tough boss in a video game or solve a tricky puzzle. Hard fun requires effort, skill, and perseverance. Players are motivated by the sense of accomplishment they feel when they conquer difficult tasks, making them willing to invest time and effort into the game.

Social Fun

Social fun is all about interacting and connecting with others. It is the enjoyment that comes from playing games with friends or meeting new people through gaming communities. Social fun can be experienced in both cooperative and competitive settings, as long as there is some form of interaction between players. Games that emphasize social fun often feature multiplayer modes, chat systems, or online forums where players can communicate and collaborate with each other.

Serious Fun

Serious fun is about experiencing emotions and narratives. It is the enjoyment that comes from immersing yourself in a compelling story or exploring complex themes. Serious fun can evoke a wide range of emotions, from excitement and joy to sadness and fear. Games that provide serious fun often have richly developed characters, immersive worlds, and thought-provoking plots. Players are drawn in by the emotional depth and meaningful experiences offered by these games.

Each type of fun offers a different kind of enjoyment, and many games combine elements of multiple types to create a rich and rewarding experience for players. Whether it is the thrill of competition, the satisfaction of mastering a skill, the joy of connecting with others, or the immersion in a captivating story, games have something to offer for everyone.
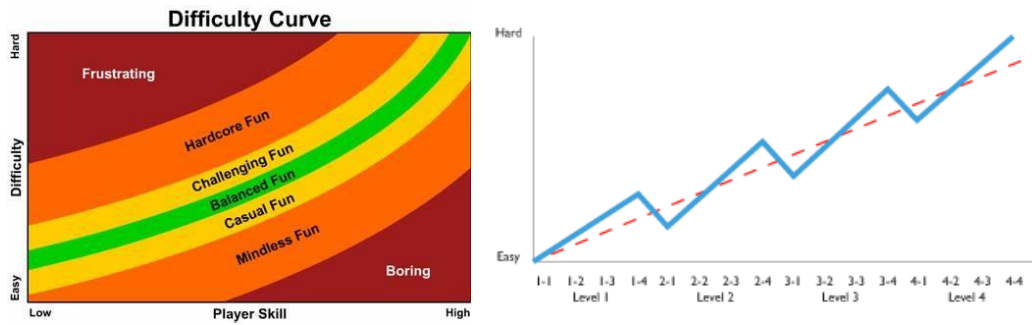
I aim to create a balance of fun in my game, some levels will be difficult, and others easy, but tend to be staggering around the average 'balanced fun' range

OCEAN Test

The Big 5 Personality Traits, or OCEAN is a test for predicting your personality, this test has some significant research to show that people's personalities can be broken down into 5 categories, the results of the test have been proven through research to have a link to genetics and past experiences in life.

Openness

This determines how open-minded or curious someone is to new knowledge and experiences. People with a high score of openness are curious about new experiences and like to learn.

This can be tested by asking:

- Are they adventurous?
- Are they imaginative?
- Are they the first to try new activities?

This will help me identify my target audience by providing information about how someone is influenced by a new experience. For example, when the player first plays the game, what will they do? Players with high openness will be curious by the gameplay and mechanics; willing to learn new ways of doing things and thinking outside the box.

I can adjust the mechanics and gameplay for people with differing levels of openness.

Conscientiousness

Conscientiousness is all about how organized, responsible, and goal-oriented someone is. People who score high here are usually dependable, detail-oriented, and great at planning ahead.

You can test this by asking:

- Do they plan their activities in advance?
- Are they detail-focused?
- Do they keep their promises and complete tasks on time?

Knowing how conscientious your players are can help you design the game better. For example, highly conscientious players might enjoy games with clear objectives, structured gameplay, and rewards for thoroughness. On the other hand, those who are less conscientious might prefer more open-ended, exploratory games without strict goals or deadlines.

Extroversion

Extroversion measures how outgoing and sociable someone is. Extroverts love being around people and thrive on social interactions.

You can test this by asking:

- Do they enjoy social gatherings?
- Do they feel energized by interacting with others?
- Do they prefer group activities over solitary ones?

Understanding a player's level of extroversion can help you design features that cater to their preferences. Extroverts might love multiplayer modes, social features, or competitive elements that allow them to interact with others. Introverts might appreciate solo gameplay or optional social features that let them choose when and how to engage with others.

Agreeableness

Agreeableness looks at how cooperative, compassionate, and trusting someone is. People high in agreeableness are often empathetic, helpful, and get along well with others.

You can test this by asking:

- How do they handle conflicts?
- Are they considerate of others' feelings?
- Do they strive to keep harmony in group settings?

Knowing how agreeable your players are can help shape your game's mechanics and storylines. Games for agreeable players might focus on teamwork, cooperation, and moral choices, rewarding players for kindness and collaboration. Less agreeable players might enjoy more competitive games or ones with moral dilemmas that challenge their views.

Neuroticism

Neuroticism measures how often someone experiences negative emotions like anxiety and stress. People high in neuroticism might get stressed or worried more easily.

You can test this by asking:

- How do they handle setbacks or challenges?
- Do they get stressed or anxious in uncertain situations?
- Do they tend to focus on negative feelings or past mistakes?

Understanding a player's level of neuroticism can help create a more enjoyable gaming experience. For instance, players high in neuroticism might appreciate games with calming aesthetics, clear feedback, and opportunities to relax. Those lower in neuroticism might enjoy more challenging and adrenaline-pumping scenarios.

By considering these personality traits, you can design games that resonate with a wide variety of players, making their gaming experience more engaging and enjoyable.

Balancing Difficulty

Types of game difficulty and progression

Static and Dynamic Difficulty in Games: In games, there are two ways to handle difficulty. Static Game Difficulty (SGD) means the challenge level stays the same from start to finish, and thus does not scale to the player's skill. Dynamic Difficulty Adjustment (DDA), on the other hand, changes the challenge based on how well the player is doing. For example, if a player finds a math problem too easy, DDA might make the problems harder as they progress. If it is too hard, DDA could make them easier to keep the player engaged.

Balancing Difficulty Based on Player Actions: This means the game adapts to how well the player is doing. In a math game for players, this could mean giving hints or simpler problems if a player struggles with certain math concepts. For instance, if a player has difficulty with multiplication, the game might offer more practice or simpler questions in that area until they improve.

Applying Expectancy-Value Theory (EVT): EVT helps game designers understand why players keep playing. In a math game, this might mean giving rewards or praise for solving tough problems. For example, if a player gets a high score in a challenging level, the game could celebrate their achievement to motivate them to keep going.

Utilizing Effective In-Game Tutorials: Tutorials are like guides that teach players how to play a game. In a math game, tutorials could walk players through solving several types of math problems step by step. For instance, a tutorial might show how to add fractions or solve equations, with opportunities to practice and get feedback. These tutorials should be easy to understand and interactive, making learning math fun and engaging for players.

Types of players and factoring their skill/experience
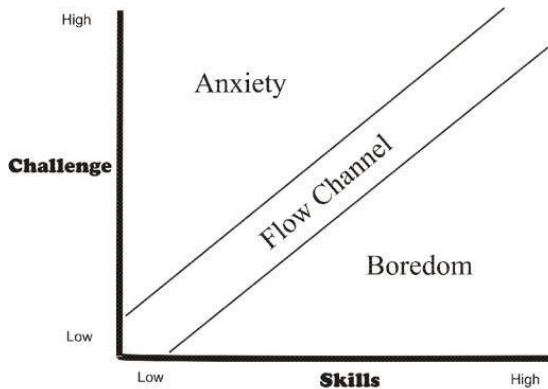
The Flow. After Mihaly Csikszentmihalyi, *The Flow (1990)*, p. 74

Deciding how hard a game should be is important, and it depends on who is going to play it and how good they are at playing games. I need to make sure the game is fun and challenging enough for players to enjoy, but not so hard that they get frustrated. Some games, like Dark Souls or Hollow Knight, are known for being super tough on purpose to test players' skills. But for most games, the best way to make sure the challenge matches the players' skills is by using DDA, or Dynamic Difficulty Adjustment. This means the game adjusts itself as you play to keep it exactly right for you. Research by Kristan and others talks about separate ways to do this, and studies by Alexander and his team show that DDA works better than other methods for keeping players happy. Figuring out the right balance of challenge and skill for most players can be tricky, but it is crucial to make a game that lots of people will enjoy playing.

Flow State and competency
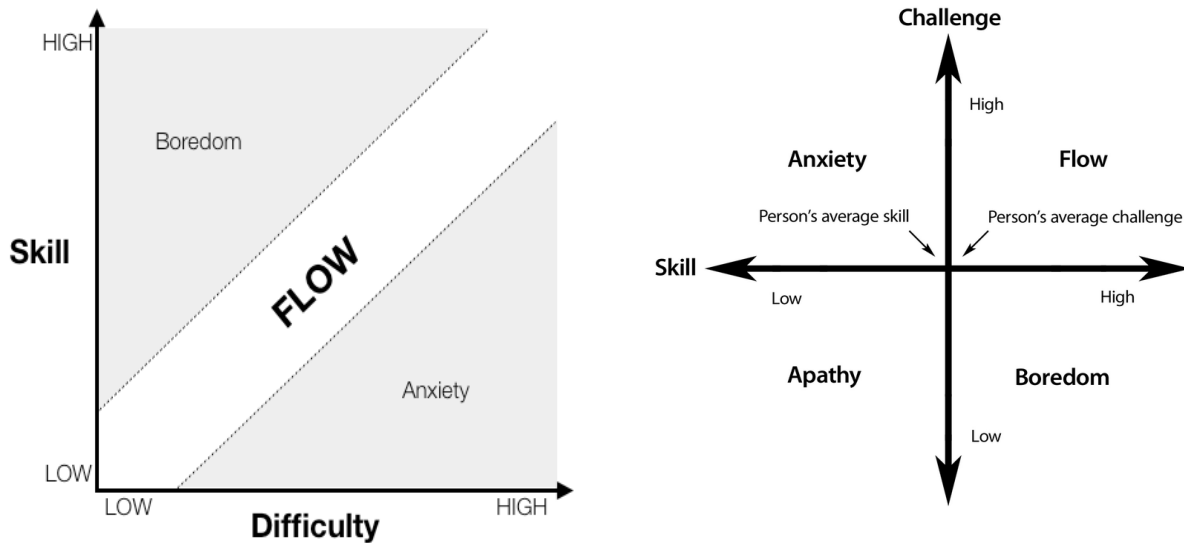
Although not often discussed, the goal for most video game designers is for their players to achieve and maintain a flow state while experiencing their game. Doing so is a complex and ambiguous undertaking in which difficulty plays a major part as finding the correct balance in difficulty for players is vital to motivating a state of flow. Successfully motivating a flow state within players during gameplay heightens their perception and enjoyment of the game and thus creates a far more positive experience of the game overall. One of the essential ways to achieve this within players is to encourage self-efficacy in players and developing their feelings of competency with the game systems, enhancing their ability to overcome further challenges thus maintaining the flow state for longer. Although it is quite a discrete concept, flow, and encouraging it within players, is an essential aspect of the game design process and one which must be considered when assigning difficulty.

Effects of difficulty on enjoyment

Difficulty and enjoyment have an almost inseparable relationship in video games. Though enjoyment is a very subjective experience, a game's difficulty system is a main objective factor within a game that has a direct effect on individual players' experiences and thus enjoyment, though this effect is neither strictly directly nor inversely correlated. In a study by Alexander and other researchers found that scaling difficulty and challenge increased enjoyment for experienced players whereas more casual players favoured lower difficulties regardless of their performance. Although enjoyment is often perceived as the paramount purpose of games and thus other aspects of the game should work strictly in favour of player enjoyment, in some cases a higher difficulty is essential for a game's systems to attain their desired effect. This usually comes with the consequence of reducing the player base to only those able and willing to gain mastery within the game itself. This choice to put the developer's goal and thus difficulty first may hinder enjoyment for many players but, in turn, heightens the enjoyment for those able to succeed within the game. Though player enjoyment is a significant factor for a game's success, this does not suggest that factors

such as difficulty must compromise for the enjoyment of the majority. Games of both high and low difficulties can and have succeeded in providing enjoyable experiences of their specific player bases.

Idea Generation and Pre-Production

Application List

Application Name	Application Source	Description of Use or Function
Unreal Engine	Epic Games	Games Engine I will use to develop the mechanics, logic and visuals
Blender	Blender.org	3D modelling software I will use to produce game assets and environment designs
Roblox Studio	Roblox Corporation	Game Engine I will use to create environment designs and test simple mechanics before transferring to Unreal Engine.

Asset List

Asset Name	Asset Source	Description of Use or Function
Colour Cubes	Blender	3D models of the colour cubes use by the player to solve the math problems
Cube Platforms	Blender and Unreal Engine	3D models of the platforms that the player will place the cubes on to solve the math problems
Level Meshes	Unreal Engine	Static Mesh Components used for Level Design
Text Rendering Method	Unreal Engine	Text Render Actor to render text objects within the game world for User Experience and Interfacing with the player
Object Highlighting Method	Unreal Engine	Highlighting Mechanic which visually highlights important objects in the game world for User Experience and Interfacing with the player

Game Mechanics and Goals

Colour Cubes

Colour Cubes are cubes that have numbers associated with them. They generate in rooms, usually more than 2, and can be grabbed by the player and places on platforms to perform math problems.

These cubes are vital in this game, they are the main interactable to complete levels. Balancing the cube values will be a major part of the DDA system I hope to implement in the prototype game.

Math Operations

Math Operators will be another mechanic the player can choose from within levels, either addition, subtraction, multiplication, or division. I could add more with further development but those are the key operators I want to implement in the prototype for now.

The player will be able to pick what operator they want to learn, aiding the learning process to the player's needs.

Intuitive Procedurally Generated Levels

The DDA system aids in providing a general difficulty for level generation. Each level being procedurally generated by the algorithm aims to tailor the learning to the player's needs whilst keeping them in the flow state.

The procedural element includes generating everything that is encompassed in a level, such as platforms, cubes, an answer for the payer to solve, and the general space in which the player can move. I aim to make levels that are familiar, but also offer differing levels of difficulty by having some levels require parkouring to get to essential elements in solving the level – such as a colour cubes at the end of some jumps.

Addictive Goals and Challenges

The goal of the game is to complete as many levels as you can. The level will get progressively more difficult through the DDA system, which aims to add a challenging learning experience that will keep the player in flow state - not too easy or too difficult.

Progression and Difficulty

Progressive Dynamic Difficulty

Seamless progression through rooms with increasing complexity, offering a consistent challenge tailored to the learning curve of young players. This encourages players to stay focused and engaged with the game as they progress, while also allowing them to increase their skills as they play. This allows for a more rewarding experience, as players can continually increase their level of difficulty as they progress. DDA systems work by dynamically adjusting the difficulty of the game based on the player's skill level and performance. This ensures that players are always challenged but not overwhelmed, creating a personalized and engaging experience. For example, a DDA system might adjust the difficulty when a player reaches a certain milestone, such as completing a level or achieving a high score. This ensures that players can keep progressing and are always challenged, instead of becoming bored or tired of the game after reaching a certain level. Ultimately, the use of DDA systems ensures that players have a consistent, enjoyable gaming experience.

Learning Experience

This game incorporates a blend of educational content with optional competitive elements, providing a unique opportunity for players to put their newly acquired mathematical and logical skills into practice. The game offers players the opportunity to use their mathematical and logical skills to solve puzzles and challenges, as well as compete with other players for the highest score. By offering both educational and competitive elements, the game encourages players to hone their skills and have fun at the same time. All in all, the game provides an enjoyable and educational experience for players of all ages.

Level Designs and User Interface

Level Design Concept

I have made some concept levels using Roblox Studio to give me some ideas for layout and visual style. I will use this as a reference when designing the levels.

Roblox's building system is good for blocking out and creating concept environments and level designs because of its ease of use. It is simple to understand, offers thousands of free assets to use and allows for lighting, environment visuals effects, camera effects and more to be edited to make the concept idea generation easy and efficient. This is an example level I created:
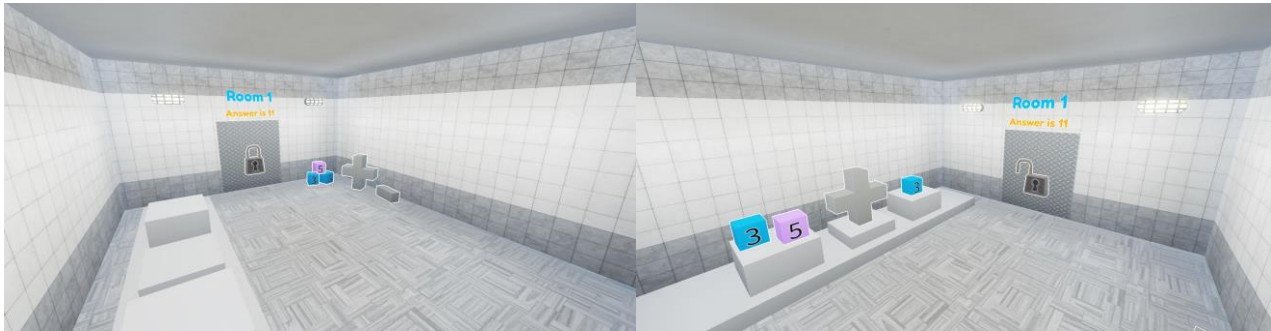
Level Design concept – Image of example level when not solved versus when it is solved

This shows both the default level and a possible solution to the level, the lock on the door shows that the next level unlocks when the player solves the puzzle.

User Interface

From the games I have researched, I have found that the HUD for most games is quite basic, I want to keep it simple for learners and tailor the UI to them.

Some feedback I received while testing was that it was hard to see what your character is looking at. To fix this, I added a crosshair in the centre of the screen

Production

Blueprints and Algorithms

Gamemode Blueprint – Main Events

The Gamemode blueprint controls what happens in the game, like level generate and general calculations to do with the main gameplay mechanics.
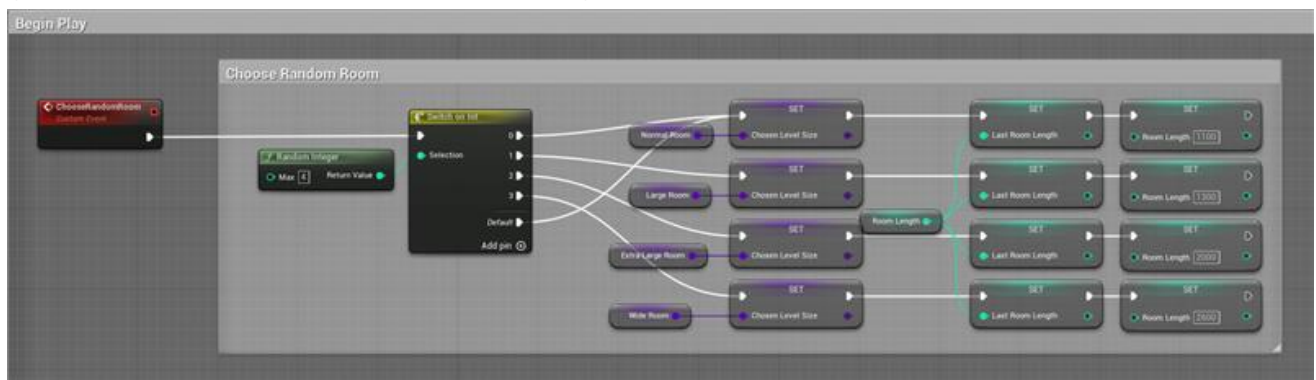

Image of Blueprint 'ChooseRandomLevel' - Chooses a random Room object class to be used as the new room

This blueprint is an event called 'ChooseRandomRoom' accepting no parameters and 'returns' a random room object class (events in the event graph cannot return values, so what is meant by return is setting a global variable as a pseudo-return statement). It uses a switch statement using an random integer between 0 and the maximum number of different room object classes, it uses this number to determine what room is picked. It also sets a global variable which describes the room length along the x-axis, which is used to

45

position the following rooms consecutively, this prevents gaps between rooms or rooms generating inside each other – creating the seamless transition of rooms.
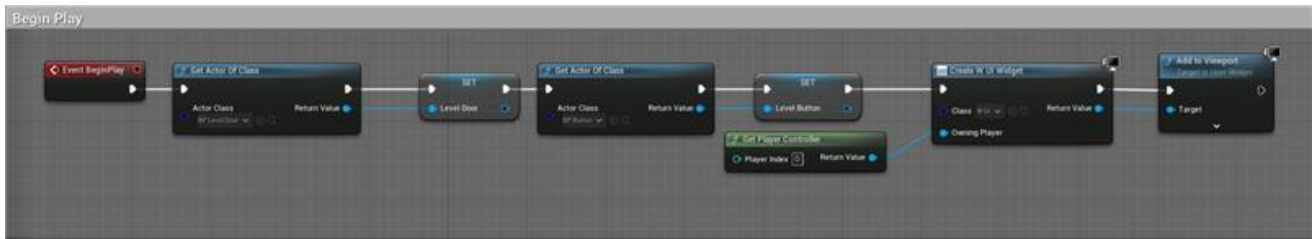

Image of Blueprint 'BeginPlay' - Initial setup of variables and UI

This blueprint sets up the initial elements of the game, like assigning variables and displaying UI elements at run time.
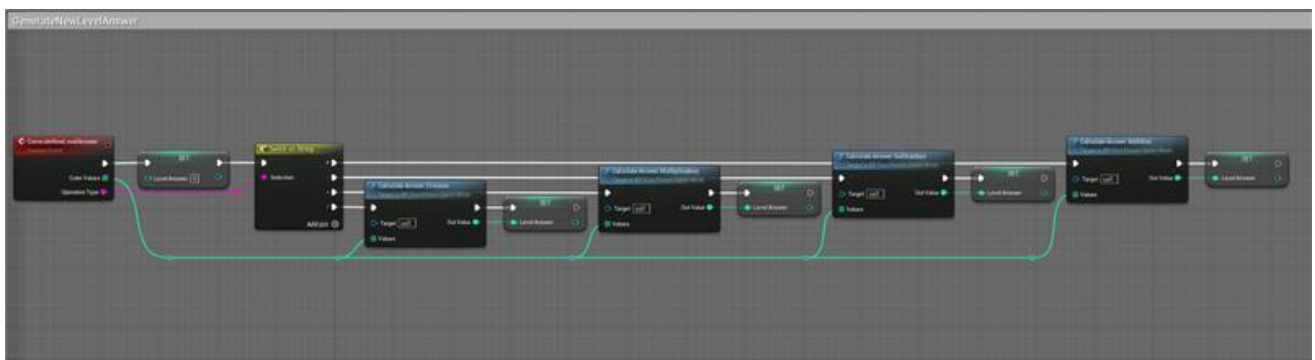
Image of Blueprint 'GenerateNewLevelAnswer' – generates a new level answer

This blueprint is an event called 'GenerateNewLevelAnswer' accepts 2 parameters –

- 'Cube Values' which is an Array of Integers,
- 'Operation Type' which is a String

And 'returns' an Integer for the new level answer. This function uses another switch statement using a string instead, it uses the 'Operation Type' value to determine what function is called, these functions use an algorithm I created which uses the CubeValues passed into the function to generate a level answer that is possible to create using the values of the cubes provided in the room.
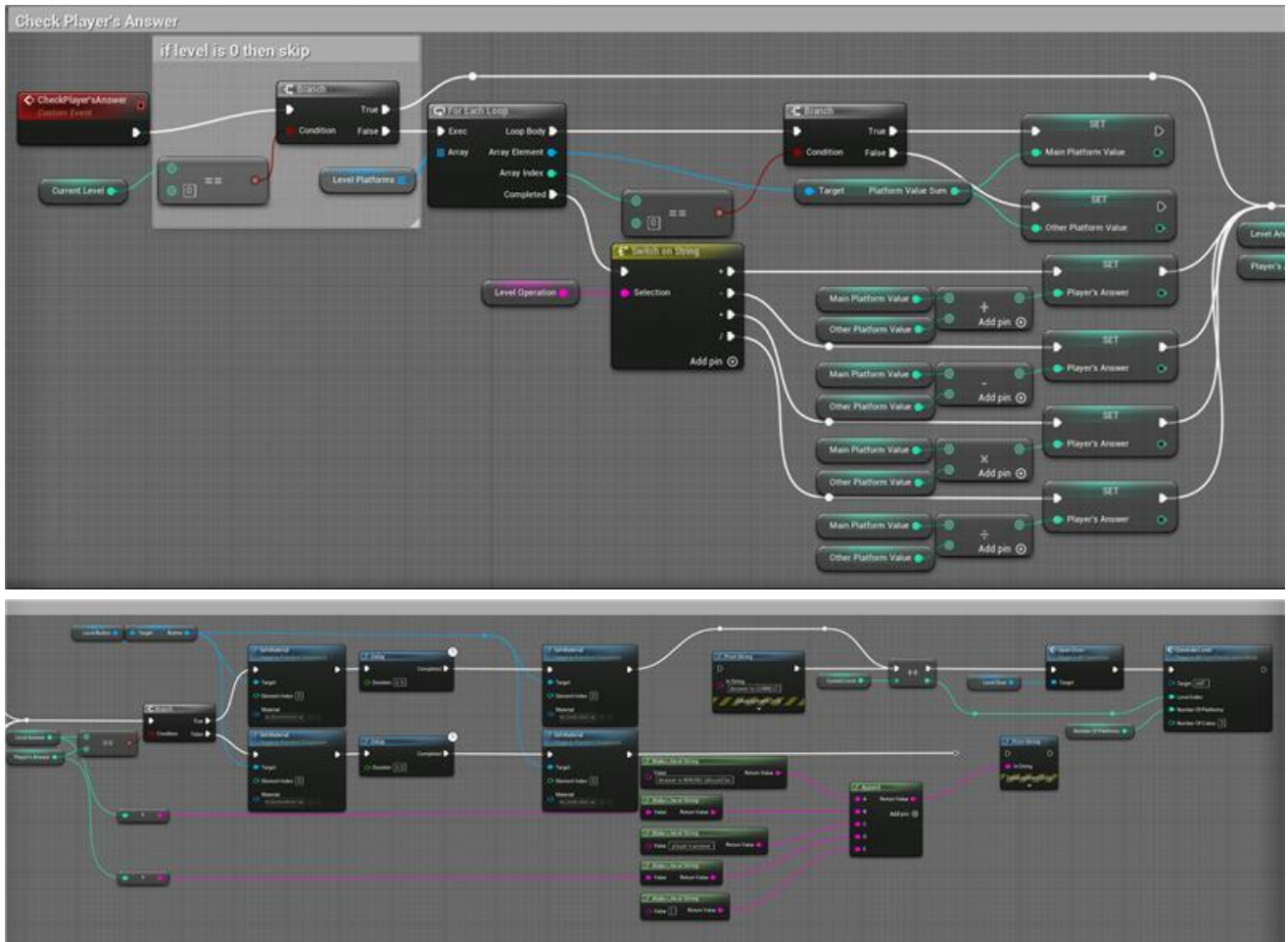
This blueprint is an event called 'CheckPlayer'sAnswer' which accepts no parameters and determines if the player's answer to the current room is correct or not. It does this by taking the total values of each platform and performs the operation on both numbers respectively to calculate the player's answer, then compares this to the level answer to check if it is correct. If it is not correct then it turns the button red for 2 seconds before resetting the colour, telling the player that the answer is not correct. If it is correct then turns the button green for 2 seconds, increments the 'Level Index' variable and begins to generate the next room.

Gamemode Blueprint – Room Generation
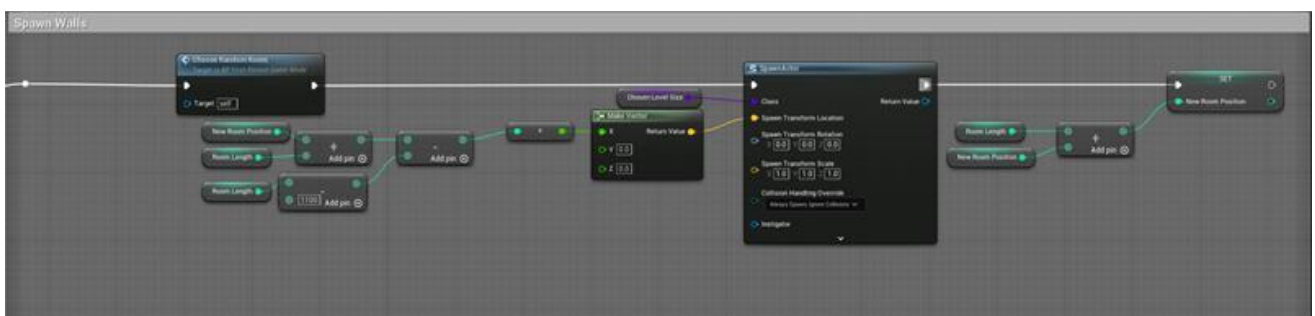
The first part of room generation consists of generating the actual room itself, it calls the 'ChooseRandomRoom' event to get a random room object class to use as the room, then

creates a new blueprint instance and positions it by manipulating the 'Last Room Length' variable.
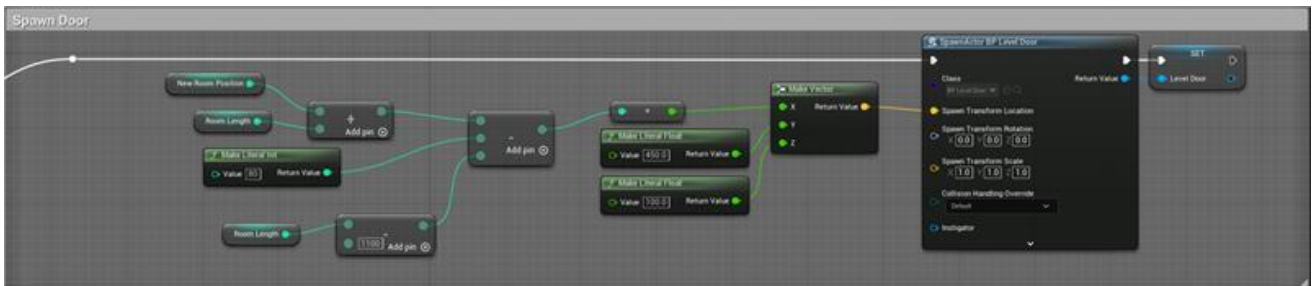
The next step to level generation is positioning the exit door for the room, it just uses math to calculate where the door is in the room and factoring where to position it in world space relative to the room's position.
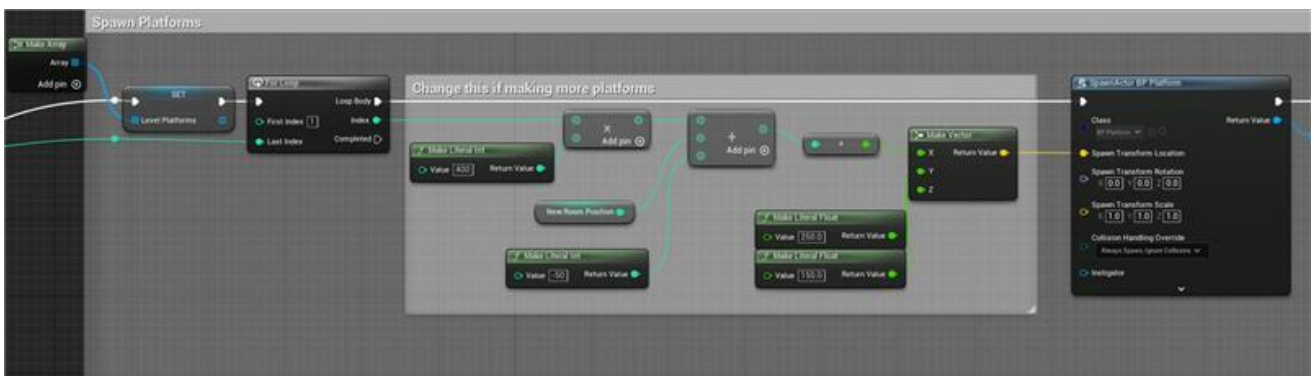
Next is positioning the platforms which the player puts the cubes onto to solve the puzzle. It uses the same process as with the door; using math to calculate where the platforms are in the room and factoring where to position it in world space relative to the room's position. This uses a for loop to iterate over the number of platforms chosen to generate in the room. It uses the index of the loop as an offset to position the platforms adjacent next to each other.
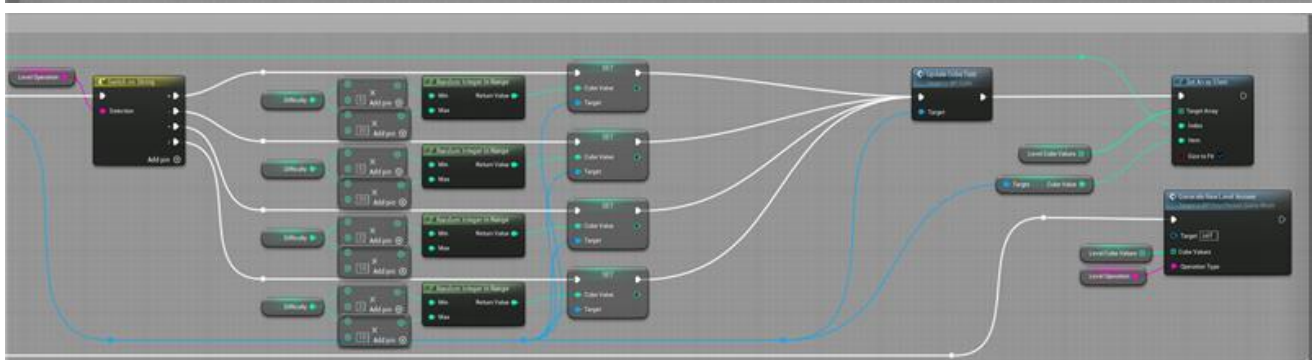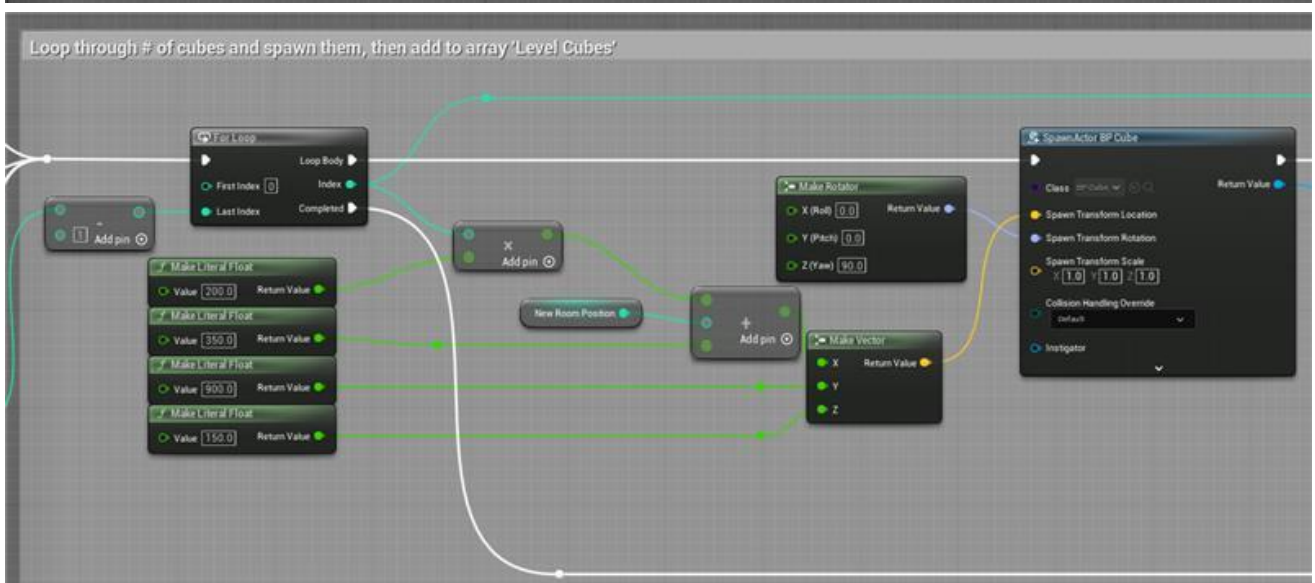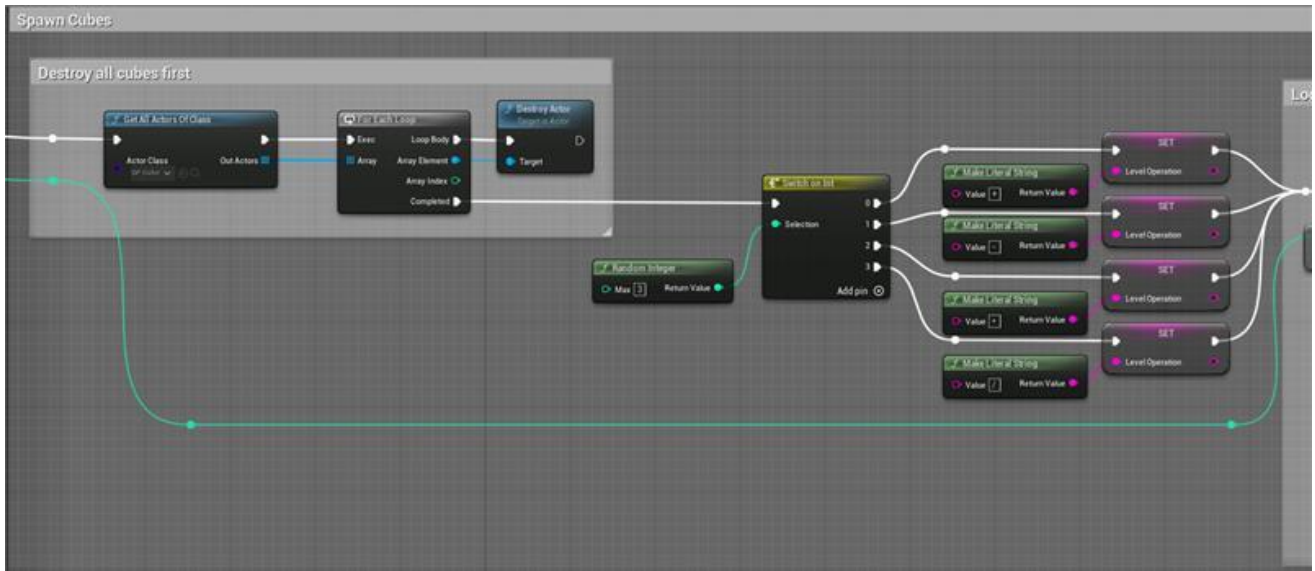
After that, it destroys all the cubes in the world and begins generating a random operation type to be used when calculating the cube values. I did this by using a switch statement using a random integer between 0 and the maximum number of operation types – being 4. It uses this value to set the 'Operation Type' variable to either "+", "-", "*" or "/" respectively. Then, it spawns the cubes using a for loop, it uses the index as the offset position for the cubes so that they do not spawn inside each other but instead spawn in a row adjacent to each other.

The values for each cube are then generated using a 'Difficulty' multiplier, which the DDA (Dynamic Difficulty Adjustment) system determines.
After all that, it generates a new level by calling the event 'GenerateNewLevelAnswer'.
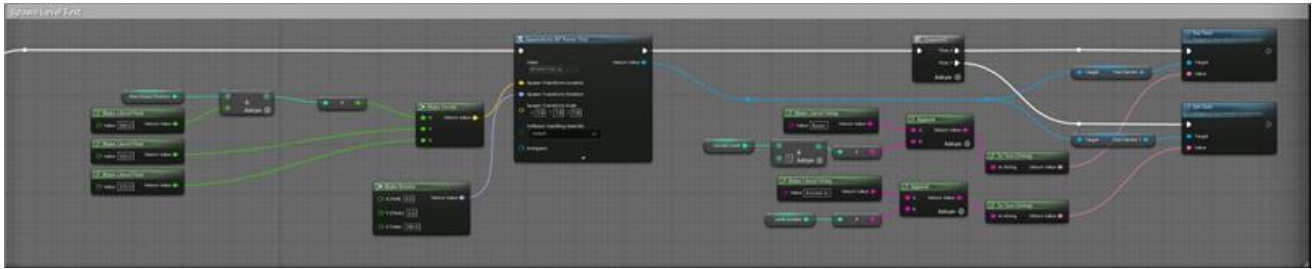
Next is spawning the text that displays the room number and the answer of the level. It uses the same positioning as other room objects, but it also requires a rotational change so that the forward vector of the text points inversely to the x-axis. After the text spawns, the text renderer components inside the actor are updated to render the text of the room index and level answer.
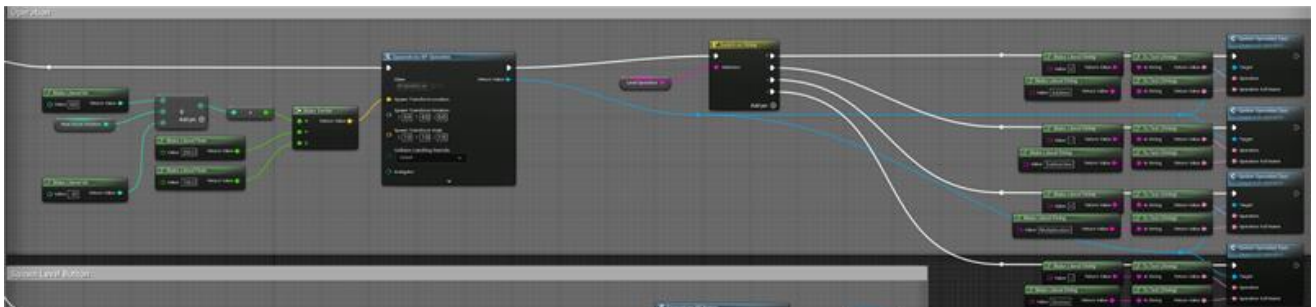
The next blueprint generates the operation actor which display the operation type as a text renderer inside the room. After it spawns, the text renderer component is updated to display the symbol and word describing the operation type for people who do not understand the symbols.
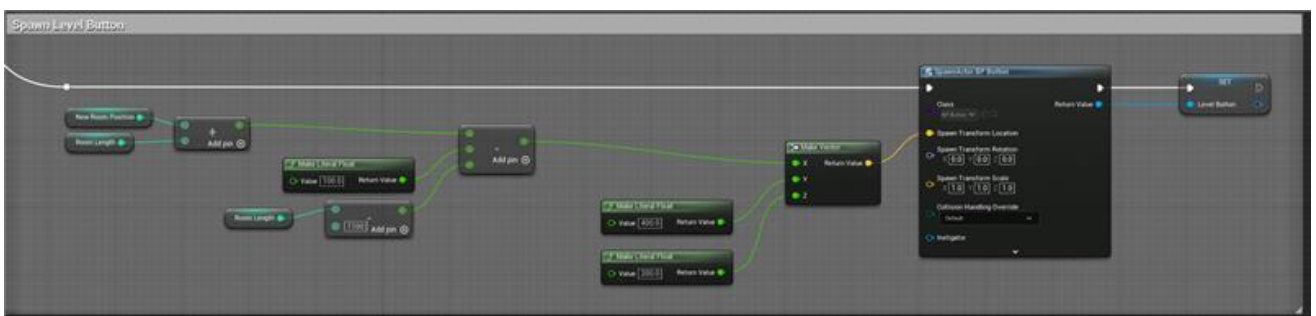
Finally, spawning the button which the player presses to confirm their answer.

Player Controller
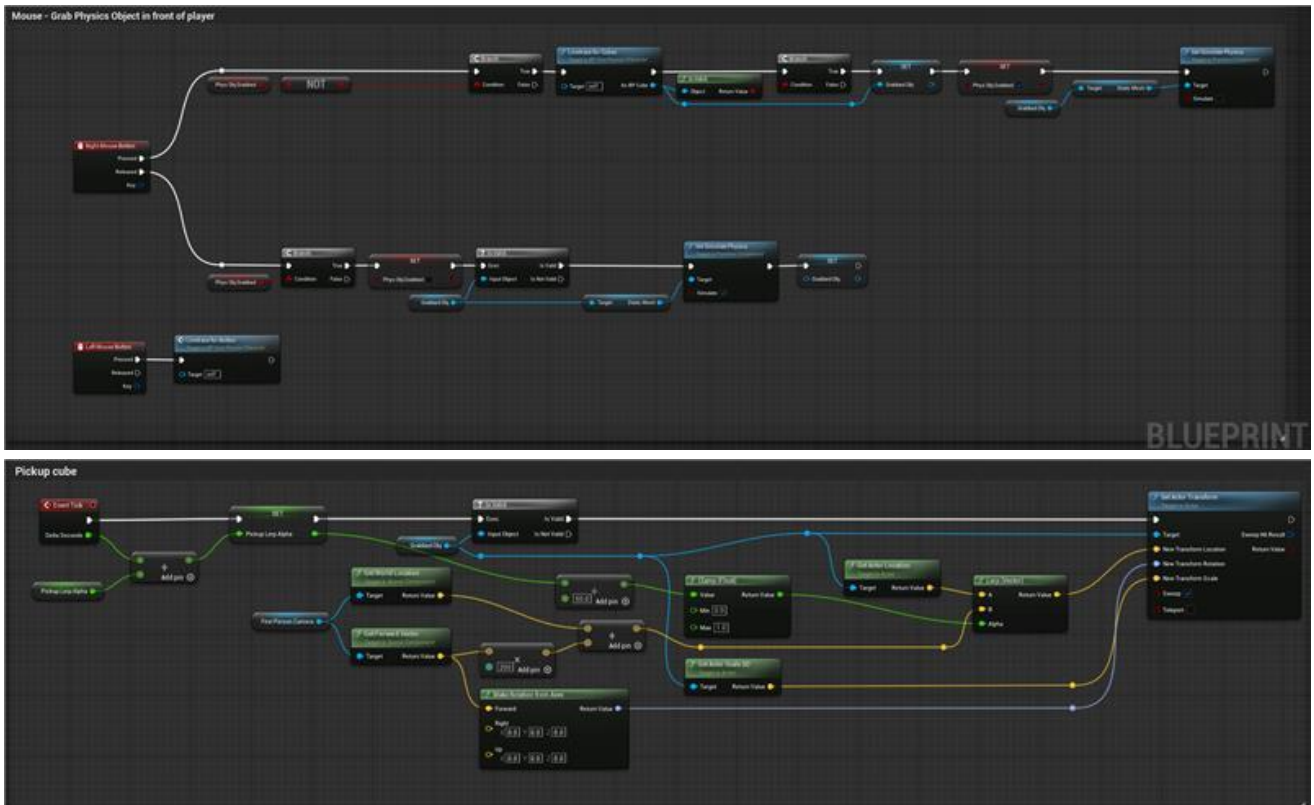
This event inside the player controller is called when the server detects a right mouse button pressed or released event on one of the clients. I use this to detect for any cubes in front of the player's camera and linearly interpolate their position in front of the player. I detect for cubes by ray casting, or in other words, projecting an invisible line into 3D space to collect hit results. Then I break the hits results into the individual values and cast the 'HitActor' value to a BP_Cube class. If the cast returns successful, then the actor hit was a cube and is then set to a global variable.

Moving the cube in front of the camera uses the linear interpolation code:

```
float lerp(float v0, float v1, float t) {
    return v0 + t * (v1 - v0);
}
```

*Where v0 and v1 are the points represented as float numbers, and t (or sometimes called alpha) is the interpolant – the percentage, between 0 and 1, to interpolate between.

This function is used on all 3 axes of the cube's position to make the smooth and predictable translations of the cube when grabbing it.

Character Design

In my first-person math game, I've decided to add a unique touch by incorporating a character model created in Blender. While the character's visibility is limited, only appearing when the player looks downwards, it adds a subtle layer of immersion and interactivity to the gameplay experience. The character's presence allows players to see their hands in action as they navigate through the game world, adding a tactile dimension to interactions such as picking up math cubes. Though not essential to the core mechanics, this character model adds a touch of personality and charm to the overall ambiance of the game.

Given the character's primarily concealed visibility within the game, I opted for a low poly design to optimize performance without sacrificing visual quality. The character's simple yet recognizable silhouette ensures that it remains distinct and identifiable, even in brief glimpses.

To create the character model, I followed step-by-step instructions found in online tutorials. Starting with a basic humanoid mesh, I carefully sculpted and refined the model to achieve the desired appearance.
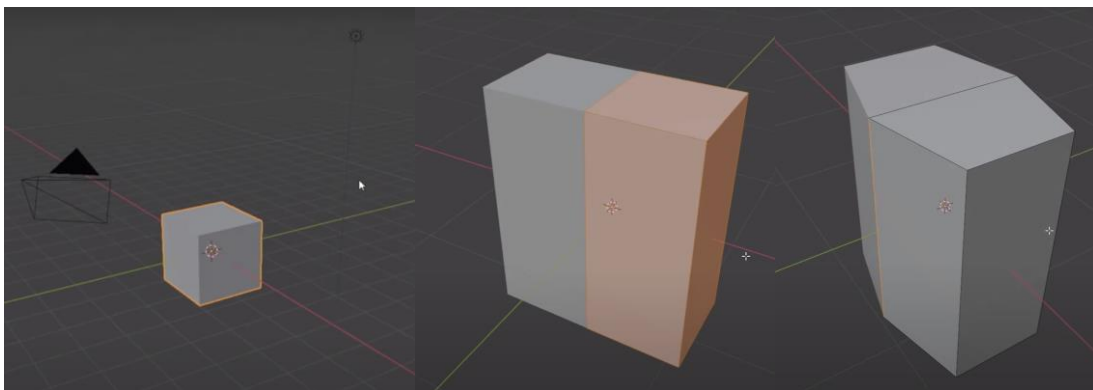
I started by using the default cube to create the torso of the character. I used a mirror modify to make the modelling process easier, then adjusted the dimensions to make a rounded torso shape while keeping the poly count low.
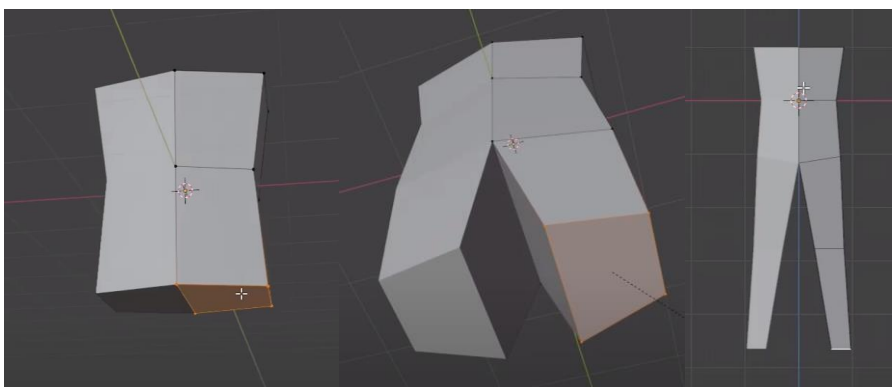
Next, I added loop cuts to the torso and began extruding the legs from the bottom, I tried to use references images to get the proportions correct. I made sure to add loop cuts where the joints would be to make the animations will look better when in-game.
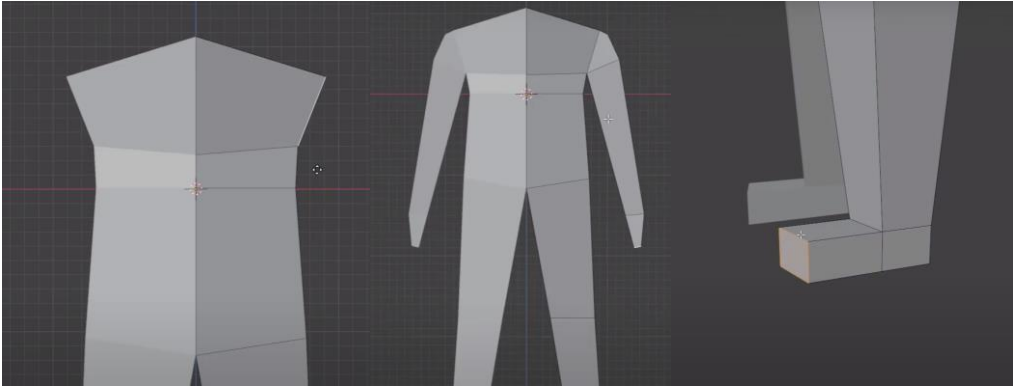
After that, I adjusted the shoulders and neck area so that I could extrude some arms. I made sure to add loop cuts to act as joints for the shoulder and elbow, then move on to shaping the feet. I kept it simple
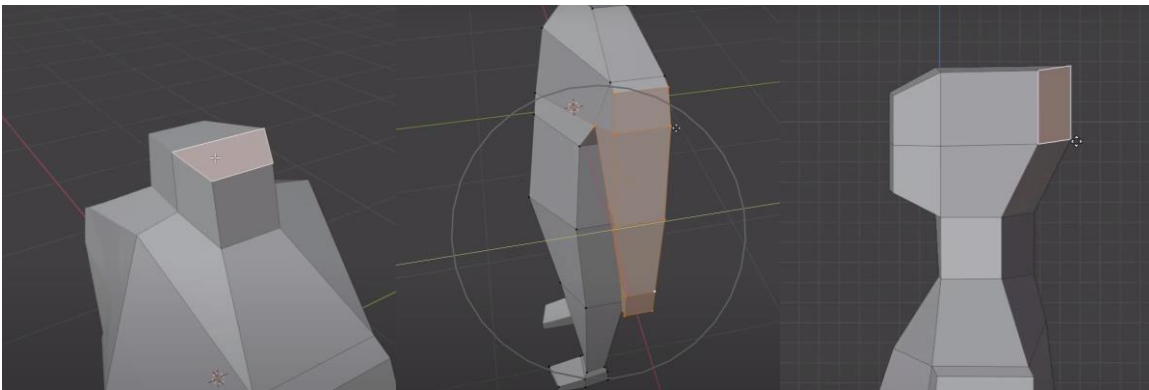
The next step was to model the neck and head, I extruded the neck and made a simple head shape.
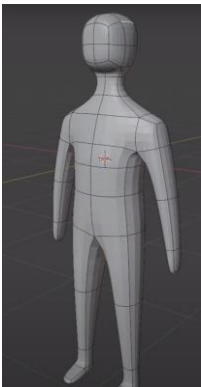
Finally, I added a subdivision surface modifier to finish off the character.

That concludes the character modelling process, i may not be the best 3D modeller, but I'm happy with what I have created for the game.

Evaluation

Play Testing Feedback

Introduction

After receiving feedback from several play-testers of my game, I'm eager to delve deeper into their insights. This feedback provides a valuable opportunity to gain a better understanding of the strengths and weaknesses of my game, as well as to identify areas for improvement. By analysing the feedback, I hope to gather actionable insights that will guide me in refining and enhancing the overall player experience. Through this process, I aim to ensure that my game meets the expectations and preferences of its target audience while delivering an engaging and enjoyable gaming experience.

Graphics

How would you rate the graphics quality of the game? (1-5, with 1 being poor and 5 being excellent)

1	Archie Holmes	5
2	Evelyn Garrett	4
3	Fabian-Ioan Cretu	5
4	Liberty Weller	3
5	Carla Helbert	4
6	Aston Gleeson	4
7	Aiden Bijak	4
8	Rico Canadinhas Canadinhas	3
9	Meekah Allen	5
10	Ali Gleeson	4
11	Gregory Kitchin	4

Overall, the graphics quality of the game seems to be rated quite positively. The majority of respondents rated it between 4 and 5, indicating a good to excellent level of graphics quality. Only a few respondents rated it lower, with scores of 3, which suggests that there may be some room for improvement, but the overall impression is still favourable. It seems like the game's visuals are generally appreciated by the players.

Playability

What aspects of the overall playability of the game do you find enjoyable, and are there any areas that need improvement?

1	Archie Holmes	I liked the mix of maths and parkour.
2	Evelyn Garrett	I found the game quite fun having to figure out the correct numbers to solve the equation. But the cubes were a bit difficult to carry and place on the podiums sometimes
3	Fabian-Ioan Cretu	I likes how you combined parkour and math
4	Liberty Weller	the maths questions made me think and realise how dumb I am :)
5	Carla Helbert	I like the game play requiring to use both mouse and keyboard - uses different motor skills at the same time.
6	Aston Gleeson	Putting the cubes on top of the green boxes was a little frustrating, but once I got the hang of it, it got consistent and alot more fun.
7	Aiden Bijak	I find the parkour quite fun and the simplicity of the game was also entertaining
8	Rico Canadinhas Canadinhas	The game is cool! Each block is like a mini calculator.
9	Meekah Allen	the cubes were a bit fiddly sometimes but overall it was very enjoyable
10	Ali Gleeson	The very simplistic aesthetic of the game compliments how simple it is to grasp how to play.
11	Gregory Kitchin	The game was enjoyable and I liked the mixture of Maths and gameplay.

Players seem to find the combination of math challenges and parkour elements enjoyable in the game. The mixture of these two elements appears to be a unique and engaging aspect of the gameplay. Some players appreciate the mental challenge posed by the math questions, while others enjoy the physical aspect of the parkour elements.

However, there are some areas that could be improved. Several players mentioned that placing the cubes on the podiums was a bit difficult or frustrating at times, suggesting that there may be room for improvement in terms of controls or mechanics related to this aspect of the game. Additionally, a few players found the cubes to be fiddly, indicating that

there could be some refinement needed in terms of the handling or interaction with game objects.

Overall, the feedback suggests that the game has a solid foundation and offers an enjoyable experience, but there are some minor issues that could be addressed to further enhance the playability and enjoyment for players.

Sound

How do you feel about the sound effects and music in the game? Do they enhance your gaming experience?

1	Archie Holmes	I enjoyed them :)
2	Evelyn Garrett	I played the game without sound so unfortunately I can't comment on their effect on the game but I did enjoy the game even without sounds.
3	Fabian-Ioan Cretu	I didn't have headphones so I did not hear it
4	Liberty Weller	i like them, very fitting
5	Carla Helbert	Sound does enhance the gaming experience.
6	Aston Gleeson	The music sort of fits, but it sounds a bit childish for your intended Target Audience.
7	Aiden Bijak	Fit the theme of the game quite well being bright and happy
8	Rico Canadinhas Canadinhas	The music feels a little generic, but it'd be nice to have some sounds for the blocks colliding.
9	Meekah Allen	sounds effects and music were very suitable for the game's theme
10	Ali Gleeson	The song is perfect, very cheery and suits the Target Audience.
11	Gregory Kitchin	I was not using headphones.

The feedback on the sound effects and music in the game seems generally positive, with most players expressing enjoyment or satisfaction with them. Some players mentioned that the sound effects and music enhanced their gaming experience, contributing positively to the overall atmosphere of the game.

However, there are a couple of points worth noting. One player mentioned that they played without sound, so they couldn't comment on the effect of the audio on the game. Another player felt that the music sounded a bit childish for the intended target audience, suggesting that there might be some room for improvement or adjustment in terms of the musical style to better match the audience's preferences.

Overall, it seems like the sound effects and music are generally well-received and contribute positively to the game's atmosphere, but there may be some room for refinement or adjustment to better align with the preferences of the target audience.

Target Audience

Do you think this game is appropriate for the intended target audience? What age group do you think this game is best suited for?

1	Archie Holmes	I believe the game is suitable for a younger audience, around 6-8, based on the types of maths questions there were.
2	Evelyn Garrett	This game seems quite suitable for children.
3	Fabian-Ioan Cretu	Yes its appropriate like 12-15 year old
4	Liberty Weller	the questions where a bit hard but maybe im just stupid
5	Carla Helbert	I think this game could be suitable for multiple age ranges by simplifying or making the sums easier/harder for that different age groups.
6	Aston Gleeson	Younger Junior School, since the maths is incredibly simple.
7	Aiden Bijak	Yes, early years up to 10 maybe?
8	Rico Canadinhas Canadinhas	9-12
9	Meekah Allen	yes i think its appropriate . id say the target audience is primary school children.
10	Ali Gleeson	I do! 11-16, if not younger.
11	Gregory Kitchin	7-11 year olds primarily.

Based on the feedback provided by the players, it seems that the game's target audience is generally perceived to be children and younger adolescents, ranging from around 6 to

15 years old, with some suggesting an upper limit of around 16. The simplicity of the math questions and the overall gameplay mechanics seem to support this assessment.

However, there is some variation in the perceived age range among players, with some suggesting it's suitable for younger children, while others feel it may appeal to slightly older adolescents as well. Additionally, a few players mentioned the possibility of adjusting the difficulty of the math questions to cater to different age groups, indicating a potential for flexibility in the game's target audience.

Overall, it appears that the game is most likely intended for a younger audience, possibly ranging from early primary school to early secondary school age, but there may be some appeal to a slightly broader age range as well. Adjustments in gameplay elements, such as math difficulty, could further refine the target audience and enhance the game's accessibility.

Engagement

How engaged did you feel while playing the game? (1-5, with 1 being no engagement and 5 being fully engaged)

1	Archie Holmes	5
2	Evelyn Garrett	4
3	Fabian-Ioan Cretu	4
4	Liberty Weller	5
5	Carla Helbert	5
6	Aston Gleeson	5
7	Aiden Bijak	4
8	Rico Canadinhas Canadinhas	3
9	Meekah Allen	5
10	Ali Gleeson	5
11	Gregory Kitchin	4

The engagement level reported by the players seems quite high overall, with the majority of respondents rating their engagement between 4 and 5. This indicates that players

generally felt immersed and involved in the game while playing. It's noteworthy that several players gave a rating of 5, indicating a high level of engagement, which suggests that the game successfully captured their interest and kept them engaged throughout their gameplay experience.

While there are a couple of players who rated their engagement slightly lower (with scores of 3 and 4), the overall trend suggests that the game effectively managed to engage most players. This positive feedback is indicative of a compelling and enjoyable gaming experience that successfully captivated the players' attention.

Progression

Did you feel a sense of progression as you advanced through the levels? Were the difficulty levels balanced throughout the game?

1	Archie Holmes	There was a sense of progression, and I only found one thing difficult, but that was because of my own mistake.
2	Evelyn Garrett	The levels seem to be well balanced and the questions were simple but nicely solvable.
3	Fabian-Ioan Cretu	Yes
4	Liberty Weller	yes
5	Carla Helbert	Felt achievement as I progressed further through the game and the difficulty levels were balanced throughout.
6	Aston Gleeson	It was. The randomization was also very seamless.
7	Aiden Bijak	Yes starts simple and gets more complex overtime
8	Rico Canadinhas Canadinhas	Yes
9	Meekah Allen	yes, the difficulty levels were preety consistent.
10	Ali Gleeson	I did! The progressions is perfect.
11	Gregory Kitchin	There was a sense of progression within the gameplay.

The feedback suggests that players generally felt a sense of progression as they advanced through the levels of the game. They perceived the difficulty levels to be well-balanced, with the gameplay starting off relatively simple and gradually increasing in complexity over

time. This progression was seen as seamless and consistent, with players experiencing a sense of achievement as they progressed further.

Several players noted that the questions were simple but nicely solvable, indicating that the difficulty curve was appropriate for the target audience. Additionally, the randomization of elements within the game was mentioned as contributing to the sense of progression, making the gameplay experience varied and engaging.

Overall, the feedback suggests that the game effectively implemented a sense of progression, with balanced difficulty levels that provided a satisfying and rewarding gameplay experience for the players.

Mechanics

What did you think of the game mechanics? Were they intuitive and easy to understand, or did you find them confusing? Were there any specific mechanics that you particularly enjoyed or disliked?

1	Archie Holmes	I liked the game mechanics, I felt it fit the game perfectly.
2	Evelyn Garrett	The mechanics were easy to understand and seemed fine.
3	Fabian-Ioan Cretu	Yes they were
4	Liberty Weller	very good, see you put a lot of effort into the blueprints, i think its really cool what u did
5	Carla Helbert	I liked the game mechanics as you had to fully interact in each level for example if the cubes were not balanced they would fall off and therefore you have to move yourself to be able to pick the cubes up again and position them correctly.
6	Aston Gleeson	They were easy to understand once I got going, but the instructions were relatively unclear.
7	Aiden Bijak	They were shown before so i knew how it all worked and meant they worked quite well
8	Rico Canadinhas Canadinhas	Yeah, it was easy to understand. It would be nice to have more functions in the blocks, for a more fun puzzle solving aspect.

9	Meekah Allen	they were easy to understand and i enjoyed the jumping puzzles.
10	Ali Gleeson	I didn't run into any bugs whatsoever and they were easy to understand, especially with the tutorial in the beginning.
11	Gregory Kitchin	It was easy to understand and to play.

The feedback on the game mechanics is quite positive. Players generally found the mechanics to be intuitive and easy to understand, contributing to an enjoyable gameplay experience. Many players appreciated the interaction required in each level, such as balancing cubes and moving around the environment to solve puzzles.

However, there were a couple of mentions of unclear instructions, which could potentially be improved to enhance the initial learning experience for players. Additionally, one player suggested the possibility of adding more functions to the blocks for a deeper puzzle-solving aspect, indicating an interest in expanding upon the existing mechanics.

Overall, while there may be some minor areas for improvement, the feedback suggests that the game mechanics were well-received and effectively supported the gameplay experience.

Optional Feedback
What aspects of the game did you enjoy the most, and why? What aspects of the game do you think need improvement?
Positive Feedback:

1	Archie Holmes	I think the game is perfect for what it's meant to be.
2	Fabian-Ioan Cretu	I liked the game a lot but there was a bug where the number cubes would bounce off the platforms
3	Liberty Weller	the division mechanics needs work on, it doesn't really work or add up correctly
4	Carla Helbert	If you enjoy maths then the game is quite addictive. perhaps add more detail to the surroundings, rooms could be decorated in themes etc appropriate to the age group.

5	Aston Gleeson	I actually found the concept really fun, even if it is just simple maths. The picking up system is very buggy though, and just freezes if its interrupted by another object.
6	Meekah Allen	I enjoyed the jumping parts the best and i think making the cube mechanics smoother would be a good improvement.
7	Ali Gleeson	When I purposely fell through one of the gaps to see what would happen, the game froze. Perhaps a respawn mechanic would help improve your game further! Other than that, it's great! Well done!

The feedback from players highlights several positive aspects of the game, including its engaging concept that combines math challenges with platforming elements. Many players found this combination enjoyable and addictive, particularly those with a fondness for mathematics.

Additionally, the game's intuitive mechanics were generally well-received, although there were some mentions of bugs or issues that detracted from the overall experience.

Suggestions for improvement include enhancing the game's visual appeal by adding more detail to the surroundings and decorating rooms thematically. Furthermore, refining mechanics such as picking up cubes and addressing issues with division mechanics could enhance the gameplay experience.

Lastly, implementing a respawn mechanic to address freezing issues when falling through gaps was suggested, which could improve the overall flow of the game and provide a smoother player experience.

By addressing these areas of feedback, the game has the potential to further captivate players and offer an even more enjoyable gaming experience.

Overall Rating

On a scale of 1 to 10, how would you rate your overall experience with the game? (1 being very poor, 10 being excellent)

1	Archie Holmes	10
2	Evelyn Garrett	8
3	Fabian-Ioan Cretu	9

4	Liberty Weller	10
5	Carla Helbert	10
6	Aston Gleeson	10
7	Aiden Bijak	9
8	Rico Canadinhas Canadinhas	10
9	Meekah Allen	9
10	Ali Gleeson	10
11	Gregory Kitchin	8

It looks like the overall ratings for the game are quite positive, with most players giving scores ranging from 8 to 10 out of 10. This indicates that the majority of players had a highly enjoyable experience with the game. Consistently high ratings suggest that the game effectively delivered on its intended experience and resonated well with the players.

While there are a couple of players who rated their experience slightly lower, with scores of 8, the overall trend is overwhelmingly positive. This feedback is indicative of a successful game that effectively engages and entertains its audience.

Improvements Made After Game Testing

Respawning

I added a respawning mechanic which spawns the player back at the start of the room if they fall out of the room. I added this for two reasons. I noticed that when people who tested my game failed the parkour jumps, they gave up because the character does not respawn and therefor needing to restart, making their progress void, and feeling unsuccessful. This was not intended and just an oversight on my part, but it was an easy mechanic to add.

Improved Grabbing Mechanic

Play testers found the grabbing mechanic finicky or unintuitive, so I improved it to make it more intuitive and forgiving. Previously, the grabbing mechanic simply checked in front of the player's camera for a cube using a ray cast, then positioned the cube a certain distance in front of the camera using linear interpolation to create a smooth motion. This method relied on Unreal Engine's default physics service to make the cubes collide with

surfaces so that it does not get stuck inside something, however this has the unintended effect of adding a velocity to the object. When the object is no longer being grabbed, it releases the collective velocities during the grab and making it fly out of the collided object, sometimes even flying outside the bounds of the room and voiding it all together. Fixing this was as easy as toggling the gravity of the object instead of the physics system entirely and setting the velocity to a magnitude of 0 when releasing the cube.

But this solution still caused issues where the cube would still catch on other objects in the way. To fix this, I decided that a variable distance should be applied instead of a fixed distance to the camera. I simply cast another ray which ignores all cubes in the world and use that as the distance to position the grabbed object. This would make the object not be positioned inside other objects, but instead position itself on the surface of the object in front.

This fix had the added benefit of allowing a cubed being dragged by the player to interact with other cubes, making the game feel sillier and let the player have fun with the physics of flinging the cubes around and have them interact with each other.

Division Fix

The division operator was not working, and I only realised why during testing. The reason is because the Level Answer variable was an integer type. When dividing two integers, they may create a floating-point / decimal number, so the answer would be converted from a float to an integer, as a result, mathematically flooring the number. This was an easy fix, all I had to do was make the Level Answer a float type variable instead of an integer type.

Improvement Effects

Adding new game mechanics makes the game even better for players. These changes help fix any issues from feedback and make the game more fun to play.

These new mechanics have different purposes, like making the game more interesting, helping players learn better, and making it more fun to play again and again.

Depending on how they're made, these new mechanics can help players learn more and get better at the game. They might make the game more challenging or teach players new things.

Also, adding new game elements makes it more fun to play the game again. Players can try new things each time they play, making the game more exciting.

Plus, these new features help the game get better based on what players say. By listening to feedback and making changes, the game can become even more enjoyable for everyone.

As the game gets better with these new mechanics, players will have even more fun and keep coming back to play again.

Conclusion

The testing feedback for the game has provided valuable insights into its strengths and areas for improvement. Overall, the feedback indicates that the game has several positive aspects that contribute to an enjoyable experience.

What Went Well

Players showed a high level of enjoyment and engagement with the game, particularly appreciating the fusion of math challenges with platforming elements. This blend added an extra layer of excitement to the gameplay experience.

The integration of math puzzles within the gameplay was warmly received, with players finding it innovative and captivating. This unique approach contributed to the game's overall appeal.

The game resonated effectively with its intended demographic, primarily children and younger adolescents. Feedback suggested that the game appealed to a broad age range, spanning from 6 to 15 years old, indicating a successful alignment with the target audience's preferences.

Areas for Improvement

Some players encountered technical issues and glitches, such as difficulties with the cube handling system and division mechanics. Addressing these issues to enhance the game's smoothness and reliability would undoubtedly improve the overall gameplay experience.

Several players noted ambiguity in the game's instructions, potentially hindering the initial learning curve for new players. Clarifying the instructions could streamline the onboarding process and enhance player understanding.

Suggestions were made to enhance the visual experience by adding more detail to the surroundings and incorporating thematic room decorations. These enhancements would elevate the game's aesthetic appeal and increase player immersion.

Target Audience

The implementation of a variable difficulty system holds promise in catering to the diverse age range within the target audience. By adjusting the difficulty levels of math questions and gameplay challenges, the game can accommodate varying skill levels and learning capabilities, ensuring an inclusive experience for all players.

The game's fusion of math puzzles with gameplay offers a valuable learning opportunity, particularly for children within the target age range. Fine-tuning the difficulty system and dynamic difficulty adjustment (DDA) can further optimize the learning experience by delivering tailored challenges that strike the perfect balance between engagement and educational value.

In conclusion, while the game has several strengths that have resonated well with players, there are areas for improvement that could enhance the overall experience. By addressing the identified issues and leveraging the variable difficulty system to cater to a range of ages within the target audience, the game can further solidify its position as an engaging and educational gaming experience.

Soft Skills

As I navigated various aspects of the project, including 3D modelling, programming, and research, I learned to adapt quickly to new tools, techniques, and challenges. This flexibility allowed me to adjust my approach as needed and find creative solutions to problems.

Balancing multiple tasks and deadlines, such as modelling characters, writing code, and conducting research, taught me the importance of effective time management. Prioritizing tasks, setting realistic goals, and allocating time efficiently enabled me to stay organized and meet project milestones effectively.

Tackling complex issues in 3D modelling, programming bugs, and research inquiries sharpened my problem-solving skills. I learned to analyse problems systematically, break them down into manageable components, and explore various solutions until finding the most suitable resolution.

Collaborating with class members and teachers, seeking feedback, and presenting findings required clear and effective communication skills. Expressing ideas concisely, actively listening to others, and articulating concepts in a way that is understandable to diverse audiences enhanced my ability to communicate effectively in both written and verbal forms.

Designing characters, developing game mechanics, and brainstorming marketing strategies demanded creativity and innovation. Exploring different ideas, experimenting with new approaches, and thinking outside the box allowed me to generate unique solutions and add value to the project.

In conclusion, the testing feedback has provided valuable insights into both the strengths and areas for improvement of the game. Overall, the feedback indicates that the game has several positive aspects that contribute to an enjoyable experience. Players demonstrated a high level of engagement and enjoyment, particularly appreciating the fusion of math challenges with platforming elements, which added excitement to the gameplay experience. The integration of math puzzles within the gameplay was warmly received, contributing to the game's overall appeal. Additionally, the game resonated effectively with

its intended demographic, spanning a broad age range from 6 to 15 years old, indicating successful alignment with the target audience's preferences.

However, there are areas for improvement identified through the feedback. Technical issues and glitches, such as difficulties with the cube handling system and division mechanics, need addressing to enhance the game's smoothness and reliability. Ambiguity in the game's instructions could hinder the initial learning curve for new players, suggesting a need for clarification to streamline the onboarding process. Furthermore, suggestions were made to enhance the visual experience by adding more detail to the surroundings and incorporating thematic room decorations, which would elevate the game's aesthetic appeal and increase player immersion.

The implementation of a variable difficulty system holds promise in catering to the diverse age range within the target audience. Adjusting the difficulty levels of math questions and gameplay challenges can accommodate varying skill levels and learning capabilities, ensuring an inclusive experience for all players. Moreover, the fusion of math puzzles with gameplay offers a valuable learning opportunity, particularly for children within the target age range. Fine-tuning the difficulty system and dynamic difficulty adjustment (DDA) can further optimize the learning experience by delivering tailored challenges that strike the perfect balance between engagement and educational value.

In addition to game-specific improvements, the project has provided opportunities to develop soft skills that are transferable to various contexts. Through tasks such as 3D modeling, programming, and research, I have honed adaptability, time management, problem-solving, communication, creativity, and collaboration skills. These skills will continue to serve me well in future endeavors, both within and beyond the scope of this project. Overall, by addressing the identified issues and leveraging the variable difficulty system to cater to a range of ages within the target audience, the game can further solidify its position as an engaging and educational gaming experience.

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