Unit 7 - Mobile App Development
Design Develop and Evaluate a Mobile App

Contents

Introduction

ICT Solutions has tasked me with developing a prototype mobile app designed to support young children in enhancing their Maths skills. The primary objective of this app is to help children improve their understanding of converting measurements through an engaging and interactive game.

The app will run a game where the user answers a series of 10 simple arithmetic questions, involving addition, subtraction, multiplication, and division of whole numbers between 1 and 12. To ensure the game remains age-appropriate, subtraction and division will not result in negative answers.

The game will feature three difficulty levels:

- Level 0: No time limit.
- Level 1: 20-second time limit per question.
- Level 2: 10-second time limit per question.

To make the app appealing and enjoyable for young children, I will be including:

- Graphics: Suitable visuals to maintain their interest.
- Sounds: Engaging audio feedback, such as applause for correct answers.
- Scoring System: Tracks and displays the user's score after completing the game.

This project aims to create a fun and educational tool that fosters both learning and enjoyment for young users.

Link to the app:
https://studio.code.org/projects/applab/575146fc-be70-4071-9049-3febc183579f

Project Plan

https://view.monday.com/1709418516-44b653a60b795996c074c5a2bc3170cb?r=euc1

App Requirements

To analyse and document the app requirements, break them down into key categories and address each systematically. Here is how I can structure the requirements for the app:

Device Capabilities Required

- The touchscreen responsiveness for the user to interact by selecting the answers and navigating the menus.
- A buzzing effect or applause sounds like the sound effects audio output.
- The timer would manage the question time limits for level 1 (20 seconds) and level 2 (10 seconds).
- The graphics render the display colourful and engaging.
- The screen orientation detection would handle the portrait and landscape modes.
- The basic storage would save and retrieve the assets during the run time.

Input Required

Below is a table that outlines the many inputs that the app will use, along with their respective sources and purposes. It provides a quick overview of how the app interacts with users and devices to deliver a seamless and engaging experience.

Each input serves a specific purpose, such as enabling the user to select options, enter answers, or adapt to their device's orientation.

Input Source	Purpose	Examples
User Tap/Touch	To select difficulty levels or start the game.	Tap the "Start" button.
Numeric Input	To enter answers to the maths question.	Typing "8" for the question 4+4.
Timers	To track the response time for each question.	Limiting response time to 10 or 20 seconds.
Orientation Sensor	To adjust the UI based on the device orientation.	Switching between portrait and landscape.

Output Required

Visual Output:

- The maths questions and the answer input field.
- The current score after each question.
- The final score at the end of the game.
- Then the feedback (e.g., green tick for correct answers, red cross for the incorrect ones).

Audio Output:

- The applause for the correct answers.
- The buzzing or mild tone for the incorrect answers.

Text output:

- The timer displays for levels 1 and 2.
- Messages like "Game Over" or "Try Again.".

User Needs

The app's design will centre on elements that are age-appropriate, interesting, and user-friendly, catering to the needs of young children studying mathematics.

Simple Navigation:

A clear and intuitive menu to help children easily start a game or choose a difficulty level without requiring assistance. There will be large buttons and straightforward labels for easy interactions.

Bright Colours:

The vibrant, child-friendly colour scheme is designed to grab attention and maintain engagement. The visual consistency ensures the interface is appealing and easy to follow the interface.

Captivating Visuals and Audio:
The positive sound effects, such as applause and cheerful tones, reward correct answers and encourage continued play. The fun animations and visual effects keep the children interested during gameplay.

Age-appropriate Content:
The simple arithmetic questions are suitable for young learners.
No negative feedback; instead, encouragement to try again when an answer is incorrect.

Accessible Design:
It would support both portrait and landscape modes to accommodate different devices.
The responsiveness to touch for seamless gameplay.

Interactive Feedback:
The immediate feedback for the answer, such as a green checkmark for the right ones and a subtle nudge to try again for the wrong ones. The scoreboard tracks the progress to motivate the children.

App Design

User Requirements
We lay out the main requirements here to ensure that the app is entertaining, educational, and simple enough for kids to use.

Simple Interface:
Easy-to-use menus and navigation, designed specifically for young children.
Large, clearly labelled buttons to make the interaction straightforward and intuitive.

Age-Appropriate Visuals:
Bright, vibrant colours grab attention and create a fun, engaging environment.
Child-friendly design elements such as playful icons and animations enhance the appeal.

Engaging Audio Effects:
Encouraging sounds like applause or cheerful tunes to reward correct answers.
Friendly prompts to motivate the children to try again after incorrect answers.

Interactive feedback:
Quick visual clues (such as a green checkmark for right answers and a red cross for wrong answers) to give quick feedback.
A dynamic scoreboard to track progress and keep children motivated.

Adaptability:
A responsive design that would adjust seamlessly between portrait and landscape orientations.
Compatibility across a wide range of mobile devices to ensure accessibility for all users.

Proposed Solution

Start Screen:

When using the app, young children will be greeted with a bright and engaging screen displaying the title "**Learn Your Numbers and Math Facts.**" The screen will be fun and child-friendly, drawing in the young learners. At the bottom, there will be a large "Start" button that will let them begin the game with ease.

Game Screen (Example for "Number 1"):

Once they have started the game, the screen will feature a bold number like "**1 + 1**," paired with a playful visual representation. For example, an image of one apple will appear, followed by another apple being added to it. The app will use vibrant colours and include interactive elements such as sound buttons, helping children connect with the content engagingly.

Below the number, there will be several answers and the answer would be an image of how many apples they have to pick boxes for the child to choose from, including the correct answer and a few distractor answers to encourage decision-making.

Navigating through the game will be simple, with arrows guiding users to the next number or level. Users will be timed when answering the questions shown on the app.

Score/Result Screen:

The score/result screen will show the user's performance after the game ends. It will prominently display the score (for example, "**Score: 8/10**") along with a happy face icon and a motivating message such as "Great Job!" for a high score.

However, if the player's score was lower, the screen might display a sad face with a positive message like "**Nice Try, Let's Try Again!**" the user would then be given the choice to play again or press a button to advance to the next level.

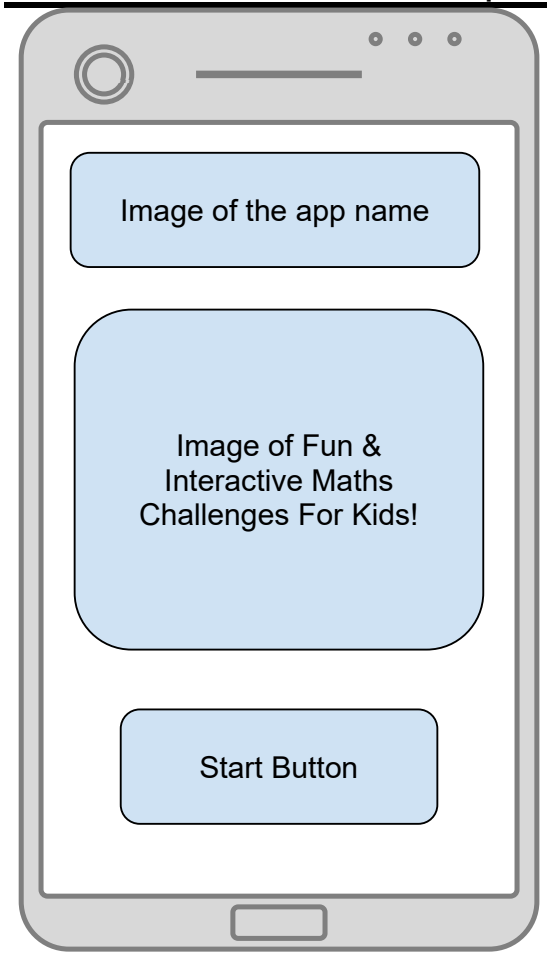
Additionally, the screen would offer audio feedback, such as gentle reminders to try again or applause for a high score.

The game's UI will be straightforward with big buttons for completing easy maths problems that are related to the number on screen.

The audio effects will encourage the children, with sounds of praise for the correct answer and gentle prompts for incorrect answers, keeping the learning experience fun and interactive when they use the app.

Screen Designs (Wireframes) - Home screen

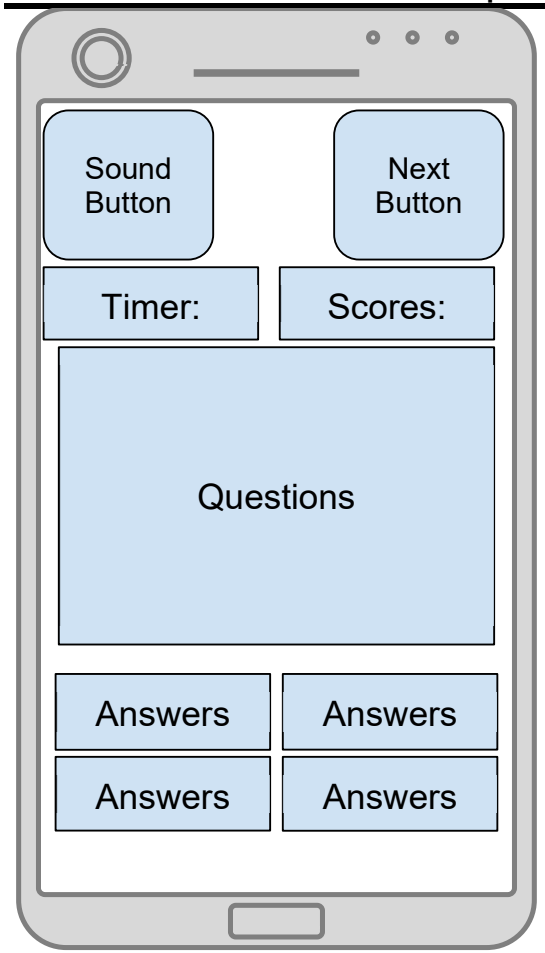
Screen Name: Home Screen **Developer name:** Ben O'Brien



Assets:	**Events (Inputs & Outputs):**
Start.png Fun_and_Interactive_Maths_Challenges_for_Kids!.png LTNMBanner.png	The user taps the "Start" button on the home screen. The output is that the app will transition to the next screen when they have taped the "Start" button.
Design Notes/Alternatives:	**Method of Solution: (what does this screen do?)**
The banner design is colourful and engaging, specifically designed to capture children's attention. The plain white background will help the banner and other elements stand out, creating a clean and uncluttered look for the app. Consider adding subtle, non-distracting elements like faint geometric patterns or outlines in the background. This would maintain visual interest while keeping the main content as the focal point. The button design is simple yet effective, featuring a green background and a red play symbol, making it easy for children to identify and interact with.	The banner does provide the branding and communicates the app's purpose ("Learn the Numbers and Maths"). The fun theme image ("Fun & Interactive Maths Challenges for Kids!") is a motivational visual and encouraging engagement image for the kids to learn maths. The start button is the central interactive element which allows the user to move to the next screen such as the challenge selection or a welcome tutorial on how they can use the app and what it does.

Screen Designs (Wireframes) - Game Screen

Screen Name: Game Screen **Developer name:** Ben O'Brien



Assets:	**Events (Inputs & Outputs):**
NextButton.png PlaySoundButton.png CorrectIcon.png IncorrectIcon.png	The sound input would sound out the question that is displayed on the screen and they will be able to understand what the question is asking them, and it will ask them to pick an answer for the right answer. So, when they tap the correct answer, it would show positive feedback (e.g., "Correct!" message or a green highlight on the selected button) but if they click on the wrong answer it will display "Try Again" and it would have a sound saying, "try again". For the next button, it will skip the current question and load the next one because they may find it hard to get right.
Design Notes/Alternatives:	**Method of Solution: (what does this screen do?)**
The Scores Section is prominently placed, which keeps users motivated to improve their performance. The Sound Button enhances inclusivity for younger children or those with reading difficulties. The background of the design will keep the plain (white) to maintain focus on the questions and answers. Subtle accents or faint borders could add polish without distracting users. The next button will help but be optional if most users answer questions correctly without skipping. Consider making it less prominent (e.g., a smaller icon) to avoid overuse.	The screen will display a question and four possible answers that the user must select the correct answer. If they get it correct the display would positively feedback, update the score, and load the next question for them to answer. But if they don't click on the right answer, it would "Try Again" message text and audio and allow the user to attempt the question again. The sound button would play an audio version of the current question to improve accessibility and support different learning styles. The next button would allow the user to skip the challenge question and move to the next one without affecting their score. The score would track the user's current score in real-time, and it would provide motivation to help the user

	The buttons are large and spaced out to minimise accidental taps, especially for the younger user.	measure their progress and it will help them understand the questions in class or at home.

Screen Designs (Wireframes) - Score/Result Screen
Screen Name: Score/Result Screen **Developer name:** Ben O'Brien

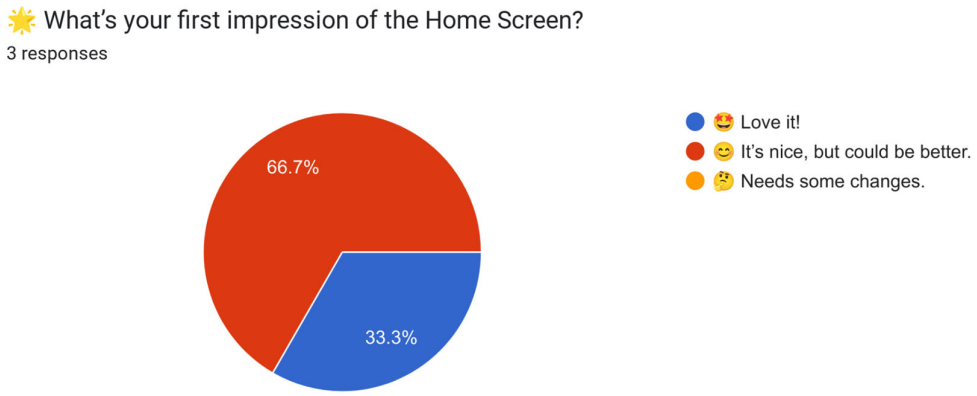
Assets:	**Events (Inputs & Outputs):**
Backtostart.png Closetheapp.png	The back-to-start button will reload the initial screen. The close the app button will close the application. The display will have a fine score that is linked to the score-tracking logic.
Design Notes/Alternatives:	**Method of Solution: (what does this screen do?)**
The score section will display the final score in bold text to make it the focal point, and it will give the user more insight into their performance with their maths skills. The well-done image will use a bright cheerful animation but if the score is lower it will show a picture saying "Good Effort! Try Again". The back-to-start will allow the user to restart the app and play on the app again to improve their math skills. The close button will close the app, allowing the user to leave the game if they don't feel like they want to play the game again. The background will be a clean white background that will allow the children to focus on what they are seeing on the screen.	The screen acts as the final feedback for the user's performance it will be displaying. The fine score is calculated based on the correct and incorrect answers the celebratory image and the motivational messages. The two buttons on the screen will lead them to start the game again or if they feel like they have done all they want to do on the day they can exit the application.

Design Review

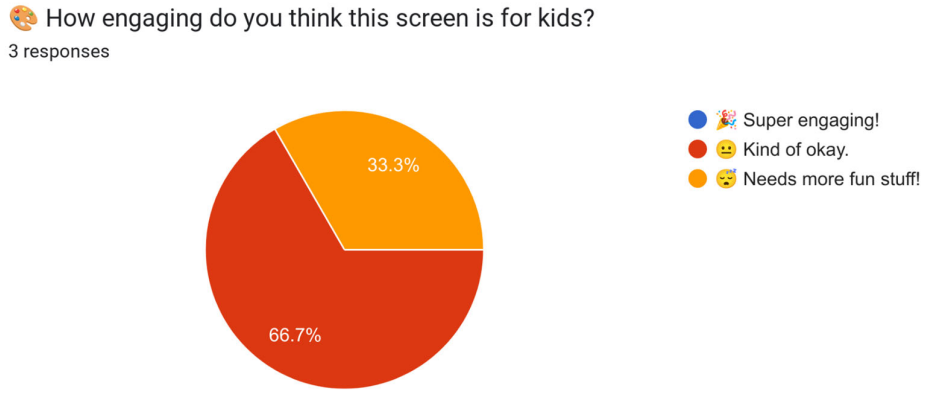
Link to the form - **U7_A2_Design_Review**

Home Screen review:

I asked them to see if my design for the mobile app was “What’s your first impression of the Home Screen?” 66.7% said that “It’s nice but could be better and 33.3% said they “love it!”.

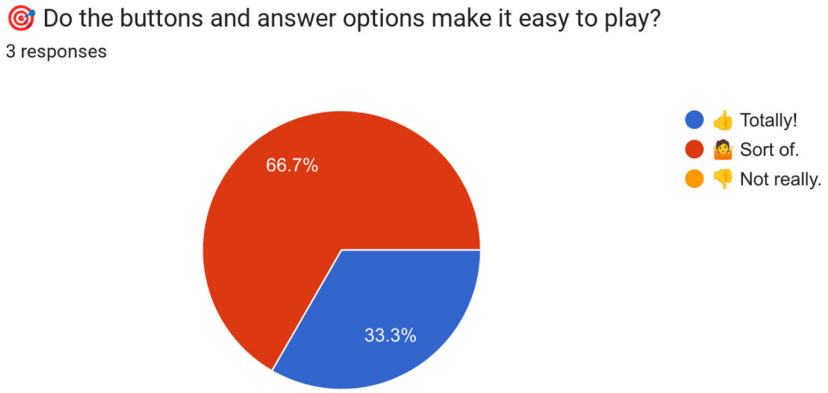


Then I asked them to see if my design for the mobile app was “How engaging do you think this screen is for kids?” 66.7% of them said that it’s kind of okay but 33.3% said it needs more fun stuff! Within the app.

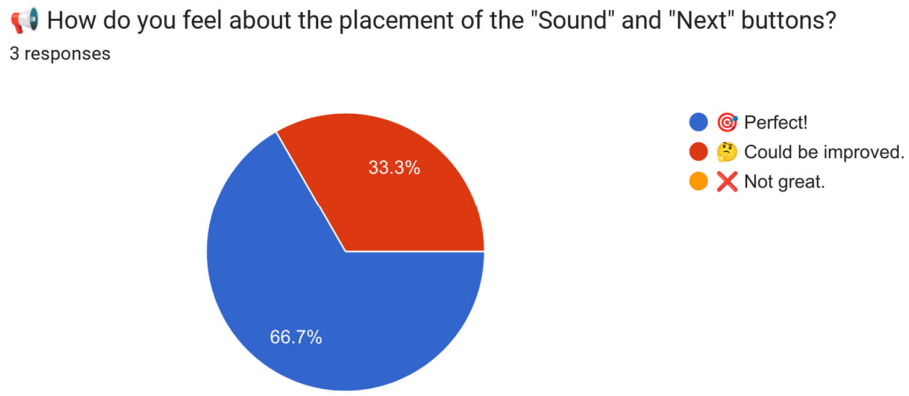


I asked them the fine question to see if my design for the mobile app would need “Any creative ideas to make the Home Screen even better?” and they said that they had no idea what I was going to put in the fun area.

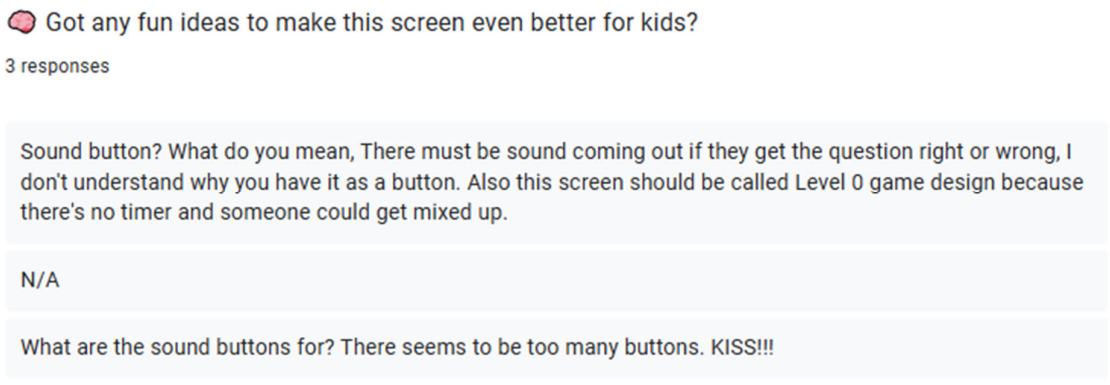
Game Screen review:
I asked them to see if my design for the mobile app was “Do the buttons and answer options make it easy to play?” 66.7% said that they “Sort of” and 33.3% said they “Totally!”.



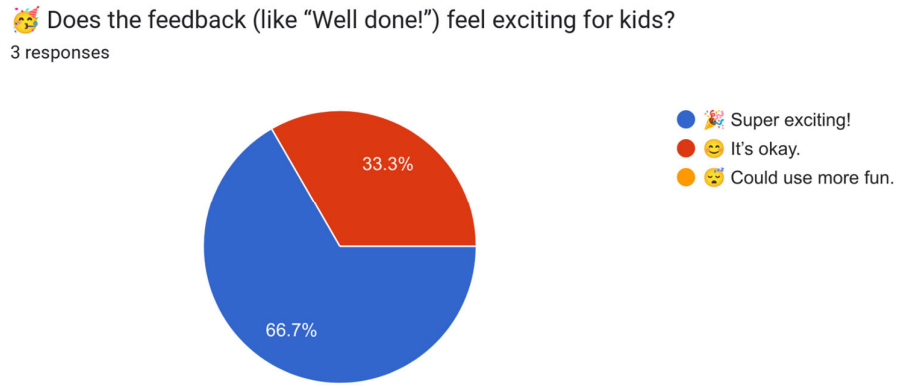
Then I asked them to see if my design for the mobile app was “How do you feel about the placement of the "Sound" and "Next" buttons?” 66.7% of them said that the sound and next buttons do feel about the placement and 33.3% of them said that it could be improved.



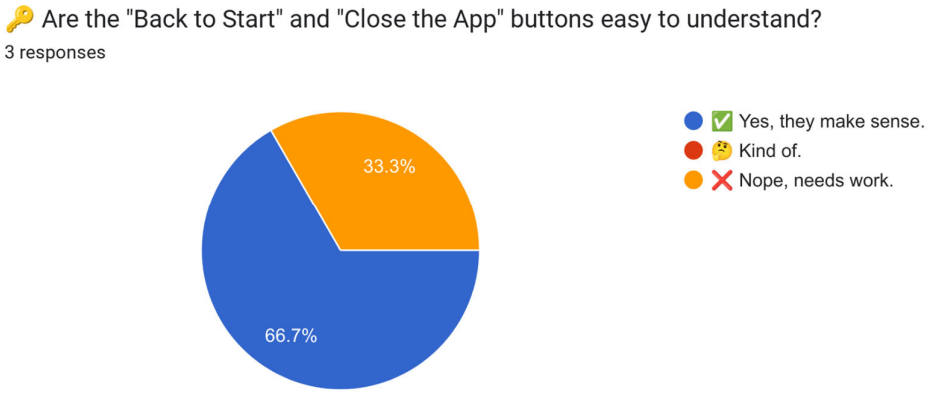
The fine question that I asked them to see if my design for the mobile app would need “Got any fun ideas to make this screen even better for kids?” they said that there were too many buttons and what the sound button was for.



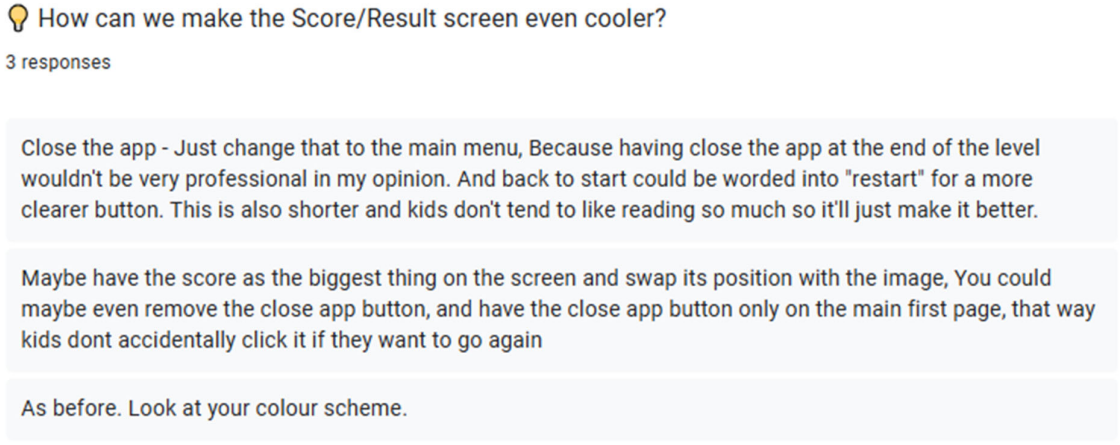
Score/Result Screen review:
I asked them to see if my design for the mobile app was “Does the feedback (like “Well done!”) feel exciting for kids?” 66.7% of them said that the screen is “Super exciting!” and 33.3% of them said that “It’s Okay.”.



Then I asked them to see if my design for the mobile app was “Are the "Back to Start" and "Close the App" buttons easy to understand?” 66.7% of them said “Yes, they do make sense” and 33.3% of them said, “Nope it needs working on”.

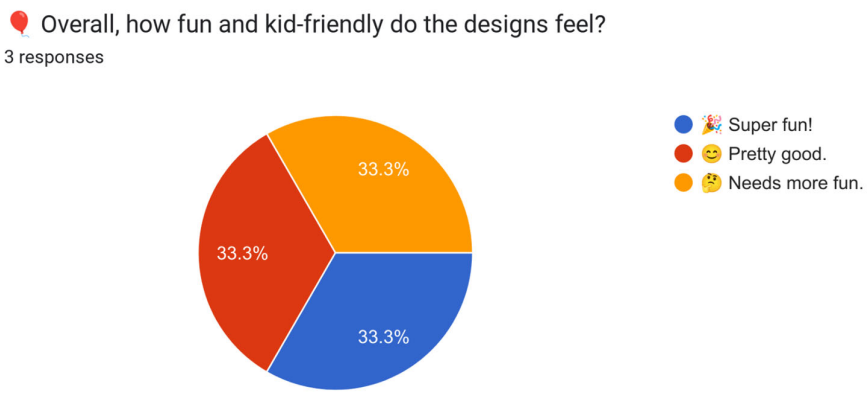


The fine question that I asked them to see if my design for the mobile app would need “How can we make the Score/Result screen even cooler?” I had

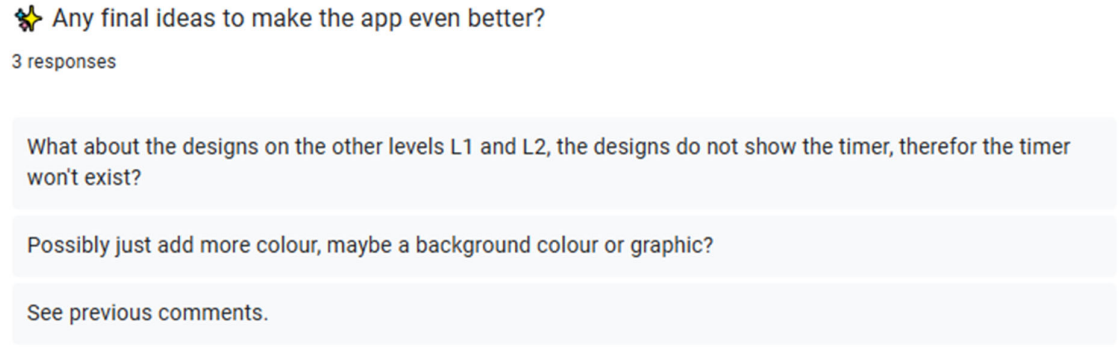


General Feedback:

I asked them to see if my design for the mobile app was “Overall, how fun and kid-friendly do the designs feel?” 50% of them said “It’s pretty good.” and the other 50% of them said, “It’s super Fun!”.



The fine question that I asked them to see if my design for the mobile app was “Any final ideas to make the app even better?” they said that levels 1 and 2 there is no design for levels 1 and 2 and it doesn’t show the timer therefore the timer won’t exist and add more colour maybe a background colour or graphic.



Design Justification

- Add a short paragraph for each major decision, using bullet points to link design choices to requirements.

Example:

- We used bright colours to make the app visually engaging for children.
- The applause sound effect was added to reward correct answers and encourage learning.

App Creation Evidence

Use a **timeline with screenshots** showing progress milestones:

Step 1: Initial Setup (Include screenshot of the blank project).
Step 2: Basic UI components added.
Step 3: Core functionality implemented.
Step 4: Final touches and Debugging.

Asset/Sources Log

Description of asset	File name	Source	Modifications made	Where used
The back button to the start.	Startagain.png	https://www.canva.com/design/DAFdHNihOns/AMdzUaJRPFQz1mZ7C79I1w/edit?utm_content=DAFdHNihOns&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Score/Result Screen
Big green start button.	Start.png	https://www.canva.com/design/DAFdHLq1hBs/JBwaFTf2p-UmH4G1tlMcfw/edit?utm_content=DAFdHLq1hBs&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Home Screen
Small blue next button.	NextButton.png	https://www.canva.com/design/DAGYzs55mU0/MUTeOBttGwpPw3dk1e95cg/edit?utm_content=DAGYzs55mU0&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Game screen
Small yellow sound button.	PlaySoundButton.png	https://www.canva.com/design/DAGYzucOUC0/Gf_zmr-Oky8aemJqf9wcHQ/edit?utm_content=DAGYzucOUC0&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Game screen
A big Banner.	LTNMBanner.png	https://www.canva.com/design/DAGXfshNuTU/iFZvbWnpZB3aLvYtwK4_5g/edit?utm_	N/A	Home screen

		content=DAGXfshNuTU&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton		
A big Fun & interactive maths challenge for kids!.	Fun_and_Interactive_Maths_Challenges_for_Kids!.png	https://www.canva.com/design/DAGXfj0GLyY/OBtPqgRGRGffGBbm5SRDTQ/edit?utm_content=DAGXfj0GLyY&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Home screen
A big close button.	Closetheapp.png	https://www.canva.com/design/DAGZc7tfAgQ/SSRCaFjhz1Bcu-YkfKcQeg/edit?utm_content=DAGZc7tfAgQ&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Home Screen
Text saying Well Done.	Well-done.png	https://www.canva.com/design/DAGYy8jT4yw/aELj8XYUnEiv50JUOSelOQ/edit?utm_content=DAGYy8jT4yw&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Score/Result Screen
Text saying “Good Effort Try Again”.	Good_Effort_Try_Again.png	https://www.canva.com/design/DAGYy1xHTKM/HrOhk6ol42jMAIsbQ9ixdw/edit?utm_content=DAGYy1xHTKM&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton	N/A	Score/Result Screen
A cartoon voice person saying Try Again.	Cartoon_Try_Again.mp3	https://audiojungle.net/item/cartoon-try-again/3939938	N/A	Score/Result Screen

Text saying “You ran out of time! Try Again!”.	timeout_image.png	https://www.canva.com/design/DAGcfJhG20w/F3-VG-tB4JK3d0dEYKfF1w/view?utm_content=DAGcfJhG20w&utm_campaign=designshare&utm_medium=link2&utm_source=uniquelinks&utlId=h229d42b62d	N/A	Score/Result Screen
A cartoon voice person saying Well Done.	WellDone.wav	https://freesound.org/people/paulmessier/sounds/271185/	N/A	Score/Result Screen
A background for the app to use.	freepik__upload__83617.png	https://www.freepik.com/free-vector/neon-purple-curve-frame-template-vector_26981965.htm?log-in=google#fromView=keyword&page=1&position=0&uuid=d6f42dc4-73ce-4585-bbea-f91a8842d77e&new_detail=true&query=App+Background	N/A	All screens

Test Plan & Log

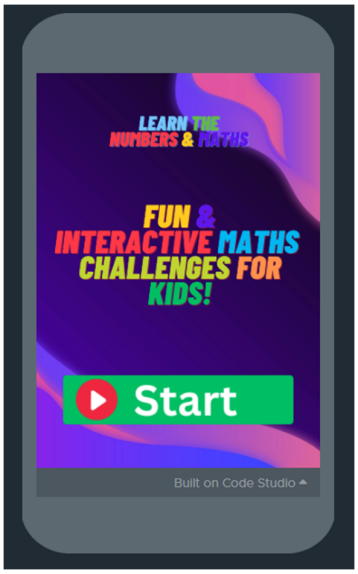
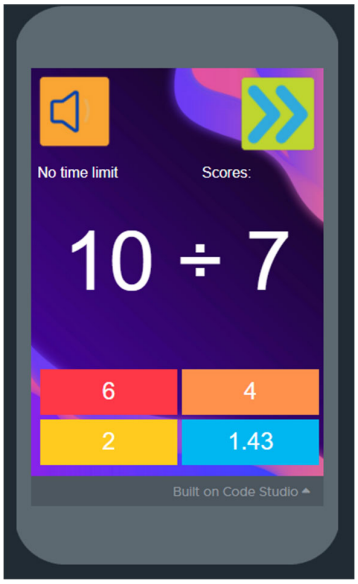
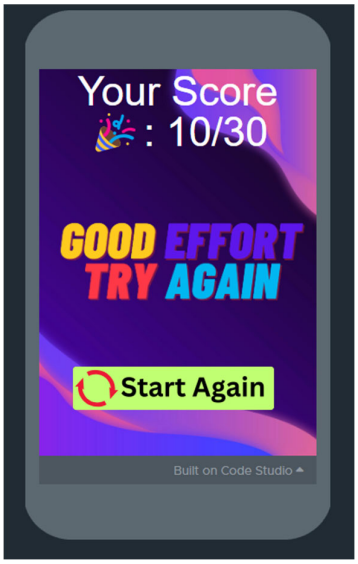
Use a table for testing results:

Test Case No	Test Case	Expected Outcome	Actual Outcome	Status (Pass/Fail)	Comments
1	Start Button	To go onto the game screen.	The game screen shows up with the question after clicking Start.	Pass	It works as expected.
2	Sound Button	To speak out the question to the learner.	The question is spoken clearly with the correct operations stated.	Pass	The functionality was verified with multiple questions.
3	Next Button	To skip to the next question.	It skips to the next question immediately without a score.	Pass	The smooth transition between questions.
4	Question Label	To show the question.	This is so that it displays the correct question and includes the math operations.	Pass	No issues were identified.
5	Timer label	To see if the timer counts down from the timing of the levels.	The timer counts down correctly based on the level.	Pass	The timer stops when the level ends or the time runs out.
6	Scores label	To show the scores that update before the game ends.	The score does not update properly during the gameplay.	Fail	They investigate why the score isn't correctly calculated on the game screen.
7	Answers buttons	To show all the answers to the	Display the four options that include the correct	Pass	The answer buttons are functional and styled appropriately.

		question.	one.		
8	Start again	To start a new game when finished or time runs out.	Resets the game and navigates to the game screen.	Pass	The reset levels, score and the timer as expected.
9	Score label	To show the end of the game and that shows the results out of 30	Display the final score accurately at the end.	Pass	It verifies for different scores and game outcomes.
10	Result image	To show "Try Again" or "Well Done" based on performance.	Displays the correct image based on the final score.	Pass	The confirmed images and the sound are displayed appropriately.

App Optimisation

Images of App Screens:

Home Screen	Game Screen	Score/Result Screen
		

The home screen welcomes the user and allows them to start the app's interactive math challenges.

The game screen displays a math problem with interactive buttons for answering and a timer on the screen. Level 0 has “No Time Limit”, level 1 has a 20-second timer and level 2 has a 10-second timer and the scores are not functional on the game screen at the moment.

The score/result screen shows the user's score and it motivates the feedback with an option to retry.

Optimisations Made

Reduced image sizes to improve load times:

The compressed and optimised graphics ensured a faster loading time without sacrificing the visual quality and the placeholder images were replaced with lightweight yet engaging graphics.

Enhanced UI to make navigation more intuitive:

- To centre align the “Start” button on the home screen for visual balance and easier access.
- The improved button design across all the screens, such as the “Next” and the “Sound” buttons match the app’s playful theme.
- Add a progress bar on the game screen to help users track their progress easily.
- The displayed scores and feedback are in a larger, more readable font to enhance visibility.
- The updated result screen features motivational messages and clear feedback on the performance that improves user engagement.

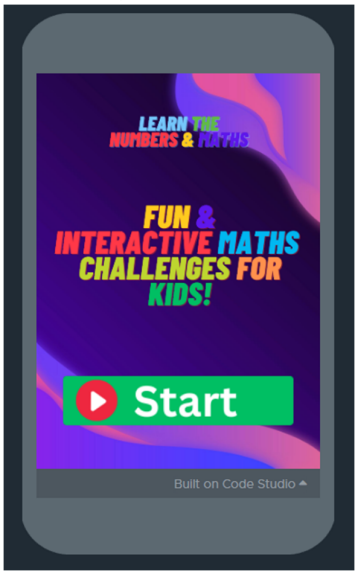
Refined the app based on testing and user feedback:
They conducted user testing with the children to identify pain points and enhance the usability. Based on the feedback:

- Adjusted the game difficulty levels for better balance between challenge and accessibility.
- The optimised performance by streamlining animations and reducing resource-intensive processes.
- The improved transitions between screens make the navigation seamless and enjoyable.
- Update the colour schemes and fonts to ensure better readability and a visually engaging experience.

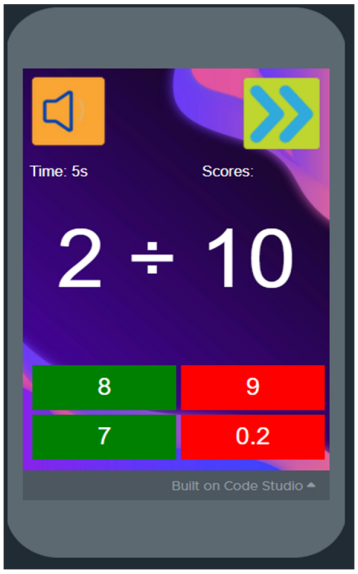
Evaluation

Effectiveness of the App:
The app turned out to be well and met the goals I had at the start.

One of my main goals was to make the app fun and educational for kids and I think that I have achieved this with the colourful design, interactive buttons and a playful theme.



I wanted the app to be easy to use and the features like transparent buttons that would motivational feedback and the timer help make it straightforward and engaging.

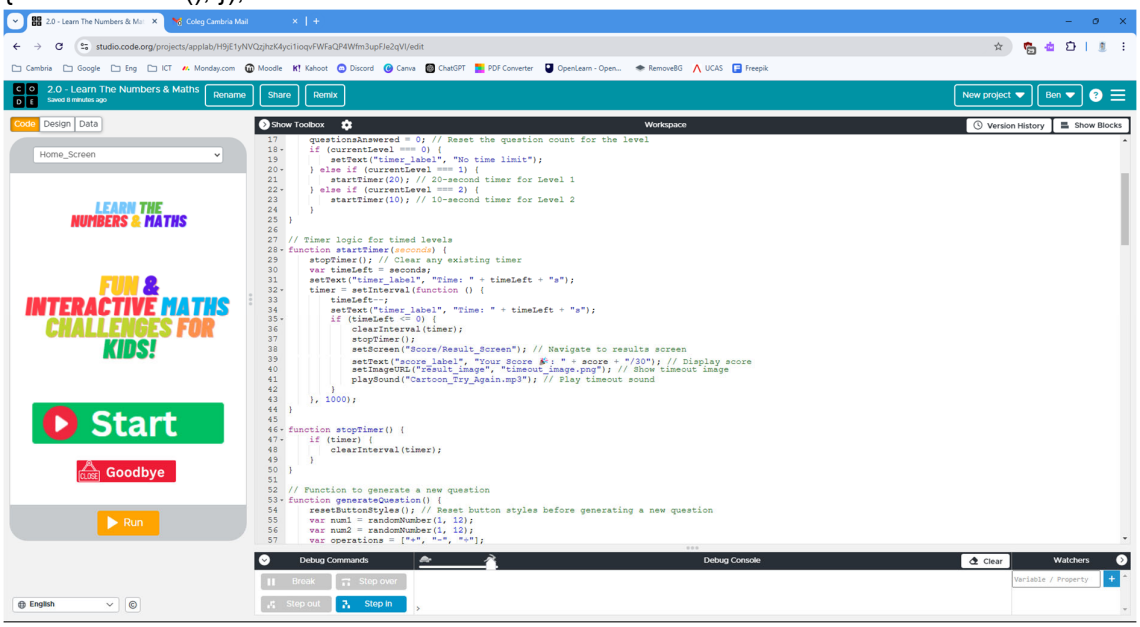


I also aimed for the app to run smoothly and by reducing the image size and improving the animations I made sure that it loads quickly and works without any issues.

Challenges and Improvements:
I have found some parts of the project quite tricky. For example, adding the timer for the levels and making the game difficulty fair for everyone was hard, but I fixed these through testing and making small changes.

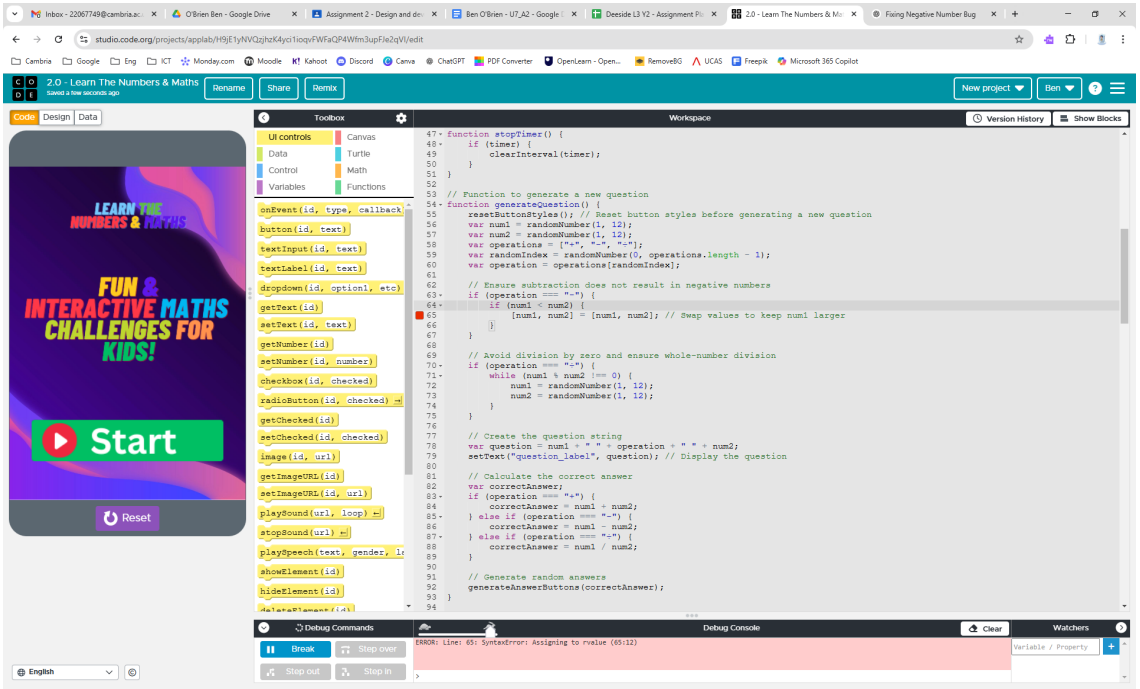
I also had the challenge of designing the app to look good while still being easy for kids to use. I spent a lot of time improving things like the fonts and the colours so that they were fun but also clear and readable things on the app.

One feature that I wanted to include in the app was a “Leave the Game” button, allowing users to exit the game before starting if they chose to. I created the button and added it to the home screen (as shown in the screenshot below), and I also wrote the code for it to function this is the code for the “Goodbye” button “onEvent("close_button", "click", function () { window.close(); });”.



However, I encountered issues during testing. The button didn’t work as expected, and the app wouldn’t exit the game when it was pressed. Despite trying different fixes, I wasn’t able to get it working properly before completing the app.

This challenge turned out to be a valuable learning experience for me. It highlighted the importance of thorough debugging and testing. In the future, I plan to revisit this feature, trying new approaches, such as seeking advice or breaking the code into smaller steps, to better understand where the issue lies.



Another challenge I faced was with how the app generated math questions. At first, the subtraction questions sometimes gave negative answers (e.g., 3 - 7 = -4), which isn't suitable for young learners. To fix this, I had to update the generateQuestion() function to make sure the first number was always larger than the second before subtracting. After making this change all the subtraction questions now result in positive answers.

I also had a problem with division questions. Some of them produced decimal results (e.g., 7 ÷ 2 = 3.5), and in some cases, the second number was 0, which caused errors. To fix this, I had to update the function to ensure the first number is always evenly divisible by the second, and I made sure that 0 was never used as a divisor. Now, the app only generates whole-number division questions, making it easier for the kids to learn without confusion.

These challenges turned out to be valuable learning experiences for me. They showed the importance of testing and refining the code to avoid unexpected problems. In the future, I plan to apply these lessons by testing the new features earlier and breaking down the problems into smaller steps to find solutions more effectively.

Future Developments:

If I were to improve the app further, I'd like to add some new features to make it even better:

- The leaderboard is where kids can compare their scores with friends to make it more competitive.
- The multiplay mode so they can play together and help each other learn.
- The option to customise the app's look with different themes and colours.
- Adding more levels and rewards would keep the kids motivated to play for longer and learn more.