

PLANNING

Through my project, I will learn how to code an interactive application as well as learn how to use my leadership skills to teach children in my community the fundamentals of mathematics. Additionally, I will improve my mathematical prowess as I will also be learning different tips and tricks to teach these students in mathematics to add to the application. I will learn how to teach people interactively so that they understand the concept and can apply what they have learned to their own benefit. Finally, I will additionally learn how to code an interactive application due to the ever developing world and the desire to gain skills in correlation to software (application) development. My personal interest has led to this goal due to my love and care of mathematics. Mathematics has always been something I have enjoyed doing since I was a child, and I have felt as if a good foundation is needed to succeed in higher-level mathematics. I decided that laying a better foundation and teaching younger children in my community the basics of mathematics interactively would benefit them greatly in the long run. Teaching has always been something very encouraging as I would love to help people as I am always willing to help my peers and others in mathematics hence why I would like to learn how to teach people, aid them in their mathematical experiences, and even work on my own understanding of mathematics. Additionally, I have really looked forward to and enjoyed noticing the creation of applications and mainly interactive applications as they have seemed to be very advanced and intriguing to me. This is also seen through my previous acquaintance with coding as I am generally fond of the use of HTML and CSS (website creation) in which I have had a love for coding to further generate the will towards coding an application. Combining both my love for teaching mathematics and wanting to create interactive applications made me create the learning goal to create an interactive application to teach mathematics. *The global context of scientific and technological innovation relates to my learning goal because my learning goal consists of me learning how to code and create an interactive application which is scientifically advanced and requires technical skills.*



Fig 1. Mind Map of my personal interests which lead to the creation of my learning goal

Table 1: Design Specifications of Product

The intended product of my goal or what I will make in order to achieve my learning goal is an interactive application through the use of Java and XML that will teach basic/standard levels of mathematics to children in my neighborhood (however will use social media to broaden the target audience) from age of 6-8. This will help me learn how to code an interactive application towards additionally learning how to teach people effectively using this said application. During the creation of this application, I will be improving and utilizing my coding skills efficiently therefore improving them overall. Lastly, with the formulation of the questions in which I will place in the interactive application, I shall be able to learn different tips and tricks towards solving different mathematical questions to be able to teach them to these children in my community.

| | Aesthetics (Speckyboy, 2020) | Cost (Aplico, 2017) | User/Audience (Understood, n.d.) | Function: Effective quiz area: <i>(Gordon, 2020)</i> | Content/Size (Gordon, 2020) |
|-------------|---------------------------------|--|--|---|--|
| 1 - 2 | The application contains | The creation of the application takes greatly varying | The application is not suited to the ages 6-8 of mathematics. The | The quiz area per topic and level asks 5 questions | The application contains 1 topic of mathematics to work |

| | | | | | |
|-------|---|---|---|--|---|
| | little images and poor organization of topics | material costs, and a lot of money spent on software and learning purposes including money paid to publish application on app store providing a great cost to purchase | application contains no different levels of difficulty of the topic which can be performed. | with no time limit , a choice between two answers (one correct and one wrong), and an unorganized layout with no external calculations/summary page | on with 1 level of difficulty without an area providing tips and tricks for solving these questions and study material. Contains no summary page at the end of each quiz |
| 3 - 4 | The application contains a proportion of images and a substandard organization of topics . | The creation of the application takes some material costs, and greater money spent on software and learning purposes including money paid to publish application on app store providing a modular cost to purchase | The application is somewhat suited to the ages 6-8 of mathematics. The application contains 1 different level of difficulty of the topic which can be performed towards giving the audience a range of what to choose from. | The quiz area per topic and level asks 10 questions with no time limit , a choice between two answers (one correct and one wrong), and an semi-organized layout with no external calculations/summary page | The application contains 2 topics of mathematics to work on with 1 level of difficulty with an area providing tips and tricks for solving these questions and study material. Contains no summary page at the end of each quiz |
| 5 - 6 | The application contains a substandard use of images, and an organized layout of the topics . | The creation of the application takes little material costs, and reasonable amounts of money spent on software and learning purposes including money paid to publish application on app store while providing a low cost to purchase | The application is indeed suited to the ages 6-8 of mathematics. The application contains 2 different levels of difficulty of the topic which can be performed towards giving the audience a range of what to choose from. | The quiz area per topic and level asks 10 questions with a 15s time limit , a choice between three answers (one correct and two wrong), and an semi-organized layout with a score counter and summary page | The application contains 3 topics of mathematics to work on with 2 different levels of difficulty with an area providing tips and tricks for solving these questions and study material. Contains a summary page at the end of each quiz |
| 7 - 8 | The application contains colors with red color scheme, excellent images, and an outstanding organization of topics . | The creation of the application takes no material costs, and little money spent on software and learning purposes including money paid to publish applications on the app store while needing no cost to purchase and download for users. | The application is thoroughly suited to the ages 6-8 of mathematics. The application contains 3 different levels of difficulty of the topics which can be performed towards giving the audience a range of what to choose from. | The quiz area per topic and level asks infinite questions with a well thought of time limit , a choice between four answers (one correct and three wrong), and a fully organized layout with a score counter and summary page | The application contains 4 topics on a home page of mathematics to work on with 3 different levels of difficulty with an area providing tips and tricks for solving these questions and study material. Contains a summary page at the end of each quiz |

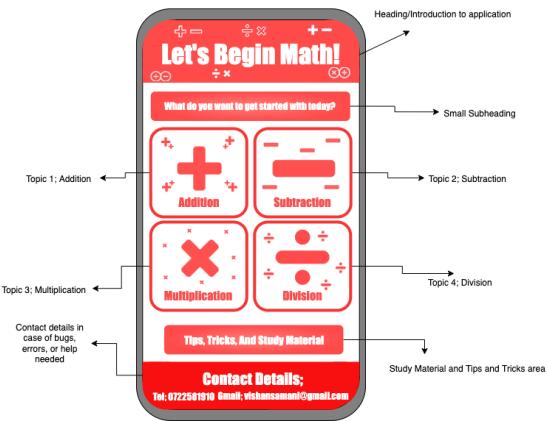


Fig. 2 Rough Sketch of what application was to look like when thinking of success criteria

Table 2: Planning Of Creation Of Product

| Date | Task/activity | To do | Relevant Success Criteria | Progress notes |
|----------------------------------|---|---|---|--|
| June 20th, 2022 | Software installation and setup | -Download and set up software used to create application | Costs - Download & Install | Done on June 21st, 2022 due to lack of timing |
| June 25th, 2022 -June 30th, 2022 | Application coding lessons. | -Form research and understanding on coding application using software -Record sessions for later reference and test software | Function & Costs -Understanding Function + Learning | Done on June 25th to 30th with the use of teachers and youtube. |
| July 1st, 2022 | Layout planning and sketching | -Consider color, layout, format, aesthetics and create a final layout for the topics which looks visually good. | Aesthetics - Color, Layout, Visual Appearance | Done on July 10th, 2022 after storyboard |
| July 10th, 2022 | Storyboard for application usage on mobile. | -Look through the way the application should work, it should be simple to navigate and look through. | Function/User Audience - Storyboard functionality of app - Built in relation to children | Done on July 1st instead of layout planning so that I could get a general idea of how the app would work and look, as some pages require development to look better. |
| July 15th, 2022 | Design backgrounds and color schemes | -Research on color schemes relating to mathematics and utilize them. -Construct a formal mathematical background (usually white) | Aesthetics - Designing Aspects of App with color, background. | Done on July 15th in which changed the layout by adding the color however not the background. |
| July 25th, 2022 | Start coding of application | -Refer to coding lessons towards the building of the | Function - Building on | Done on July 23rd, I referred to coding lessons |

| | | | | |
|-------------------|--|---|---|---|
| | | application. | <i>foundation.</i> | and began the coding. |
| July 30th, 2022 | Creation of home page | -Build the first page which will be used for showing the topics using software and experiment with software to build understanding. | Content - Including Topics in Home Page | Started building the home page of 26th and Finished on 30th, struggled with basic codes although experimenting aided. |
| August 10th, 2022 | Use of java, create questions, and choices of questions and answers for the topics chosen. | -Using previous lessons, simply formulate questions for each of the topics and levels or create a generator for those questions. -Utilize Javascript/Python for answers to be easily kept. | Function - Question Answer Coding → Main Function of Application | Done on August 10th but started on 31st due to lack of organization, question generating algorithms were difficult although revisiting YouTube tutorials aided in creation. |
| August 15th, 2022 | Coding of final page/summary page once questions are answered. | -Create a pop-up page which shows the child their summary of their results from the questions answered | Content - Summary page to deal with learning = Content | Done on August 15th, more simple to be done as pop-ups were familiar from online learning. |
| August 18th, 2022 | Finalization of application - tidying up errors and bugs | -Application testing towards looking for bugs and errors -If found, fixed immediately to be eligible for publishing | Function → Ensuring app functions appropriately to teach children well. | Done on August 18th, Finalization included fixing mathematical algorithms and testing errors. |
| August 20th, 2022 | Publishing the application | -Publish application on google play store | Cost → Publishing | Done on August 20th, Published successfully |

APPLYING SKILLS:

ATL Skill Chosen: Research Skills (Towards accomplishment of both Learning Goal and Product goal)

It was critical to use research skills to achieve my learning goal and product goal as it was essential to devise a research plan in order to provide me with a more specific field to look through while conducting my research.

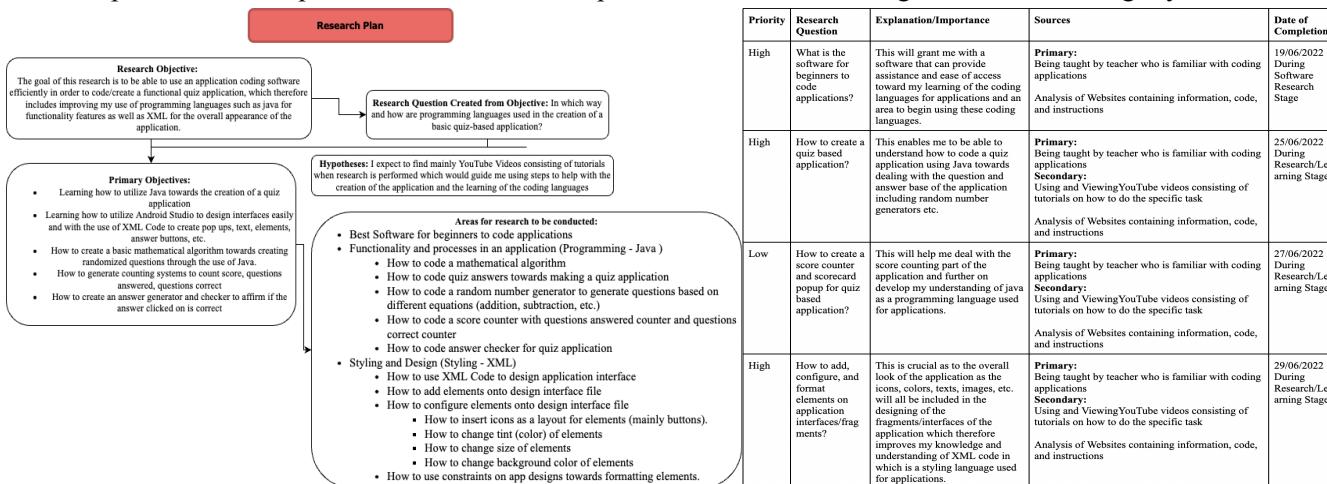


Fig 3a & 3b. Research Plan (Kindly zoom to see clearly)

How Research Skills Helped Achieve (Learning Goal)

The Research Plan as shown above helped greatly in the achievement of my learning goal in various ways. Firstly, the research plan consisted of the breaking down of my research and learning objective to find specific points of information towards improving my knowledge of Java as a programming language and XML code as a styling language towards the creation of an application. Secondly, due to the fact that the process of learning two difficult coding languages can be confusing on how to begin and where to start from, referencing the research plan helped greatly in following me up with what research I should do towards learning these coding languages easier. Finally, the plan helped with the documentation of my sources. There were many resources that I had used when learning how to code which were primarily primary sources where I used a coding teacher who was familiar with app development. This is because when I had specified gaps in my understanding of coding, I was able to ask a question directly related to what I am struggling with and receive help instantaneously rather than searching for the specific help needed by scouring through various websites. Although, I did indeed use a variety of secondary sources towards achieving my learning goal mainly including YouTube Videos, Websites, and Quora help sites. Throughout the following of this research plan, I used information literacy skills towards being able to extract and interpret information online from the websites and quora help sites stated above towards improving my understanding on coding and additionally using media literacy skills towards analyzing YouTube Videos towards finding specific aspects in the videos that help me with learning/broaden my knowledge on how to use these coding languages effectively.

How Research Skills Helped Achieve (Product Goal)

Due to being able to specify where my research was to be carried out, the research plan provided research questions and ways that directly related to helping me with reaching my product goal. The application of research skills in carrying out this research was critical when it came to my product goal as they enabled me to understand information from secondary sources consisting of YouTube Videos, Websites, and Quora help sites and then further on use this information to be able to input my understanding and therefore help me in creating features that correlate to my application towards reaching my product goal (*information literacy (Websites, Quora) & Media literacy skills (YouTube Videos)*). For example, with the use of research skills and the research plan, when looking at one of the research questions used towards the creation of my product it reads “How to create a quiz based application?” which directly relates to my product goal due to the fact that my application is a mathematical quiz based application in which this information found online through the various sources would be easily interpreted, analyzed, and recorded towards easy usage into the creation of my application.

Overall, Research skills enabled me to be able to gain information in the form of knowledge and understanding of coding languages and utilize this in a basis as to code my application.

ATL Skill Chosen: Communication Skills (Towards accomplishment of Learning Goal)

Communication skills played a crucial role as to help solve the problems that were faced throughout capturing my understanding of Java and XML. There are various ways communication skills had been used towards the accomplishment of my learning goal:

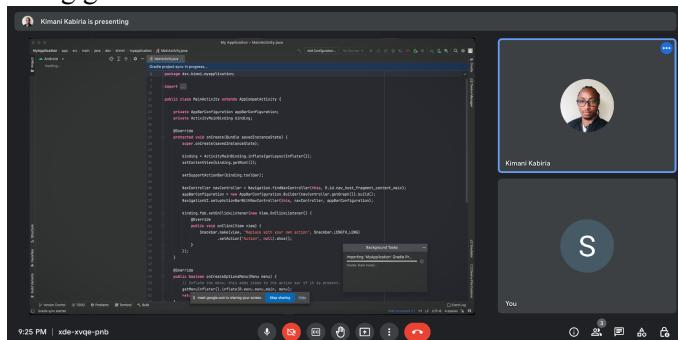


Fig 4. Screenshot of meeting with a specialist.

I had communicated with my coding teacher through the use of whatsapp however primarily Google Meets. (Fig. 4) Through communicating with this application specialist, I had to utilize communication skills effectively due to our *interactions*. This is due to the fact that we had 3 sessions of learning under the time span of 5 days which consisted of me asking questions and receiving aid on the specific areas in which I had gaps in knowledge that were needed for a better understanding of the coding languages. Furthermore, I had to exchange my thoughts, knowledge, and information to this specialist through our interactions to receive feedback and assistance that would help develop my understanding of application coding.



Fig 5a & Fig 5b. Meetings with supervisor

Firstly, these meetings were based on the medium of an interview. Secondly, these meetings with my supervisor consisted of me using communication skills that helped greatly with learning how to effectively teach students interactively online which indeed was a part of my learning goal. These meetings helped greatly with this aspect of my learning goal as teachers such as my supervisor are priorly experienced with teaching students online and interactively through the use of online learning during the COVID-19 Pandemic. With our essential exchange of information and thoughts, my supervisor was able to provide me with information on how to help students learn more efficiently online by showing me teaching methods, ways to keep them '*hooked*'/*Interested*, and how to ensure learning is experienced.

ATL Skill Chosen: Thinking Skills (Towards accomplishment of Product Goal)

Due to the fact that my product goal consisted of the creation of an interactive quiz-based application, It depicts why the use of thinking skills was dire to the creation of the application/the achievement of my product goal as when coding an application I was to start the creation of the applications interfaces, functionality, and design all from scratch. This is in which I had to think creatively for the creation of designs towards being able to produce a more modern and aesthetically pleasing application. Additionally, I found myself thinking profoundly on the functionality of the application by coming up with new ideas on how to add different aspects. Finally, being able to solve errors within the coding of the application to make it function with ease was very important and predominantly was from the use of critical thinking skills. Examples of the utilization of these thinking skills are shown below;

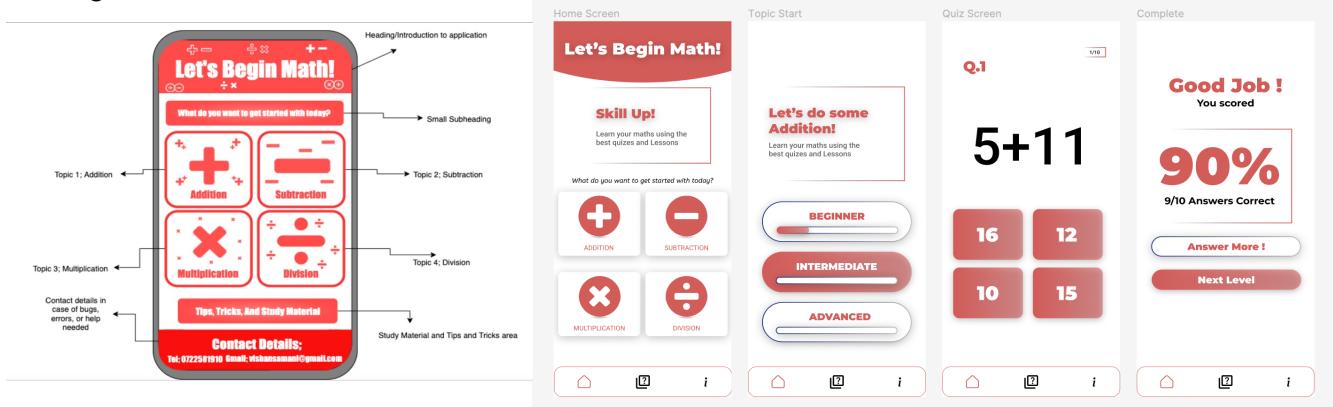


Fig 6. & Fig.7 (Previous Design (Left)) (Final Design Created for application (Right))

Before the creation of the application, I had created a basic design and a final design in which the application was to be designed similarly to. These designs greatly portray the use of creative thinking skills towards reaching

my product goal as the creation of this design consisted of me creating and inputting new ideas into the design to see how the application would/shall look like. However, during the creation of this design I had also utilized critical thinking skills towards evaluating and analyzing my issues and ideas towards creating a better design than the one made before. I had evaluated the problems in the previous design and made changes to make it appear better in the Final Design. This is shown by the improvement from the basic design to the final design. Altogether, this design was used significantly towards accomplishing my product goal as it functioned as an insight to guide my actions/code when in the applications creation process.

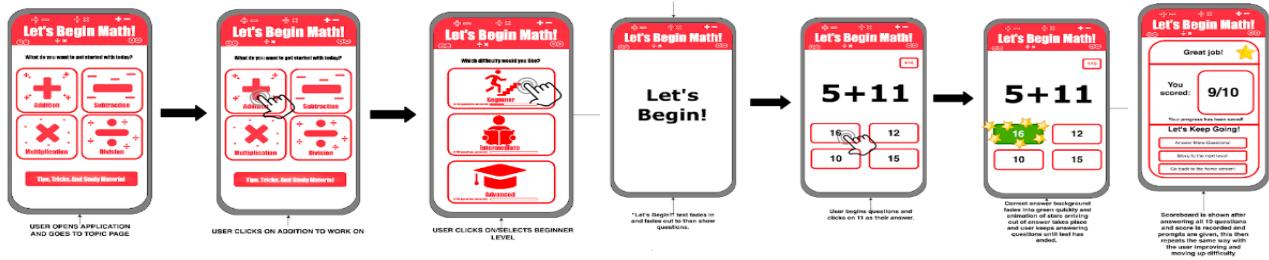


Fig 8. Storyboard of the application

The creation of the storyboard (Above) greatly helped me with understanding and placing my ideas onto a plane which can be seen and utilized as a guide for the creation of my application. However, this storyboard had been created before the design for the functionality of the application. During the creation of this storyboard, I had used a great amount of primarily creative thinking skills as I had to generate new ideas and perspectives for each page to form the functionality of the application as a whole.

Finally, during the creation of the application, there had been various errors with the code, systems, and mathematical algorithms which needed to be solved. Using my prior research, I had used critical thinking skills to evaluate the problems/issues accordingly and then solve them in an appropriate manner for the betterment of the application. Additionally, there had been a very large issue with the division section of the application. This is because the answers of the randomized questions would contain decimals in which disturbed the code. In this situation I had used transfer skills in which I used my prior knowledge and understanding in mathematics in order to create a formula that would guarantee a whole number as an answer. The formula I used is: $a*b=c \mid c/b$ or $c/a \mid >$ always equals to a whole number. I inputted this formula from the first screenshot to the second screenshot in the way below;

```
//Generate Random Question
public Question(int upperLimit){
    this.upperLimit = upperLimit;
    Random randomNumberMaker = new Random();

    this.firstNumber = randomNumberMaker.nextInt(upperLimit);
    this.secondNumber = randomNumberMaker.nextInt(upperLimit);
    if (topic == "Add"){
        this.answer = this.firstNumber + this.secondNumber;
        this.questionPhrase = firstNumber + " + " + secondNumber + " = ";
    }
    else if (topic == "Subtract"){
        this.answer = this.firstNumber - this.secondNumber;
        this.questionPhrase = firstNumber + " - " + secondNumber + " = ";
    }
    else if (topic == "Multiply"){
        this.answer = this.firstNumber * this.secondNumber;
        this.questionPhrase = firstNumber + " x " + secondNumber + " = ";
    }
    else if (topic == "Divide"){
        this.answer = this.firstNumber / this.secondNumber;
        this.questionPhrase = firstNumber + " / " + secondNumber + " = ";
    }
}
```

```
if (Objects.equals(topic, b: "Add")){
    this.answer = this.firstNumber + this.secondNumber;
    this.questionPhrase = firstNumber + " + " + secondNumber + " = ";
}
else if (Objects.equals(topic, b: "Minus")){
    this.answer = this.firstNumber - this.secondNumber;
    this.questionPhrase = firstNumber + " - " + secondNumber + " = ";
}
else if (Objects.equals(topic, b: "Multiply")){
    this.answer = this.firstNumber * this.secondNumber;
    this.questionPhrase = firstNumber + " x " + secondNumber + " = ";
}
else if (Objects.equals(topic, b: "Divide")){
    int num = this.firstNumber * this.secondNumber;

    this.answer = (this.firstNumber * this.secondNumber) / this.secondNumber;
    this.questionPhrase = num + " / " + this.secondNumber + " = ";
}
```

Fig 9. & Fig 10. (Previous code (Left) (Final Code (Right)

REFLECTING

Dealing with the primary beneficial outcomes of this journey and personal project experience, it helps bring about how this has impacted me, which can be easily addressed. Digital Design taught me two different coding

languages including HTML and CSS which are applied in the creation of a website although, towards reaching my product goal I was to successfully code an interactive application. This called upon two new coding languages I have learned to be partially fluent in their use, Java (*programming language*) and XML (*layout styling*). This new knowledge of the Java coding language has enabled me to create interactive features that allow a user to click on specific sections and receive responses in correlation to the area they would like to visit on the application which was very different from the HTML I had learnt prior. Furthermore, Java was crucial towards achieving my product goal as I learnt how to code the primary abilities needed for the overall application through its use, including the generation of questions, the generation of answers for these questions, the answering of these questions, the calculation of scores, and even routing through the pages to access these questions. All of these aspects that were included in the through Java programming had all been newfound features as I was newly able to produce functionality and interaction with the use of this newfound coding language. This would allude to my development of effective *critical thinking skills* as during the process I was forced to improve on my evaluation of various ideas (*dealing with functionality*) and errors inside of the code to ensure the application works appropriately. Moving on, when mentioning XML as a more styling language, it provided me with the ability to successfully create templates of UI with appropriate use of colors, styling, (Similar To CSS although allows more freedom and ease) and constraints for the placement of these different elements around the page/interface wanted (*interface is also referred to as a fragment in XML Code*). In reference, this XML styling has developed my *creative thinking skills* as when designing these interfaces, I improved my ability to think appropriately and in which way the application would look more visually appealing further improving my *artistry* and *ingenuity*. In conclusion, this journey and creation of my product has provided me with a more extensive comprehension of coding, development of effective technical skills, and bright use of creative thinking to create vibrance and attractiveness in coding.

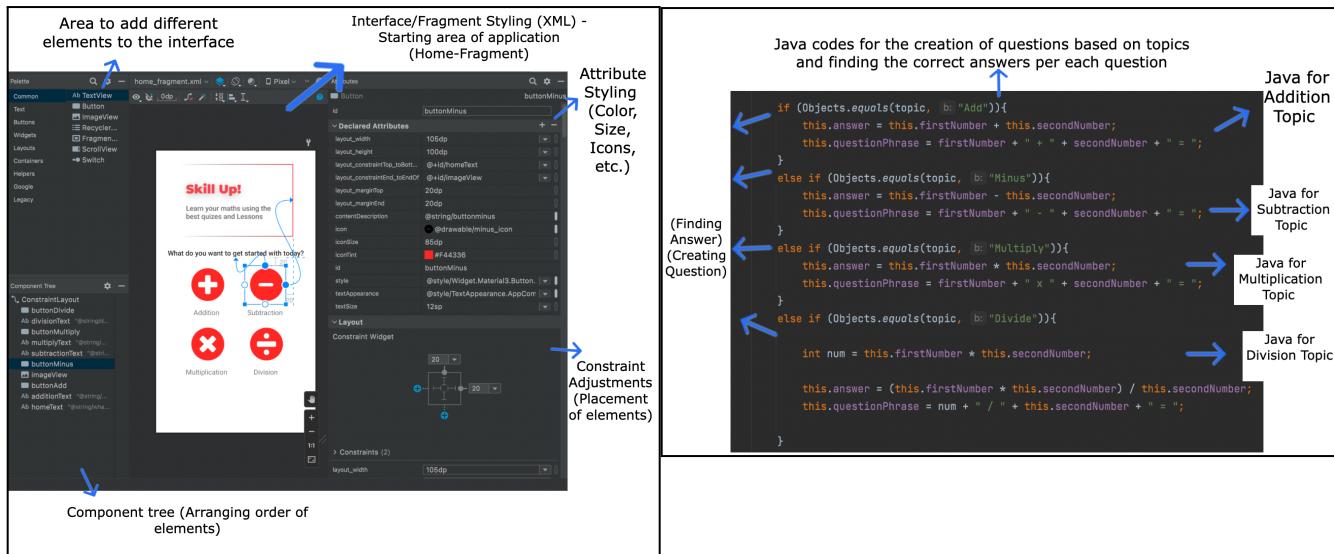


Fig 11. (XML Interface creation (styling language)) & Fig 12. Java functionality (programming language)

There are additional ways in which this personal project process has led to my self-development. PP had furthermore led to the development of two *ATL Skills: communication skills and research skills* with reference to the *IB learner profiles*: to be more of *an inquirer and knowledgeable* (as shown above to develop my understanding of various coding languages).

When looking at my use of *communication skills (ATL SKILL)*, towards reaching my learning goal, I had to efficiently exchange information, messages, and thoughts with a coding teacher/specialist prior the creation of my application to ensure I would generate a strong understanding of Java and XML (*correlating to me wanting to acquire knowledge on how to code an application*) in which I learned how to communicate in the optimal way

possible to enhance congruence between my teacher and myself towards ensuring I strongly improve my understanding of how to code an application.

This aspect of communication works in correlation with my development of my ability to be more inquisitive (*an inquirer*) (*IB LEARNER PROFILE*) as during these lessons, I had to push myself to ask more effective and thoughtful questions towards ensuring I reduce any gaps of understanding that I have in these coding languages, helping the development of *curiosity*. This curiosity would enable me to generate the ability of more independent learning (*research*) while also improving my collaboration with others during learning (*inquisitive*) further developing a stronger love and joy for learning.

Moving forward, dealing with *research skills (ATL SKILL)*. These skills had been utilized towards being able to *plan, locate/search, interpret, evaluate, and utilize* different types of information which extensively enabled myself to carry out more effective research. Firstly, I was able to newly create effective research plans to gather more accurate and relevant information which further helped develop my ability of utilizing both *information literacy skills and media literacy skills* towards *extracting effective information online/in forms of media* (through using the research plan) towards interpreting this information and constructing an application based on the information provided while building knowledge of the coding languages. The development of these skills came into play when there were both minor and major errors with the codes of the application which led to me having to conduct a strong research towards finding the solution to these problems furthermore allowing the application to function appropriately. This enabled me to be more positive when facing problems as I would repetitively try and find ways to solve these issues therefore making me a *better learner*.

Finally, due to the fact that I only had a stronger understanding in two coding languages due to digital design (*HTML, CSS*), through this journey, I have been shown to be more *knowledgeable (IB LEARNER PROFILE)* has I have acquired effective information about two different coding languages that take part in the creation of an interactive application (*Java, XML*) which would enable me to develop in aspects of *technical innovation* and due to the fact that the world is consistently following a path to the existence of artificial beings, I have further developed my understanding of *humanities* as this knowledge of coding languages helps my development in ability to participate in the development of future communities (*portraying an aspect of global significance*).

Table 3 - Success Evaluation

| Success Criteria | Success Evaluation |
|---|---|
| <p>Aesthetics: The application contains colors with a red color scheme, excellent images, and an outstanding organization of topics.</p> | <p>To an Extent - The application followed a strong red color scheme which correlated to mathematics however there was a strong lack in the use of images minimizing the elements and aesthetics that would make it more appealing. In contrast, the topics were organized successfully in a user-friendly manner.</p> |
| <p>Cost: The creation of the application takes no material costs, and little money spent on software and learning purposes including money paid to publish applications on the app store while needing no cost to purchase and download for users.</p> | <p>Yes - The application utilized minimal energy costs due to the utilization of solar energy conversion into electricity to generate charge for my possessions during the applications creations. All materials had been previously possessed by me and Android Studio (Software) was free however money for teaching and publication was kept minimal.</p> |
| <p>User/Audience: The application is thoroughly suited to the ages 6-8 of mathematics. The application contains 3 different levels of difficulty of the topics which can be</p> | <p>Yes - The application strongly aids in the development of a basic foundation of mathematics for children of the ages 6-8 which allows a range in which students can move from different levels and advance their mathematics.</p> |

| | |
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| performed towards giving the audience a range of what to choose from. | |
| Function: Effective quiz area: The question area per topic and level asks infinite questions with a well thought of time limit , a choice between four answers (one correct and three wrong), and a fully organized layout with a score counter and summary page with minimal bugs and glitches through regular bug fixes | To an extent - The question area provides infinite questions with a visible 30 second timer in which when the timer ends, the questioning ends as well in which the number of questions answered correctly are put against the number of questions answered overall in a summary page with a calculated score. All organization is strong in the question area. However, crashes are repetitive. |
| Content/Size: The application contains 4 topics on a home page of mathematics to work on with 3 different levels of difficulty with an area providing tips and tricks for solving these questions and study material. | To an extent - The application contains 4 subjects/topics on the main page with 3 levels of difficulty even containing a summary page at the end of each quiz however not containing an area providing tips and tricks for solving these questions with study material. |

Aesthetics (1) → This criteria was rendered successful (*level 5-6*) however to an extent due to the omission of various images in the designs to make the design appear more visually appealing and attractive.

When talking about the red color scheme the application was to follow, it is depicted below that this application indeed followed a strong color scheme of red and white in which the color scheme worked in congruence to display the effect and appeal of mathematics.

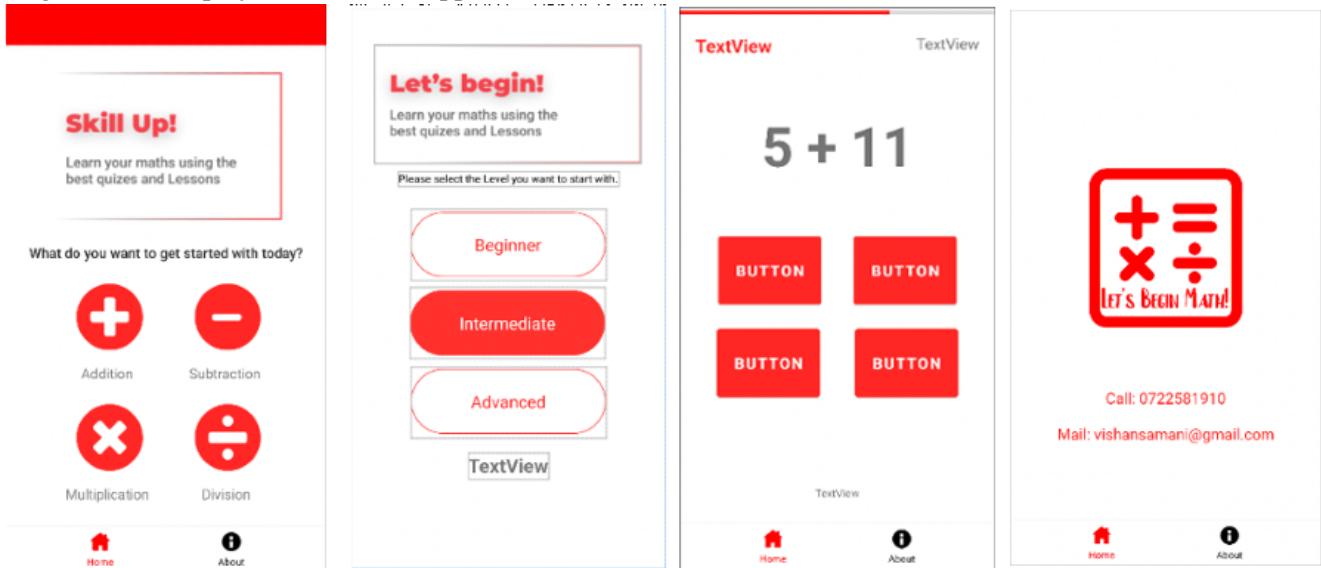


Fig 13. Appearance of all the pages in the application.

In correlation, as shown above on the first page, there is a strong organization of topics in which selecting the wanted topic is very feasible. This is noticed as all topics are placed in a 2x2 area containing icons to work as buttons and corresponding text to work as a caption to these icons and allow the user to select the exact topic they want to work on. However, as also shown through the applications interfaces, there is a visible lack in images as the only images provided are in the home-page and the about-page which negatively affects the appearance and ease in user-friendliness in which visual information is easier to be understood when looking at the perspective of a child aged 6-8.

Cost (2) → This criteria was rendered successful (*level 7-8*) due to the quality management of funds utilized while creating the application while also finding the cheapest and most feasible software to help create the application although ensuring there was money available for the publication of the application.

Taking into account the material costs, all materials were possessed by myself prior to the creation of the application in which I already had access to a laptop (*research, etc.*) and a phone (*to use as an emulator*) in which I had to pay no amount of fee towards gaining access to these materials. Secondly, the creation of an application is made on a free-online basis leading to the fact that there are no needs for any external materials for the creation of this application.

When it comes to the money spent on the software learning and downloading, the specialist who was teaching me about this application provided me with 3 2-hour sessions that helped greatly with my understanding while minimizing cost. The cost of these sessions succumbed to an amount of 15\$ with 5\$ per session.

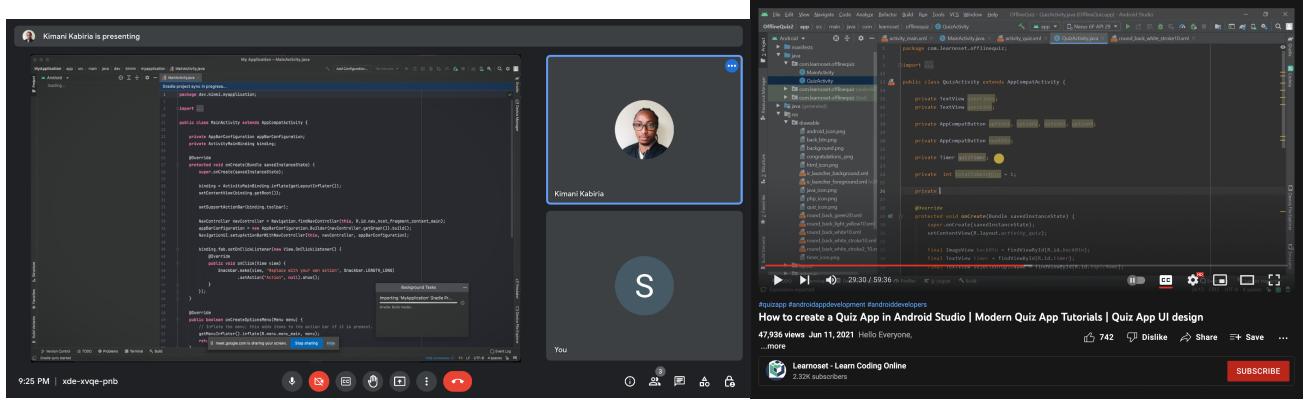


Fig 14. (Taking Online Lessons with Specialist/Teacher) & Fig 15. (Youtube Videos and Tutorials to learn)

Instead of increasing the number of sessions (*further increasing the cost*) when I had issues with my coding, I simply sent a direct message to the specialist for aid in that specific area or most of the time I had utilized various youtube videos to improve my understanding.

Dealing with the cost taken to publish the application online, it succumbed to a fee of \$20 for me to become a google developer allowing me to further publish my application. Evidence of this payment towards joining the google app development area is shown below:

| Complete your purchase | | | | | | | |
|---|---|---|--------------------|---------------------------|---------------|--------------|---|
| Developer Registration Fee | \$25.00 | App | Installed audience | App status | Update status | Last updated | |
| Your payment info will be saved to your Google Account. Manage your payment methods at pay.google.com . | |  Let's Begin Math! com.vishan.lbm | 0 | Draft Internal testing | In review | 20 Aug 2022 |   |
| Add credit or debit card |  | | Show rows 10 ▾ | 1 - 1 of 1 | < | > | >> |

Fig 16. Purchasing rights to publish application and sending it for testing

Finally, towards ensuring that my target audience is maximized towards providing aid in improvement of mathematical foundations both in my community and worldwide, the publication of the application was ensured to be set up to have no fee of purchase. This would render my application to be free for all to use as it firmly asks you to install the application without prompting any cost. The product is affordable to many people and can be accessed by anybody any time as long as someone has the network.

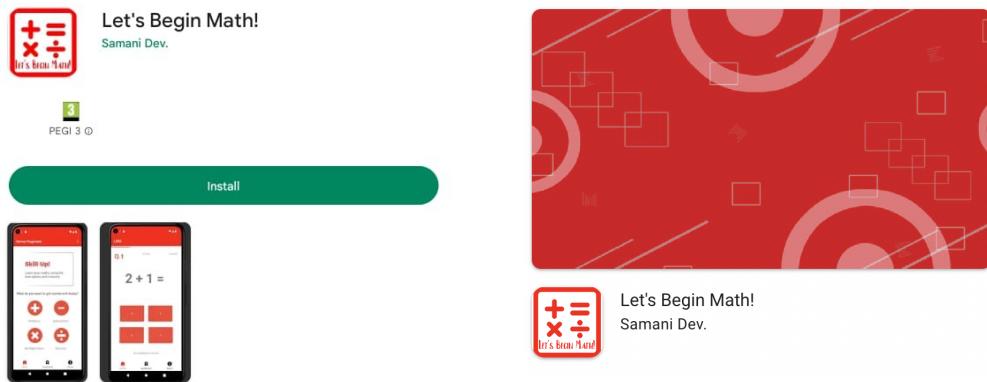


Fig 17. Published App on Play Store

User/Audience (3) → This success criteria is rendered to be successful (*level 7-8*) as the application strongly fulfilled and matched the average knowledge of a 6-8 year old child allowing for an increase/decrease in level of questions towards enhancing the range of difficulty of the questions therefore enabling children of lower/higher levels of mathematical ability to choose a difficulty that would enhance their performance best.

In reference to the application being suited against the ages of children 6-8, towards acquiring the most sufficient information it would deem to be best to retrieve the opinions of the children and a few parents in my community to talk about how they felt about the applications impact on the children. Due to this, I dispersed a form to my community and received the feedback provided below from 6 children:

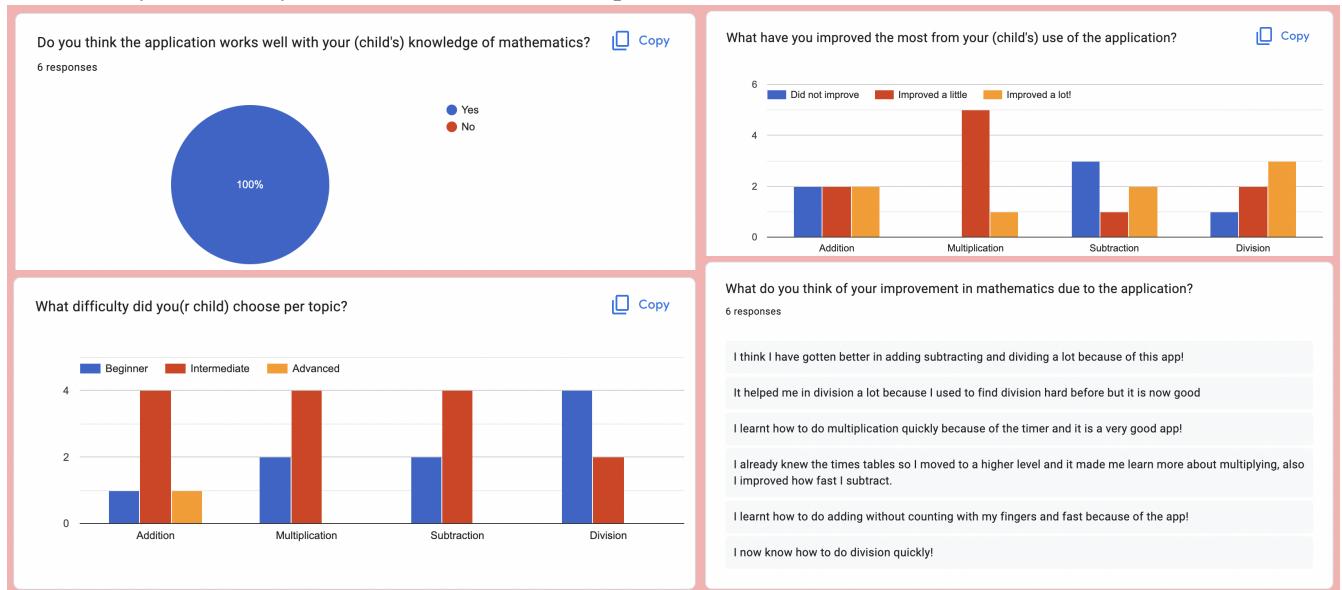


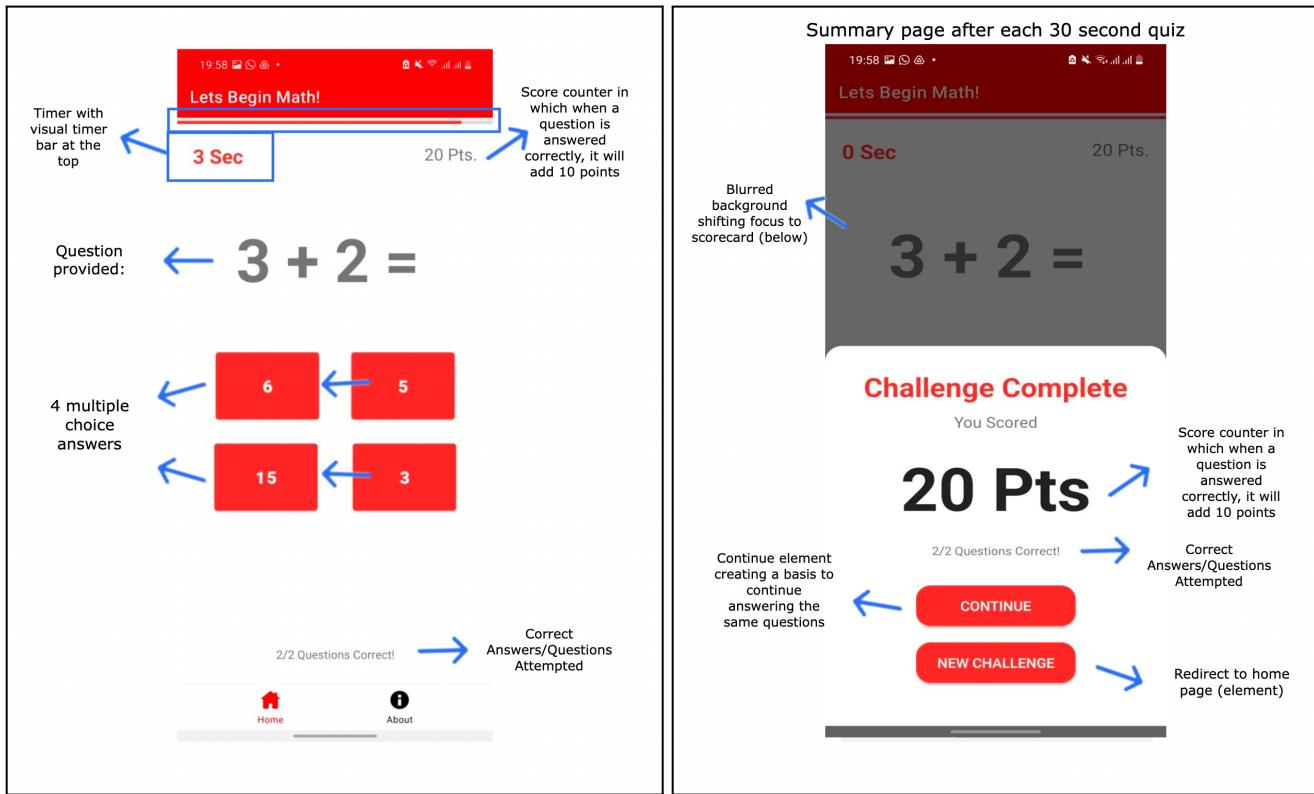
Fig 18. Google Forms Assessment based on community enjoyment of application

This data extracted from the forms has helped me come to various conclusions based on the extent to which this success criteria has been met. Firstly, with the first question asked, all of the answers agreed that the application works in correlation with the mathematical knowledge of my target audience (*children from ages 6-8*) showing signs of strongly induced learning with the development of knowledge/foundational skills in mathematics therefore concluding that the application is indeed thoroughly suited to children's ages of 6-8. Moving onto the second question, it shows correlation between whether there were signs of no improvement, little improvement, or great improvement in which the answers varied accordingly however showing stronger signs of either a little improvement or a large improvement which can help me conclude that the aid of mathematical ability to the target audience was successfully provided by the application. In contrast, the third question depicts the *large difficulty* provided in the advanced section as it was not chosen to help the child the

most as it had seemed to be the hardest to do with a time limit illustrating that the difficulty should be reduced per levels and ensure they are more specific to *linear improvement* rather than strong leaps between difficulty. Finally, the last question strongly shows the improvements and opinions of the application from the children further enhancing on the aid they received from the application.

Function: Effective quiz area (4): → This success criteria had been rendered successful as each of the different specifications had been included in the quiz area/question area that all support the improvement of mathematical prowess. These different aspects are mentioned below:

Firstly, the quiz area consisted of an effective timer which helped push the target audience to answer each of the questions faster and faster each time towards improving their general speed when doing basic mathematics further on improving their foundational skills (*this timer can be depicted in the image below (30s)*), this timer works in correlation with a timer bar on the top of the screen to give the user a more visual perception of how much time they have to answer the questions. In correlation, due to the fact that there is a timer, the user is prompted with an infinite amount of questions and forced to answer as many questions as possible to rack up a larger score while keeping all their questions correct (*with an answer correct/questions attempted checker*) which is all shown on a summary page when all questions have been answered. Additionally, there are 4 multiple choice answers to ensure there is more decisiveness in the user's answers providing them with a more precise understanding of the topics rather than focusing on guessing. Further depiction of this quiz page in reference to the criteria is shown below:



Although this quiz area provides the primary functions of generating understanding, there are various crashes induced by this page. The google console crash rate of the application is shown below:

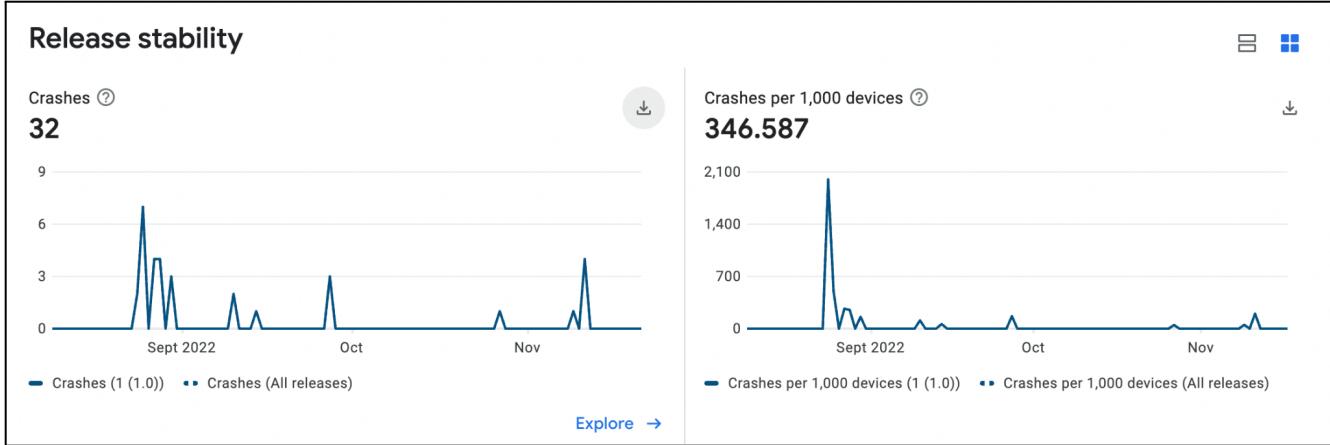


Fig 21. Crash Rates of Application (Most Received from Quiz Page)

This further creates a conclusion that the application followed its main use towards providing efficient questions while including interactive features to help create more advanced and feasible learning although reduced by the abrupt crashes when answering questions.

Content: (5) → This success criteria was met *to a certain extent* as the application consisted of all the topics which were to be included with all the levels additionally providing infinite questions although the application did not consist of an area containing tips, tricks, and study material.

In correlation to the incorporation of 4 topics in correlation to the success criteria, the home page of the application strongly brings out addition, multiplication, subtraction, and division in which are accompanied with icons to show strong organization. Adding onto the content of the application, every topic has 3 different levels of difficulty to provide a more decisive array of choices to build upon the understanding of these familiar concepts. Although, in reference to the need for tips, tricks, and study material, they had not been included as I thought of integrating an area in which when you get a question wrong, it provides you a hint on how to answer the question.

These aspects included/excluded can be shown below through screenshots of the application on a phone:

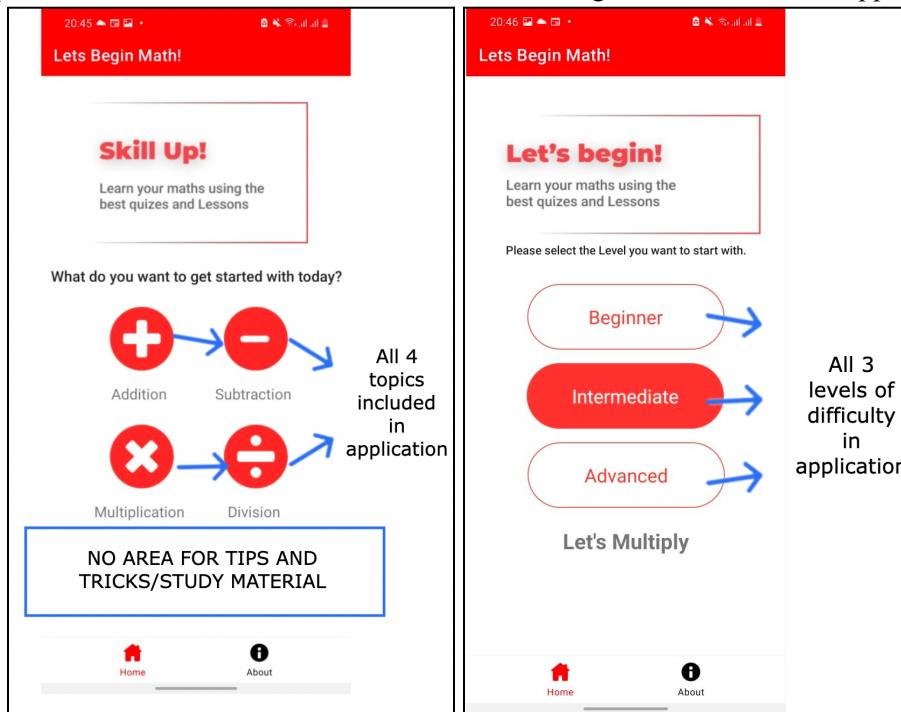


Fig 22. Subject selection page (lacks area for tips, tricks, and study material) & Fig 23. (Difficulty Selection Page)

Conclusion

When reflecting on this personal project journey, I can proudly say that it has greatly improved me as a person and a learner while being able to successfully achieve my learning goal. I gained various amounts of knowledge based on coding applications (Java and XML) while also developing myself as an IB Learner and improving my use of ATL Skills. Additionally, when in reference to the product created, I successfully fulfilled my product goal which fulfilled all of the success criteria however with some to an extent with minimal changes made while still being able to include the main elements required for the application to achieve its main objective as 40% of all success criteria were successfully reached with 60% met however to an extent.

As I come to the end of my project creating a mathematical-based quiz application for children aged 6-8, I am proud to say that the intended purpose has been achieved. This application provides an engaging and interactive platform for children to improve their mathematical skills in addition, multiplication, division, and subtraction, and has levels that cater to different skill levels.

Through this application, children can develop their problem-solving and critical thinking skills, which are essential for their academic growth. It is also available for free on the play store, making it accessible to a larger audience of children who may not have access to other educational resources.

In terms of sustainability, this application is an excellent tool that can contribute to the development of young children through its feasible accessibility, availability, and the fact that the app will be present on the play store for a long time to come. As a result, it can continue to provide value to its users for an extended period.

As I look to the future, I am open to making improvements to this application based on user feedback and suggestions. Adding new topics, levels, and features such as tracking progress and providing feedback are all potential enhancements that could make the application even more useful to children and their parents.

Overall, I am satisfied with the outcome of this project and look forward to seeing the positive impact that it can have on children's math skills and academic growth.

“It is good to have an end to journey toward; but it is the journey that matters, in the end” - Ursula K. Le Guin