PlayMax: Shaping Learning for Primary School Students - Java Swing

Research Proposal · May 2023

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Module Code: **PUSL3122**	Module Name: HCI, Computer Graphics, and Visualization
Coursework Title: **Final Project - Shape Learning Application (PlayMAX)**	
Deadline Date: **25th May 2023**	Member of staff responsible for coursework: **Dr. Alaa Alkhafaji**
Programme: **B.Sc. (Hons) Software Engineering**	

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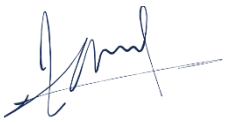
Signed on behalf of the group: 

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PlayMax

Shape Learning Application

Group Project - 01

PUSL3122

HCI, Computer Graphics, and Visualisation

Acknowledgement

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Thank you all for making this project a success!

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Introduction

This report presents a thorough examination of the design, execution, and implementation process of an interactive educational software application intended to facilitate **learning of 2D and 3D shapes** among **primary school students**. The ensuing sections will guide the reader through each stage of the project, encompassing user analysis, requirement elicitation, creation of user stories and personas, user interface design, prototyping, user testing, and the eventual implementation. The primary objective of this project is to develop an engaging and user-friendly educational tool that makes the learning process both enjoyable and informative for young learners.

In the context of the software development lifecycle, this report showcases our rigorous adherence to the principles of **Human-Computer Interaction (HCI)** as well as agile-scrum methodology. This project has made extensive use of various tools and technologies including, but not limited to, **Java programming language with Swing APIs** for user interface development and implementation, and **Figma for high-fidelity prototyping.** A concerted effort has been made throughout this project to ensure the utmost usability and accessibility of the application, which is substantiated by comprehensive formative and summative user evaluations.

The source code for the project is accessible on the Plymouth university organization GitHub repository, the link for which is provided.

GitHub Link - https://github.com/Plymouth-University/main-coursework-playmax

Background

The present-day digital era has enabled the integration of technology into education, making learning more interactive and engaging. To contribute to this dynamic landscape, we introduce **"PlayMax"**, an innovative educational application designed specifically for primary school children to **learn about 2D and 3D shapes** in a fun and interactive way.

PlayMax aims to create a comprehensive learning environment where kids can explore, understand, and engage with various geometric shapes. It provides diverse functionalities including visual representations of different shapes, interactive tutorials, quiz games, and an opportunity to create, modify, and visualize custom shapes. The features are designed to be simple and intuitive, making it easy for kids to navigate and learn independently or under adult guidance.

The target audience for PlayMax is primarily children aged 5-10 years old, who are in their early years of formal education. These children are in the phase where they are being introduced to the world of geometric shapes, a fundamental concept in mathematics.

In addition, PlayMax is also designed to be a useful tool for educators and parents. For teachers, it serves as an auxiliary teaching tool that can supplement their classroom instruction, making abstract concepts tangible and understandable. For parents, it provides an opportunity to engage in their child's learning process, monitor their progress, and facilitate productive screen time.

In essence, PlayMax is a child-friendly, educational, and interactive tool that makes the process of learning about shapes an enjoyable experience. By offering a practical, hands-on approach to learning, it fosters a better understanding of geometric shapes, contributing to the early educational development of the child.

Gathering Data

To gather data for this project, a survey or questionnaire approach was likely used to collect information from parents and guardians. Data analysis has been done based on **50 responses** received on a questionnaire form sent to an identified group of people. The survey would have been designed to gather insights about their preferences and requirements for a shape learning application for their children. Participants would have been asked to provide their relationship to the child, the age group of the child, their interest in a shape learning application, desired features, payment model preference, and other relevant aspects.

Google Form Link -
https://docs.google.com/forms/d/e/1FAIpQLSdSFM2LKA7aKheR1_nf9pTQADBS46WwGwd6GrYRwsDm7HJ5LA/viewform?usp=sf_link

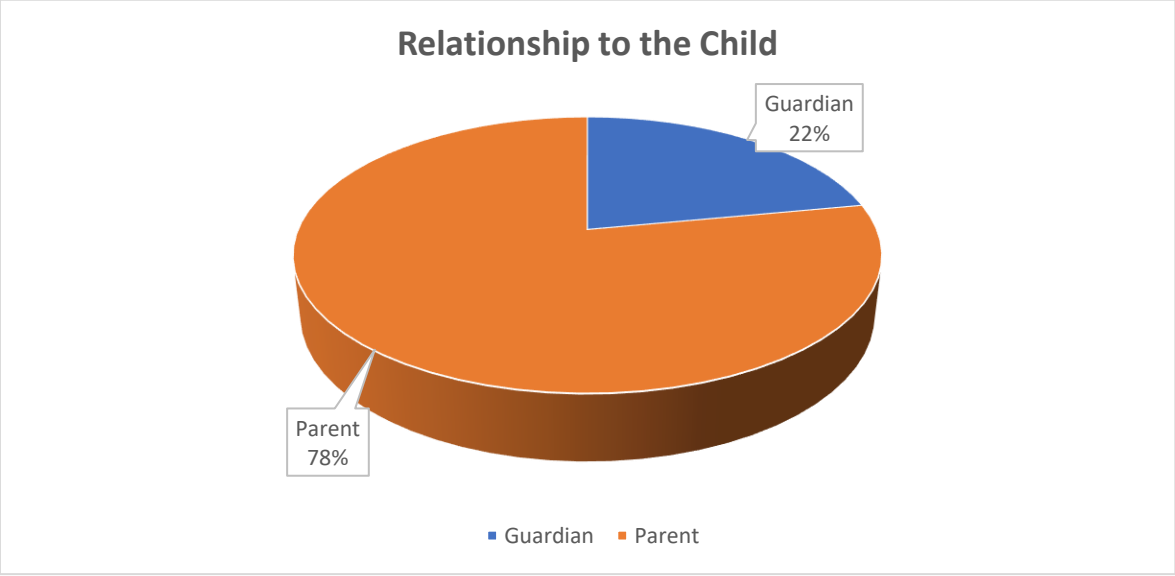

Chart 1 - Relationship to the Child

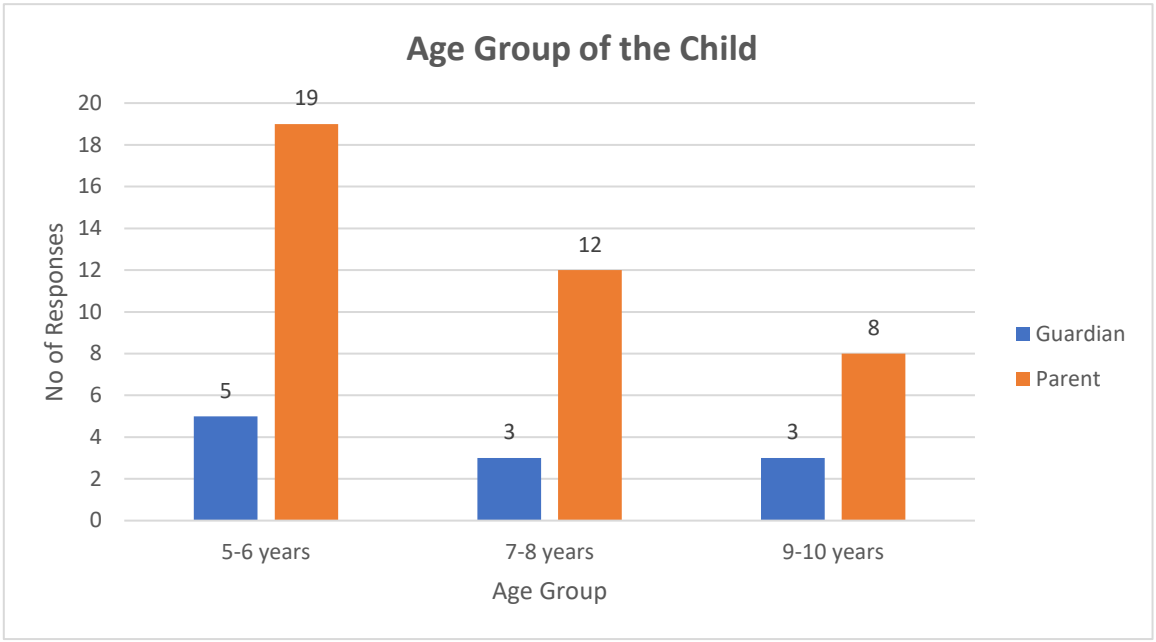

Chart 2 - Age Group of the Child

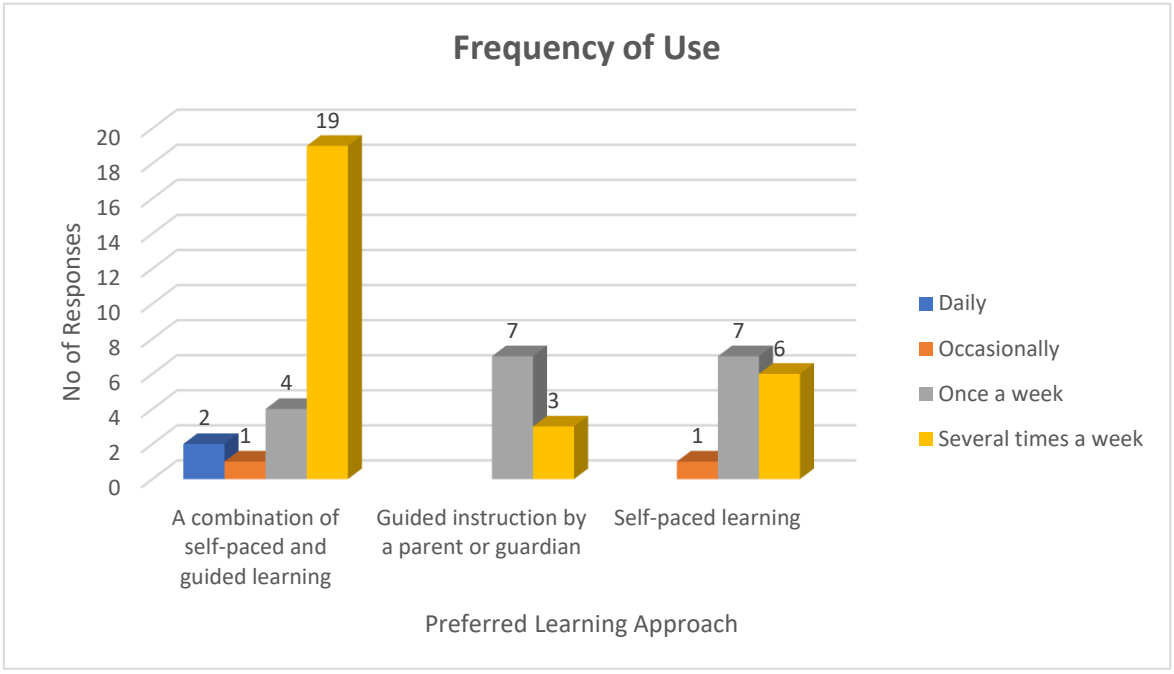

Chart 3 - Frequency of Use

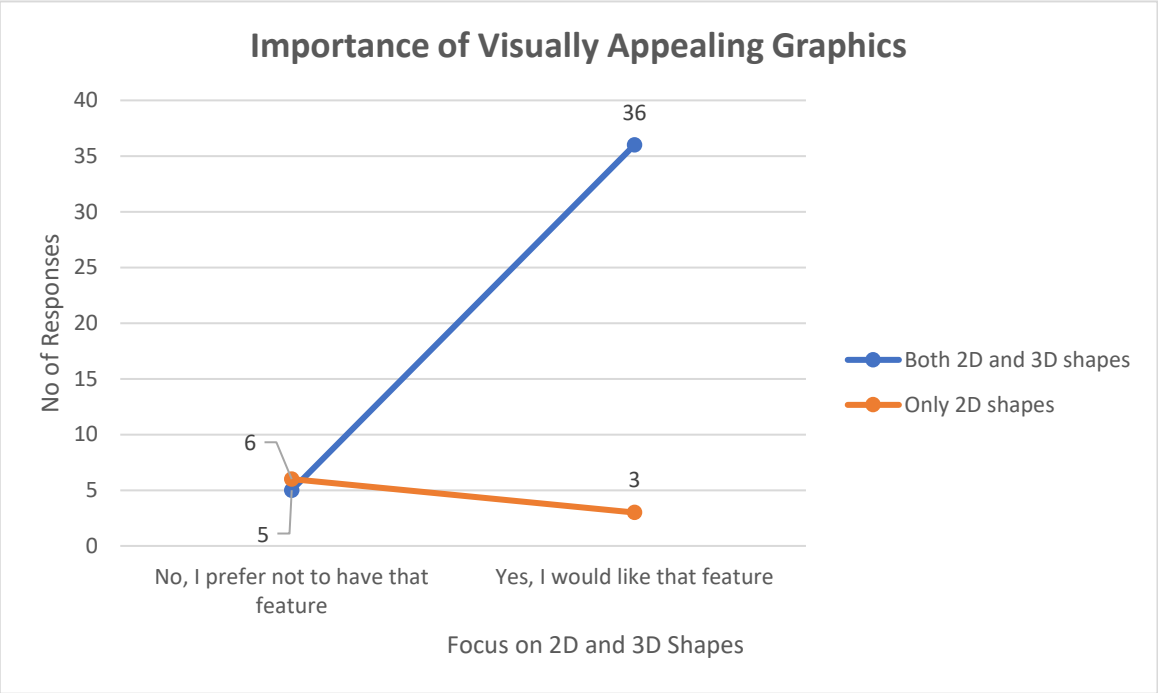

Chart 4 - Importance of Visually Appealing Graphics

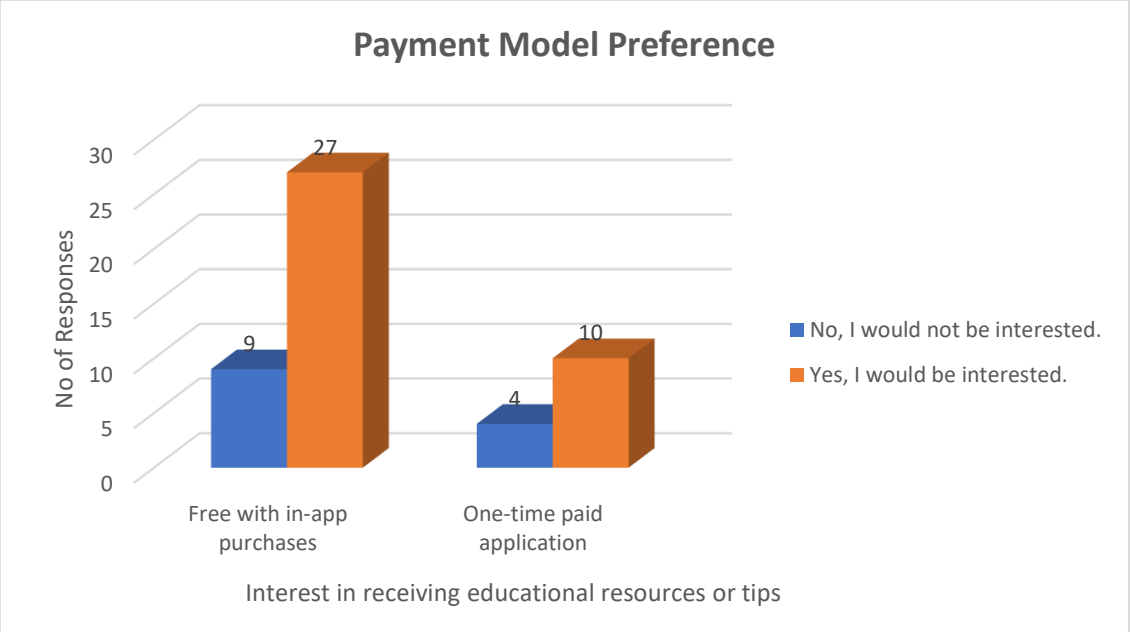

Chart 5 - Payment Model Preference

Data Analysis & Findings

Question No	Analysis	Findings
1	Relationship to the child	Majority identified as parents or guardians
2	Age group of the child	5-6 years and 7-8 years are the most common age groups, with some in the 9-10 years age group
3	Interest in a shape learning application	Majority expressed interest in using a desktop application to help their child learn about shapes
4	Desired features in a shape learning application	Interactive games, 2D and 3D shapes, various colors, step-by-step instructions on drawing shapes and polygons
5	Focus on 2D and 3D shapes	Majority prefer the application to include both 2D and 3D shapes
6	Payment model preference	Majority prefer a free application with in-app purchases
7	Interest in a save and share feature	Majority would like the application to have a feature to save and share their child's drawings or creations
8	Importance of visually appealing graphics	Majority rated visual appeal as important
9	Likelihood of recommending the application	Majority expressed a high likelihood of recommending a shape learning application to other parents or guardians
10	Frequency of use	Most believe their child would use the shape learning application several times a week
11	Preferred learning approach	Combination of self-paced and guided learning is favored, with some indicating guided instruction by a parent or guardian
12	Interest in receiving educational resources or tips	Majority expressed interest in receiving educational resources or tips related to shape learning to support their child's learning

Conclusion

The data suggests that there is a significant interest in using a desktop application to help children learn about shapes. The preferred application would include interactive games, a variety of 2D and 3D shapes, step-by-step instructions, and the ability to save and share creations. Visual appeal is important, and a free application with in-app purchases is the preferred payment model.

A combination of self-paced and guided learning is favored, and there is an interest in receiving additional educational resources. Based on these findings, developing a shape learning application that aligns with these preferences could be well-received by parents and guardians.

Design

The design of PlayMax focuses on delivering a user-friendly interface, intuitive navigation, engaging visuals, and interactivity to foster a fun learning environment.

Requirements Documentation

1. **Interactive Learning**: The application provides interactive learning materials for children to learn about 2D and 3D shapes.
2. **Shape Creation**: The application allows users to create and manipulate shapes.
3. **Visualization**: The application is able to render both 2D and 3D shapes and allow users to interact with these shapes.
4. **Quiz Module**: The application has a quiz game to test the user's understanding of the shapes.
5. **User-Friendly Interface**: The application has an intuitive and child-friendly interface.
6. **Usability**: The application is easy to navigate for its primary users - children aged 5 to 10.

Personas/User Stories

Persona 1: Mrs. Inoka - The Supportive Teacher

Mrs. Inoka is a dedicated primary school teacher looking for innovative ways to teach her students about shapes.

User Stories:

1. As Mrs. Inoka, I want to provide an interactive learning tool to my students to aid their understanding of shapes.

2. As Mrs. Inoka, I want to monitor the progress of my students to see how well they understand the shapes.
3. As Mrs. Inoka, I want to use a learning tool that keeps my students engaged.

Figure 2 - Persona Supportive Teacher

Figure 1 – User Story Supportive Teacher

Through PlayMax, Mrs. Inoka aims to create a more interactive and enjoyable learning experience for her students, allowing them to understand and appreciate geometric shapes in a new light.

Persona 2: Anura - The Involved Parent

Anura is a 35-year-old parent who is highly involved in his 8-year-old son's learning process. He likes to introduce his son to fun learning methods and actively looks for resources that make learning more enjoyable and effective.

User Stories:

1. As Anura, I want to find an educational tool that makes learning about shapes fun and engaging for my son.
2. As Anura, I want to be able to track my son's progress in understanding shapes.
3. As Anura, I want an application that is safe and suitable for my son's age group.

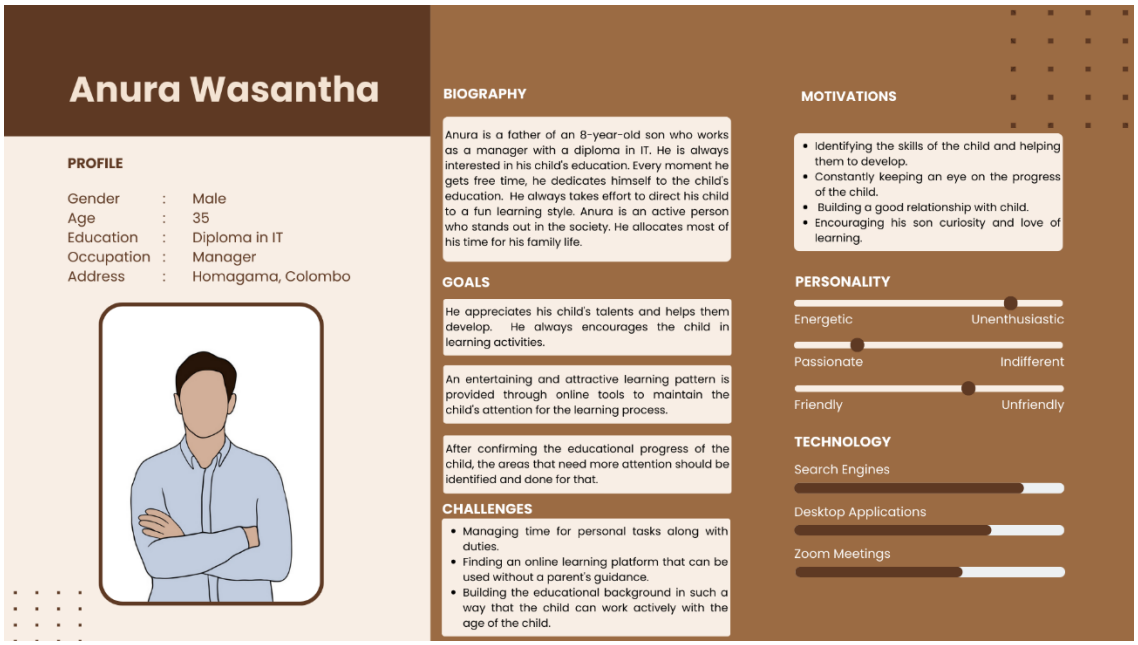

Figure 3 – Persona Involved Parent

Through PlayMax, Mr. Anura aims to make learning about geometric shapes an enjoyable experience for his child, while actively participating in his educational journey.

Figure 4 – User Story Involved Parent

These personas and their respective user stories will ensure that PlayMax addresses the needs of all its potential users. It provides guidance in designing a versatile application that is useful for parents and tutors in enhancing the learning experience of children. These user stories will guide the development of PlayMax, ensuring it meets the needs of both the children using it and the educators who will implement it.

Storyboard

The storyboard of PlayMAX starts by installing the application on a desktop that a child has. From then on, the child accesses the application with the help of the parent, teacher, and guardian parties. Immediately after entering, the child will see a colorful loading page. Children are then welcomed to an application containing a variety of geometric and colorful shapes with backgrounds and are then given the opportunity to select shapes, draw shapes and participate in these related activities. The first thing a child who enters the application tries to select a shape. The icon on the welcome page by clicking one, the child enters the other page related to it. Accordingly, the child must choose the type of shape by presenting two options as 2D shape and 3D shape. After accessing 2D shapes, creating different geometric shapes and the required size scaling can be done according to the child's wishes. After accessing the 3D shapes, the same happens. At some point, when referring to the draw shape on the welcome page, the child will be taken to a new page. Having a color palette to choose from,

changing the size of the shape as per your wish, you can save, share, clear the page completely and undo your creations. After interacting with the shape, the child will refer to the quiz related to that shape. These quizzes are designed as a game puzzle in a very attractive way. In the hope of getting the child excited for this, marks are awarded for each question. Finally, the child confirms his or her progress and exits the application and ends the session.

Storyboard: Teacher Using the PlayMax Application

Figure 5 - Storyboard: Teacher Using the PlayMax Application

This storyboard illustrates how Mrs. Inoka, a supportive teacher, uses the PlayMax application as an effective educational tool to teach children about geometric shapes in an engaging and interactive way.

Storyboard: Parent Using the PlayMax Application

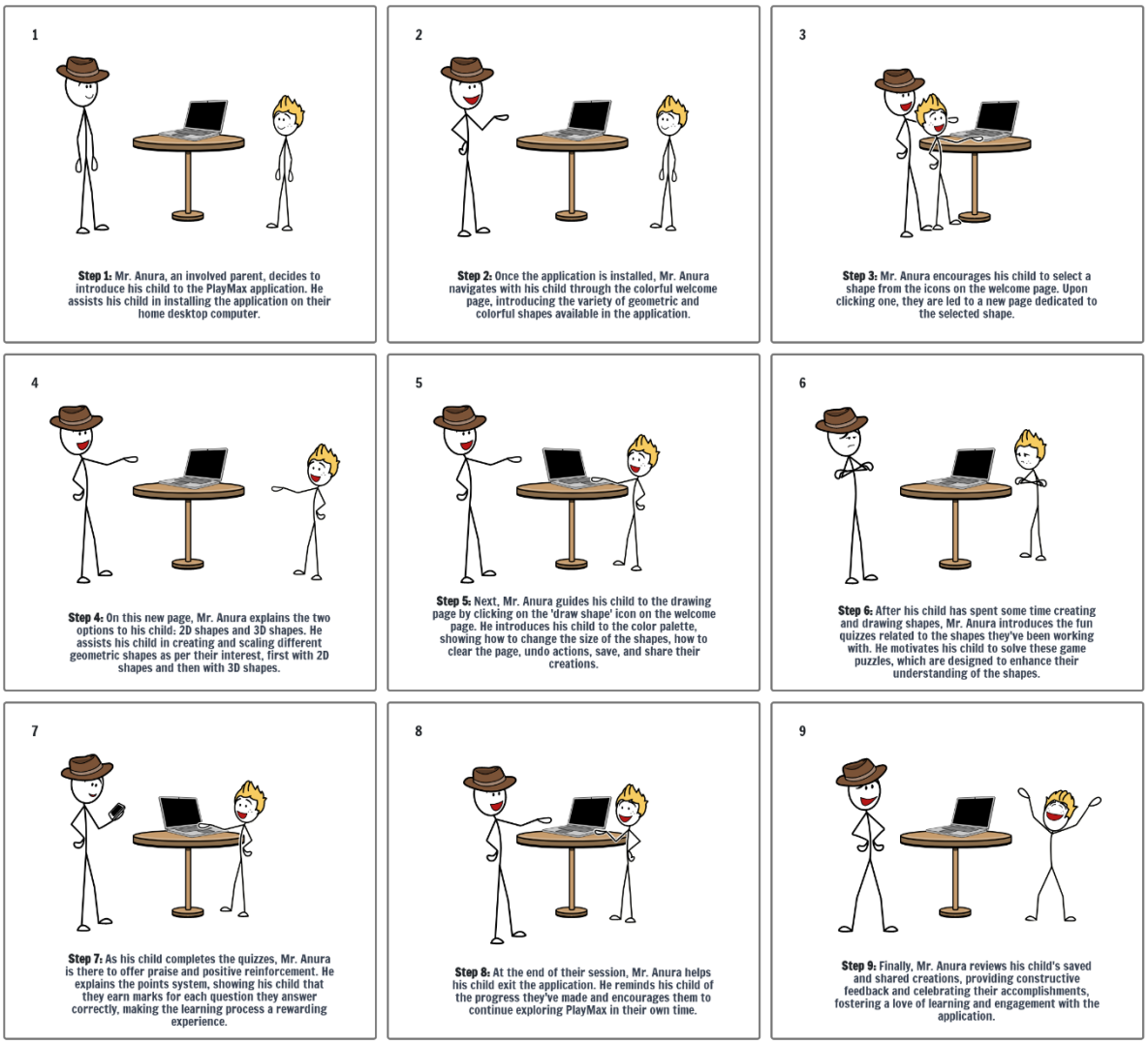

Figure 6 - Storyboard: Parent Using the PlayMax Application

This storyboard illustrates how Mr. Anura, as an involved parent, uses the PlayMax application as a beneficial educational tool, aiding his child in understanding geometric shapes in a fun and interactive manner.

Low-Fidelity Prototype

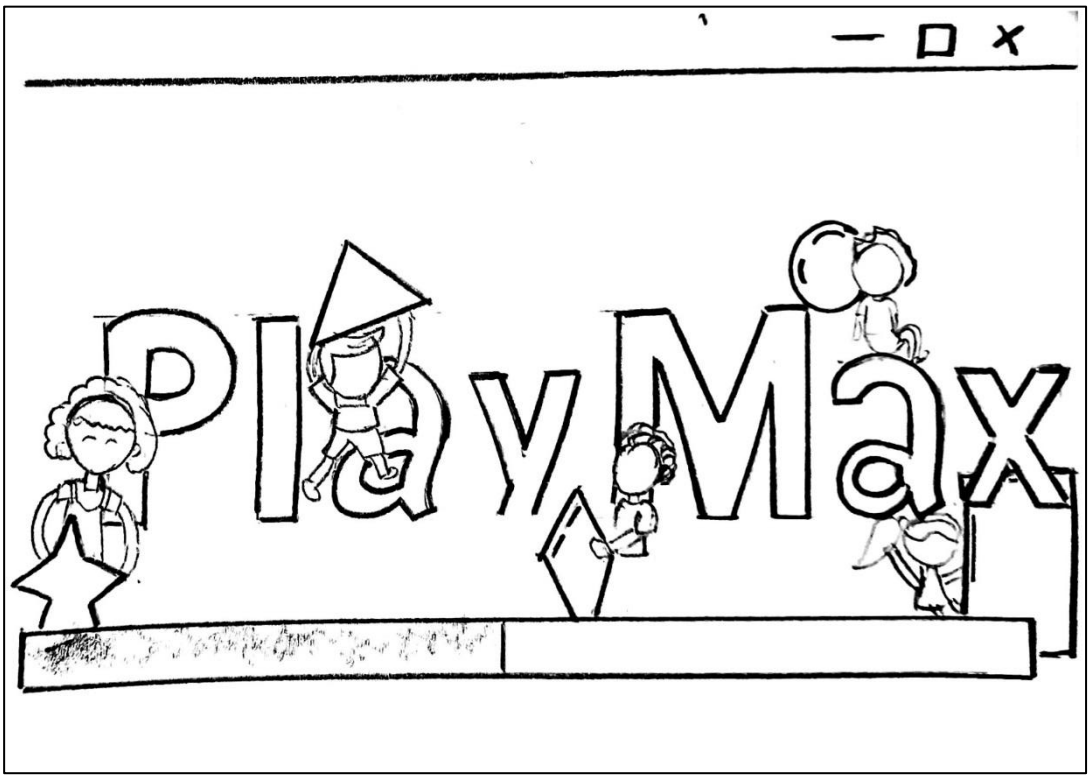

Figure 7 – Wireframe UI 1

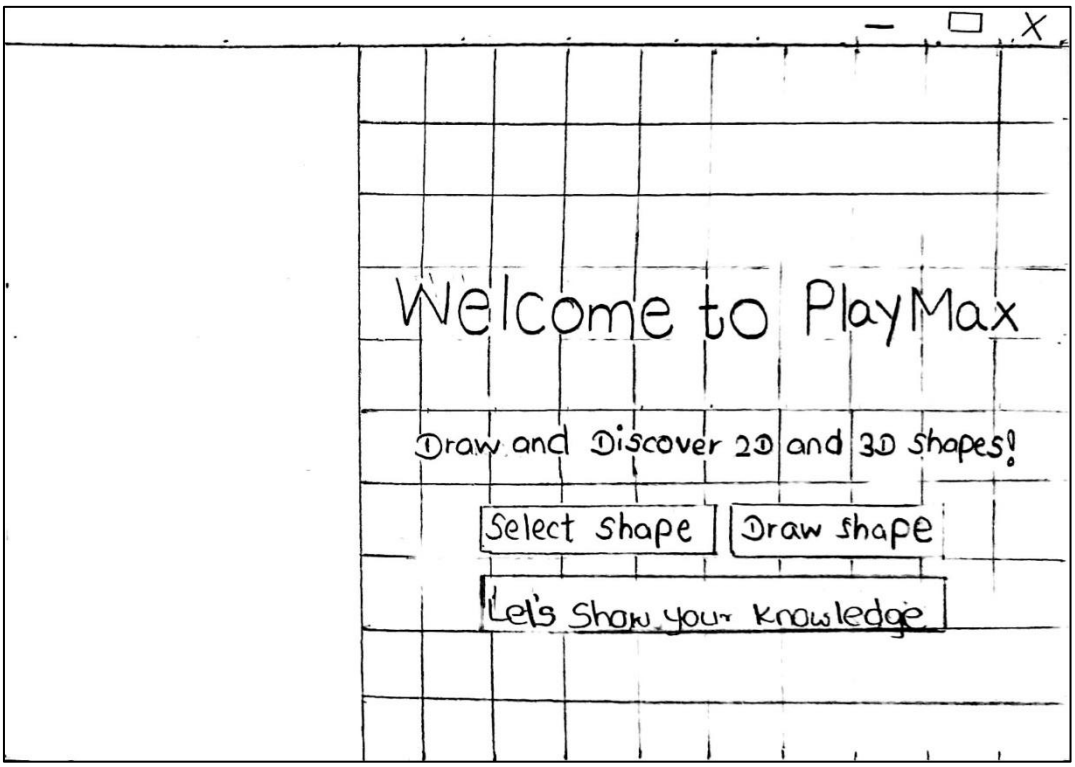

Figure 8 - Wireframe UI 2

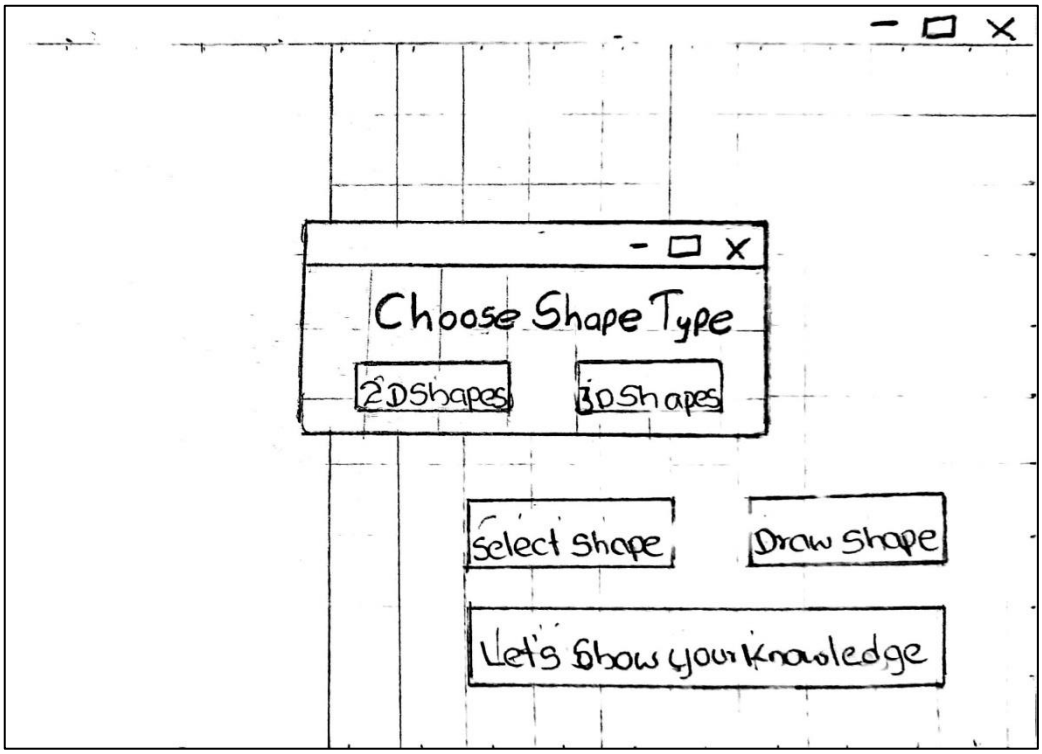

Figure 9 - Wireframe UI 3

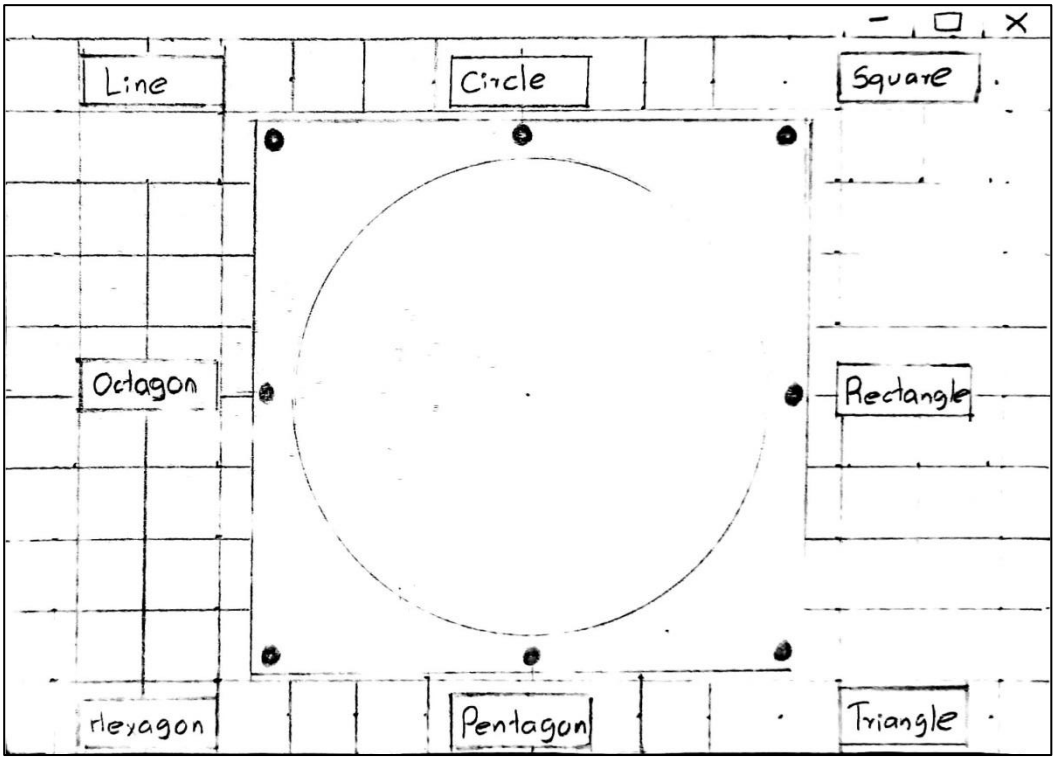

Figure 10 - Wireframe UI 4

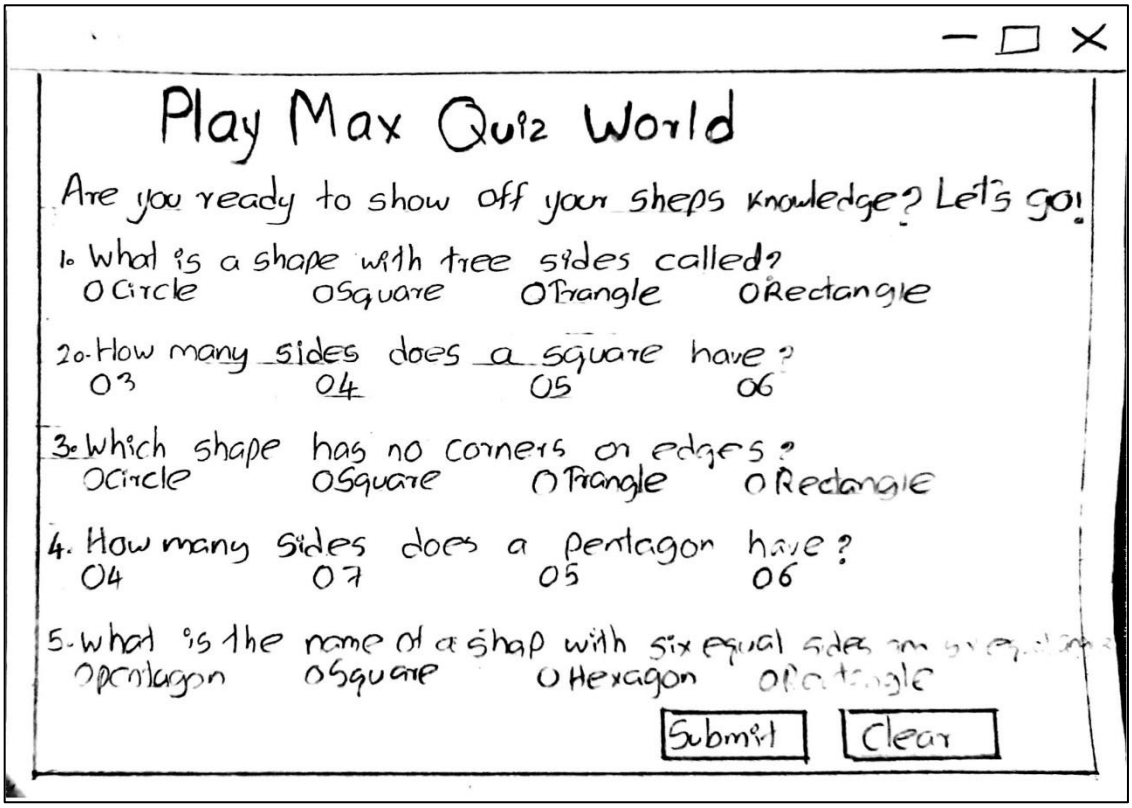

Figure 12 - Wireframe UI 5

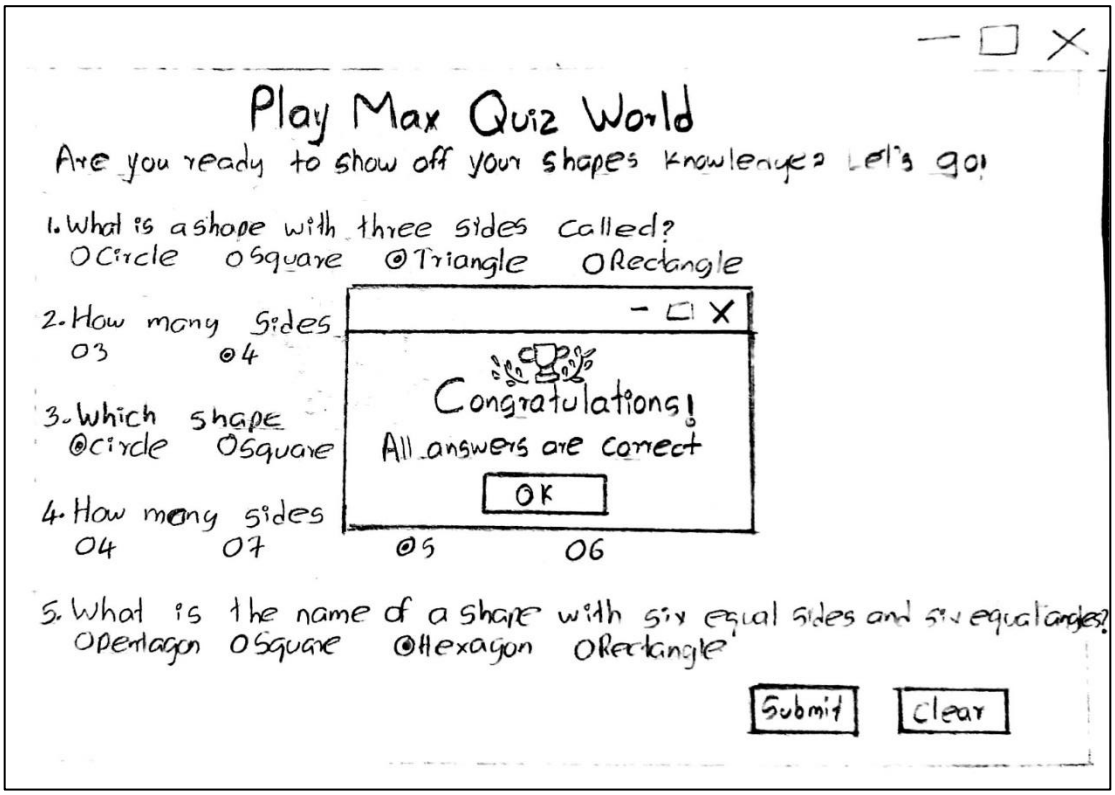

Figure 11 - Wireframe UI 6

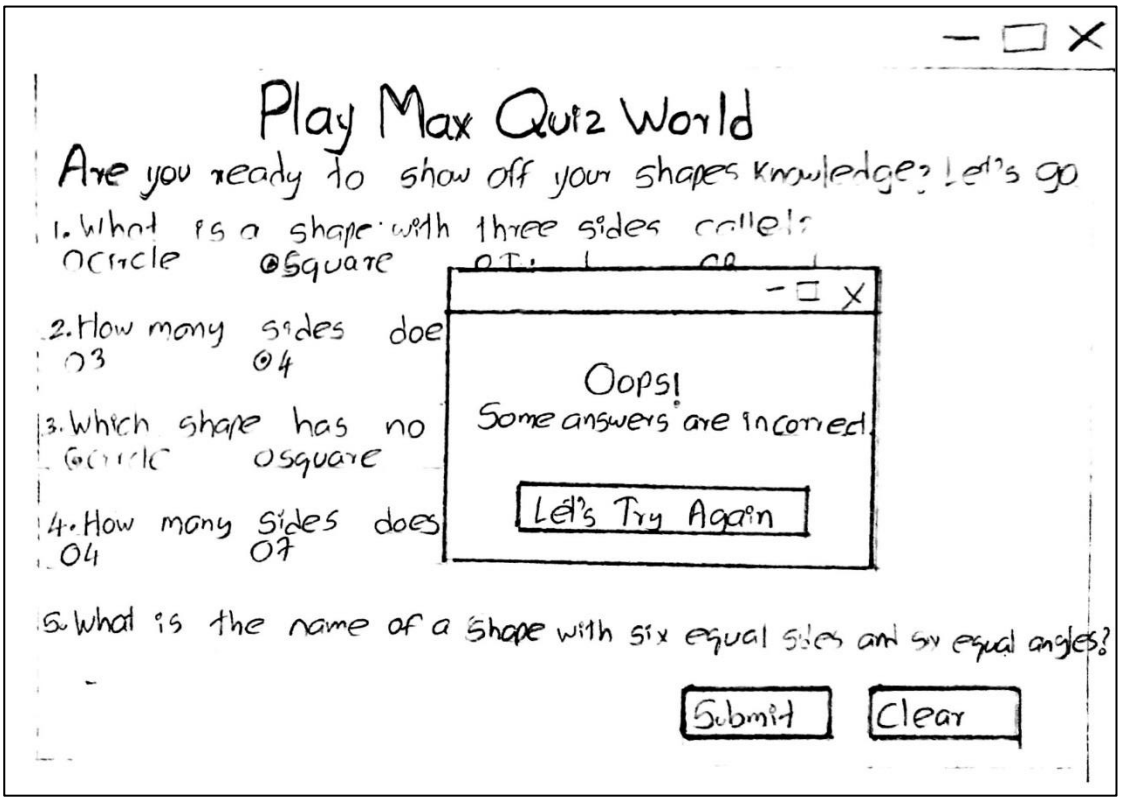

Figure 14 - Wireframe UI 7

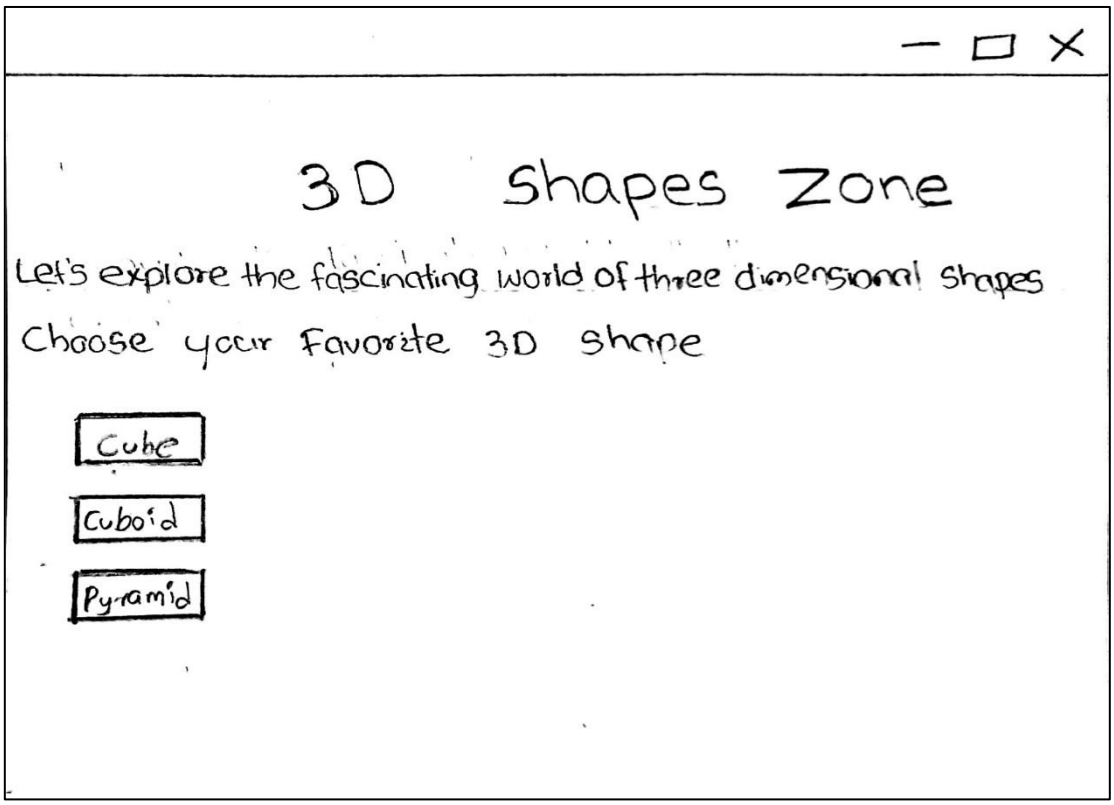

Figure 13 - Wireframe UI 8

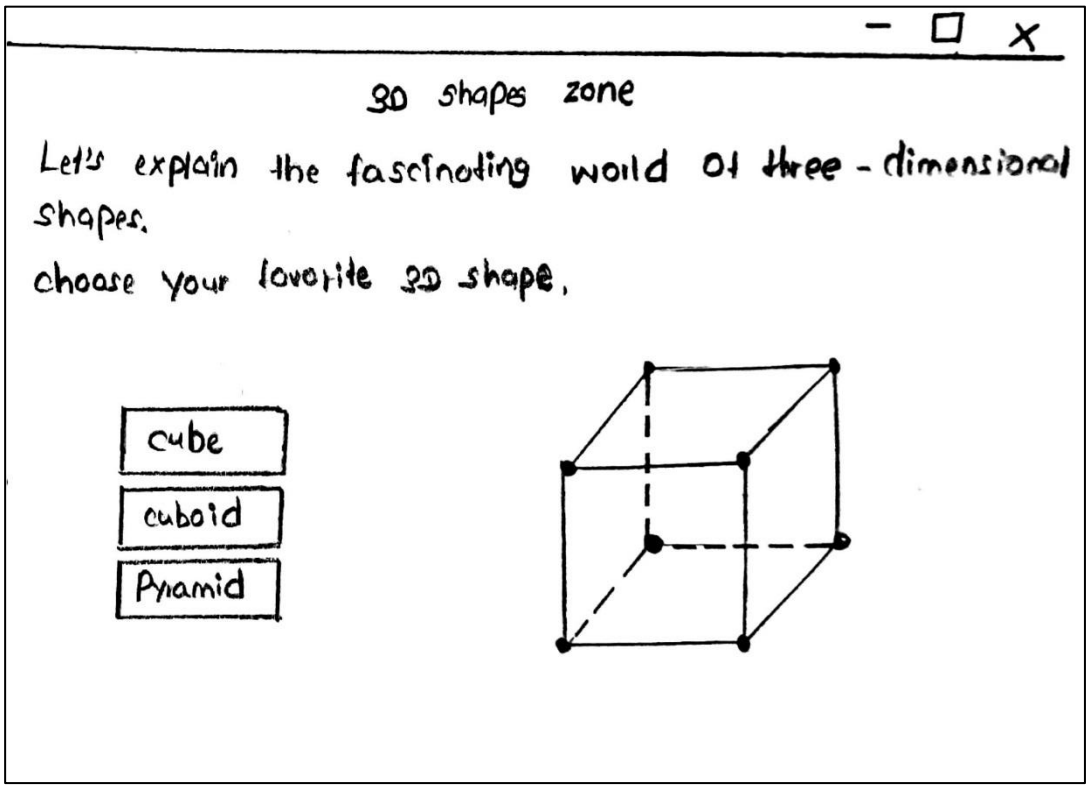

Figure 16 - Wireframe UI 9

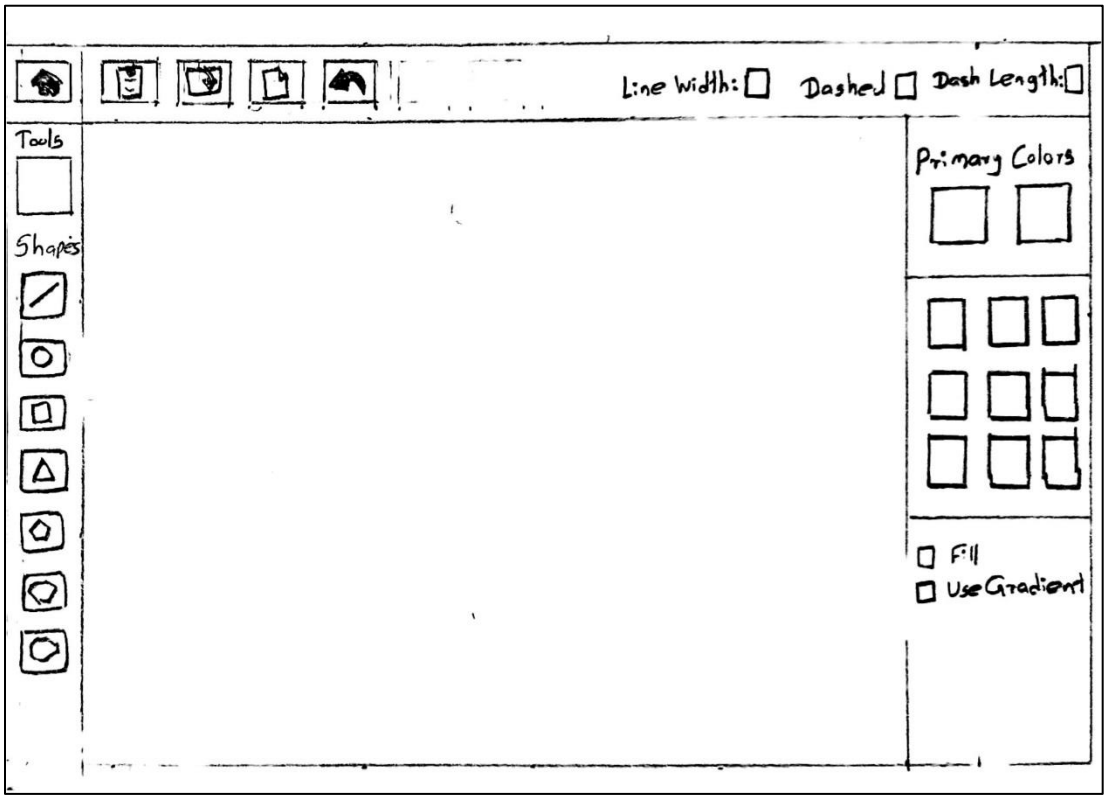

Figure 15 - Wireframe UI 10

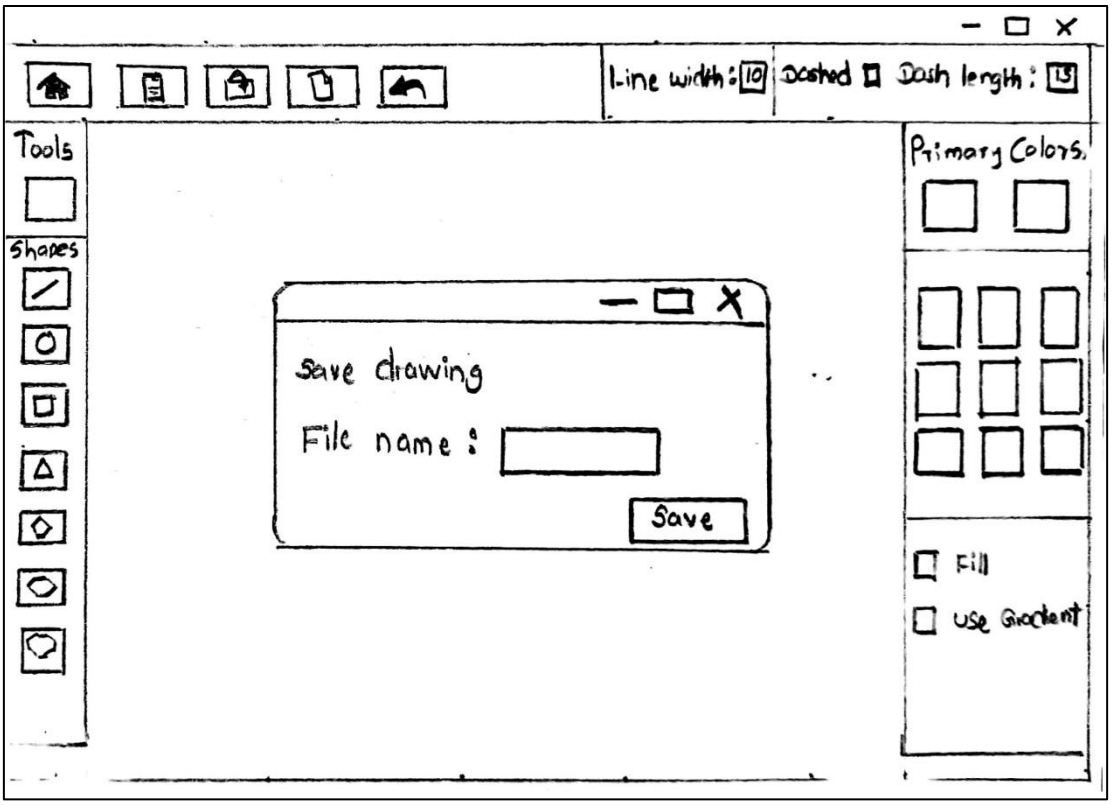

Figure 18 - Wireframe UI 11

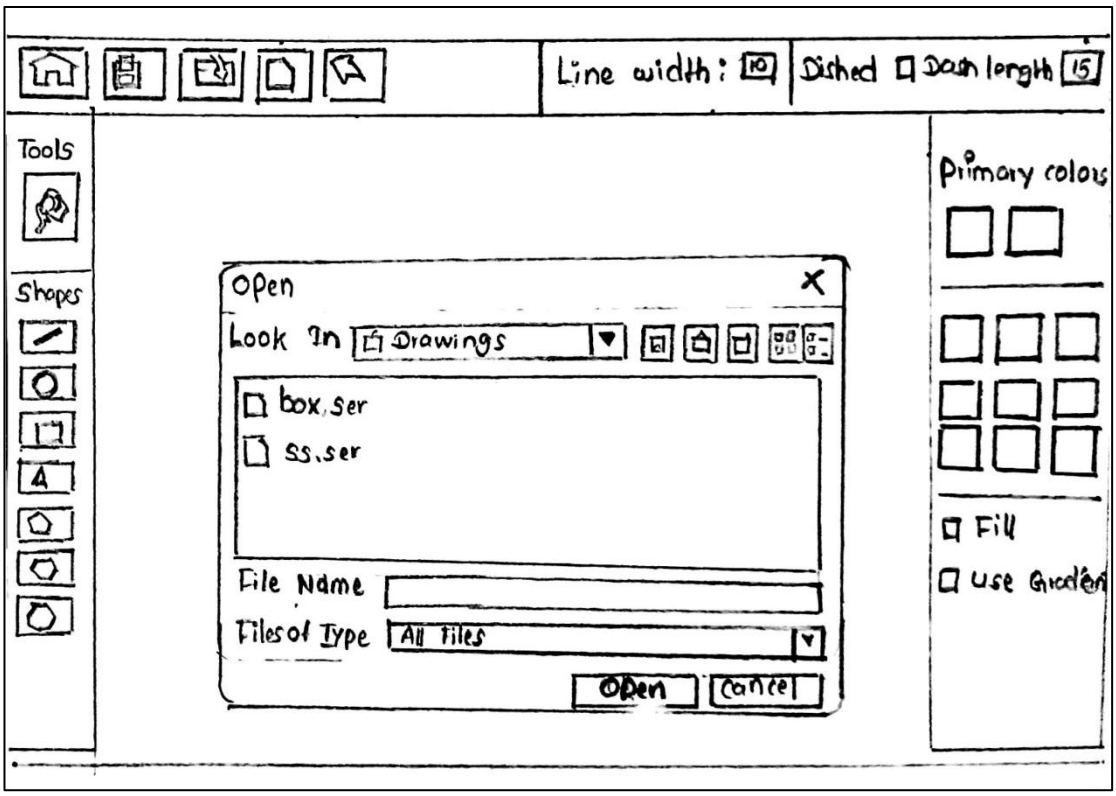

Figure 17 - Wireframe UI 12

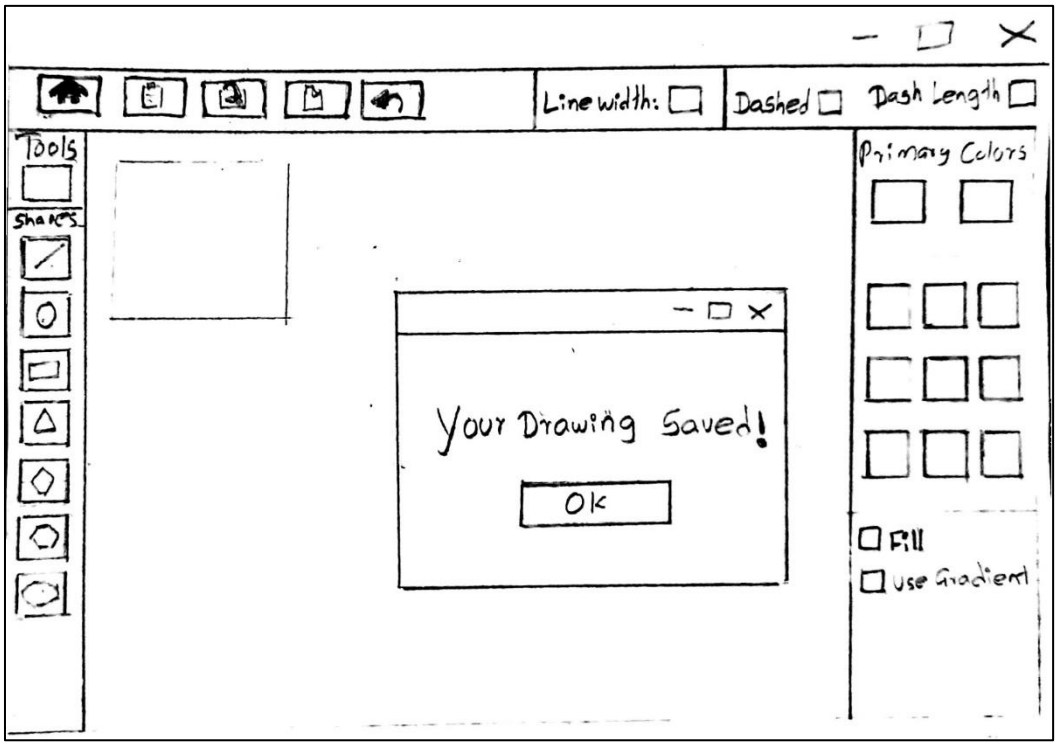

Figure 19 - Wireframe UI 13

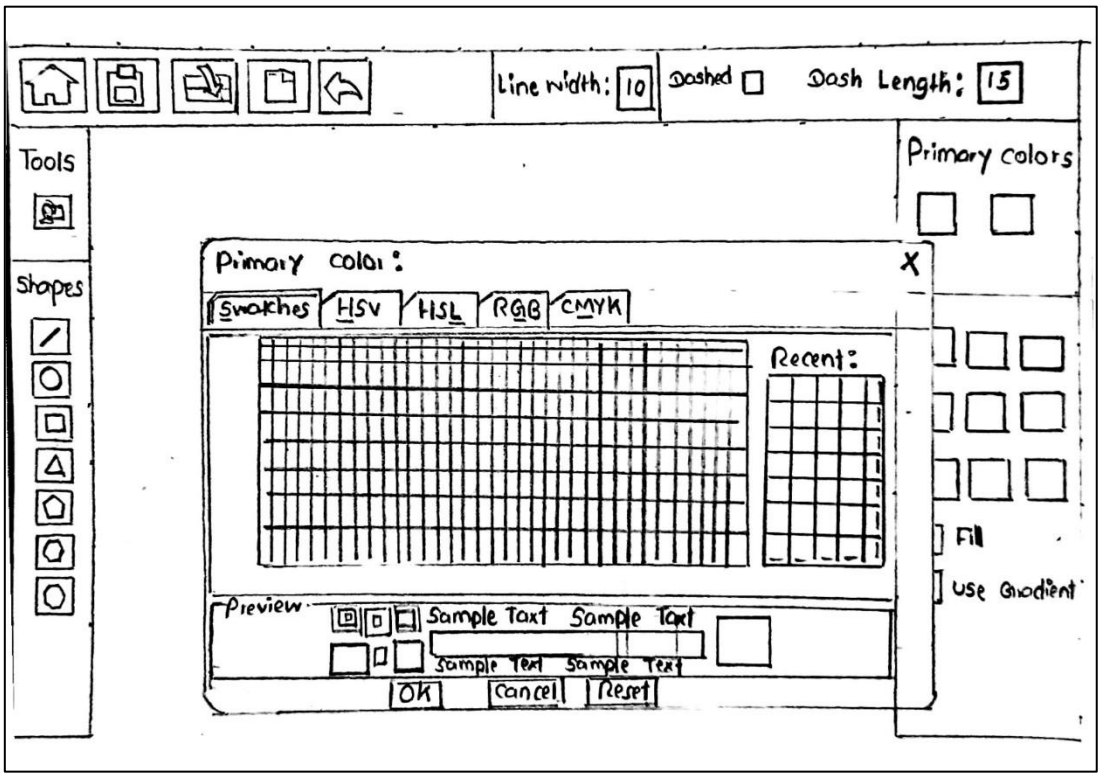

Figure 20 - Wireframe UI 14

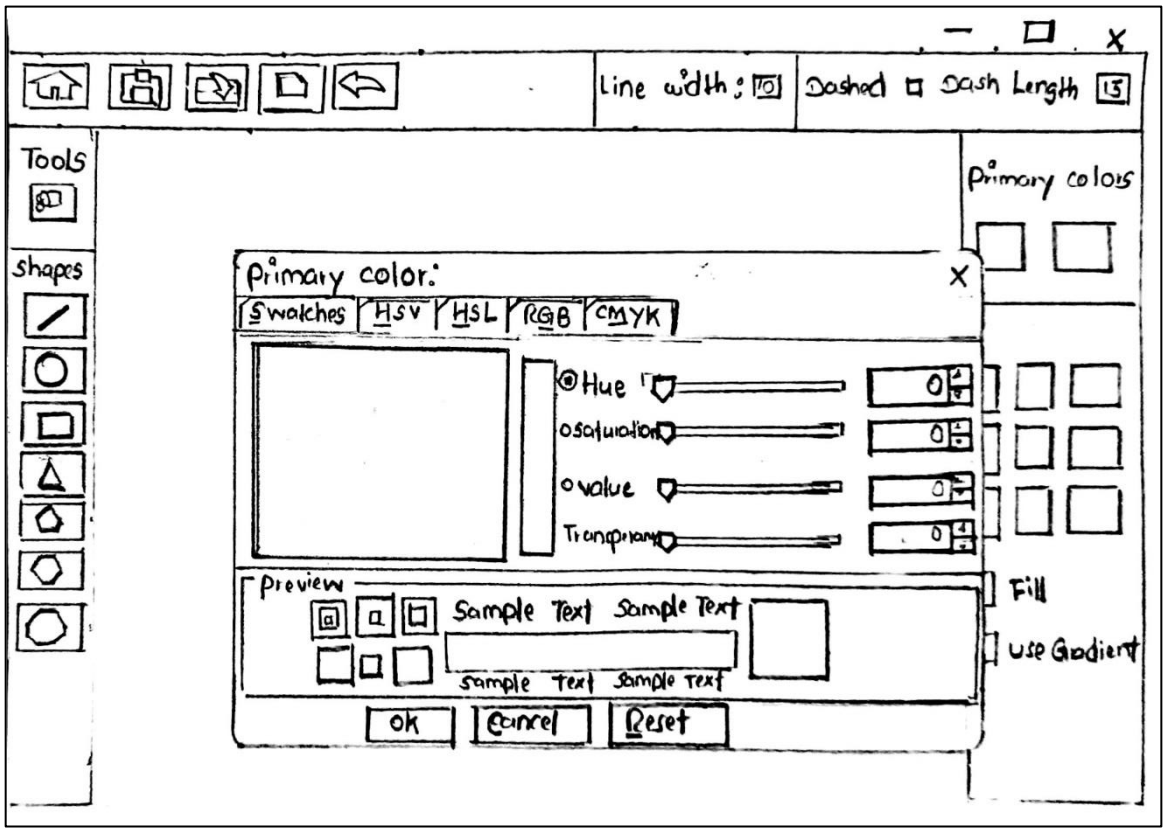

Figure 21 - Wireframe UI 15

High-Fidelity Prototype

The high-fidelity prototype design was based on the feedback provided by the user for the questionnaire form. Also, Figma, (https://www.figma.com) which is an advanced and interactive software, was used for this purpose. This allows the user to get a realistic and immersive user experience.

Figma Link -
https://www.figma.com/file/FrXcZDWcPLQx3HPiFvBZSD/PlayMax?type=design&node-id=0%3A1&t=TuSk85tA0BS9lfMs-1

There are several assumptions based on this. This was done before committing to implementing the application.

- By accessing the desktop application, the child can engage in all activities under parent or guardian.
- Only one user can access the system at a time.
- Shapes can be drawn many times and they can be saved with different names.
- Files can be saved according to the **".ser"** format.

Implementation

1. Main Class - PlayMax

The entry point to our application is the PlayMax class, which is responsible for initializing and launching the application. Here is a snippet of the code:

```
package com.playmax.main;

public class PlayMax {

    public static void main(String[] args) {
        java.awt.EventQueue.invokeLater(new Runnable() {
            public void run() {
                new Loading().setVisible(true);
            }
        });
    }

}
```

Figure 22 - Main Class Code

The **main** method is the entry point of the Java application. It instructs us to run a new instance of our **Loading** class, which brings up the loading screen of the application.

GitHub Link: https://github.com/Plymouth-University/main-coursework-playmax/blob/main/src/com/playmax/main/PlayMax.java

2. Loading Class

The Loading class is a **JFrame** that runs a separate thread to create a visual loading indicator for our application. This creates a pleasing user experience, as it gives the impression of the application 'starting up'. Here is the core code:

```
public class Loading extends javax.swing.JFrame implements Runnable {

    public Loading() {
        initComponents();
        String logoPath = "AppIcon/logo.png";
        try {
            Image logoImage = ImageIO.read(new File(logoPath));
            ImageIcon icon = new ImageIcon(logoImage);
            this.setIconImage(icon.getImage());
        } catch (IOException e) {
            e.printStackTrace();
        }
        Thread t = new Thread(this);
        t.start();
    }

    @Override
    public void run() {
        for (int i = 1; i <= 100; i++) {
            try {
                Thread.sleep(40);
            } catch (Exception e) {
            }
                        lblProgress.setText(i+"%");

            progress.setValue(i);
        }
        new Main().setVisible(true);
        dispose();
    }
```

Figure 23 – Loading Class Code

This class extends **javax.swing.JFrame** and implements **Runnable** so that we can use it to create a new thread. Upon instantiation of the **Loading** object, the constructor initializes the GUI components with the **initComponents()** method, and then creates a new thread with the **Loading** object itself as the target.

GitHub Link: https://github.com/Plymouth-University/main-coursework-playmax/blob/main/src/com/playmax/main/Loading.java

3. Main Class

The Main class is the starting point for our application. It is a **JFrame** that contains the core navigation buttons to interact with the app. Here's the core code:

```
public class Main extends javax.swing.JFrame {

    public static Map<String, Object> shape2D_Details = new HashMap<String, Object>();

    public Main() {
        initComponents();
        setLocationRelativeTo(null);
       String logoPath = "AppIcon/logo.png";
        try {
            Image logoImage = ImageIO.read(new File(logoPath));
            ImageIcon icon = new ImageIcon(logoImage);
            this.setIconImage(icon.getImage());
        } catch (IOException e) {
            e.printStackTrace();
        }
        jLabel2.requestFocus();

    }
```

Figure 24 - Main Class Code

GitHub Link: https://github.com/Plymouth-University/main-coursework-playmax/blob/main/src/com/playmax/main/Main.java

4. Quiz Class

The Quiz class is another JFrame which contains the code to execute the quiz feature of the application. Here's the core code:

```
public class Quiz extends javax.swing.JFrame {
    String ans1;
    String ans2;
    String ans3;
    String ans4;
    String ans5;

    public Quiz() {
        initComponents();
        setLocationRelativeTo(null);
        String logoPath = "AppIcon/logo.png";
        try {
            Image logoImage = ImageIO.read(new File(logoPath));
            ImageIcon icon = new ImageIcon(logoImage);
            this.setIconImage(icon.getImage());
        } catch (IOException e) {
            e.printStackTrace();
        }


    }
```

Figure 25 - Quiz Class Code

5. Algorithm Package

The Algorithm package in the PlayMax application contains all the algorithms and mathematical functions required for the graphics operations in the app. Here's the overview of the **Algorithm** class:

```
public class Algorithm {

    public static void drawLineDDA(Graphics2D g, int x1, int y1, int x2, int y2, int width) {
        int dx = x2 - x1;
        int dy = y2 - y1;
        int steps = Math.max(Math.abs(dx), Math.abs(dy));
        float xIncrement = (float) dx / (float) steps;
        float yIncrement = (float) dy / (float) steps;
        float x = x1;
        float y = y1;

        g.setStroke(new BasicStroke(width));

        for (int i = 0; i <= steps; i++) {
            g.drawLine(Math.round(x), Math.round(y), Math.round(x), Math.round(y));
            x += xIncrement;
            y += yIncrement;
        }
    }
```

Figure 26 - Algorithm Package

This class provides methods for drawing different shapes (lines, circles, squares) and filling shapes with color (flood fill algorithm). It also provides a method for converting measurements from centimeters to pixels, which is likely used to ensure the shapes drawn match the physical size desired.

The flood fill algorithm is used to fill an area with a particular color. It starts from a seed point and extends in all directions (up, down, left, right) to fill the area with the target color.

GitHub Link: https://github.com/Plymouth-University/main-coursework-playmax/blob/main/src/com/playmax/algorithm/Algorithm.java

6. Dimension Class

This class takes **shapeType** as a constructor argument. It creates an instance of this class and passes the type of shape as a string argument. In the **initComponents()** method, you differentiate between the shape types and initialize components accordingly.

```
public class Dimension extends javax.swing.JFrame {

    private String shapeType;

    public Dimension(String shapeType) {
        this.shapeType = shapeType;
        initComponents();
        setLocationRelativeTo(null);
        String logoPath = "AppIcon/logo.png";
        try {
            Image logoImage = ImageIO.read(new File(logoPath));
            ImageIcon icon = new ImageIcon(logoImage);
            this.setIconImage(icon.getImage());
        } catch (IOException e) {
            e.printStackTrace();
        }
    }

    private void initComponents() {
        // Code for initializing components
        // It could be different based on `shapeType`
        if (shapeType.equals("Circle")) {
            // code for initializing Circle related components
        } else if (shapeType.equals("Hexagon")) {
            // code for initializing Hexagon related components
        }
        // ... continue with the other shapes
    }

    // ... Rest of your code ...
}
```

Figure 27 - Dimension Class Code

GitHub Link: https://github.com/Plymouth-University/main-coursework-playmax/tree/main/src/com/playmax/dimensions

7. 2D Shape

In the PlayMax application, the **com.playmax.shape2d** package is responsible for handling the 2D shapes available to the users. This package contains several classes that represent different shapes. Let's explore a few of them:

- **Circle**: The **Circle** class represents a circle shape. It has attributes such as **firstColor**, **secondColor**, and **lineWidth**. The implementation of the circle shape can be found in the Circle.java file.
- **Square**: The **Square** class represents a square shape. It has attributes like **fill**, **gradient**, and **lineLength**. The implementation of the square shape can be found in the Square.java file.
- **Triangle**: The **Triangle** class represents a triangle shape. It has attributes such as **startingPosition**, **endPosition**, and **dashed**. The implementation of the triangle shape can be found in the Triangle.java file.

8. 3D Shape

The **Shape3D** class in the **com.playmax.shape3d** package provides an abstract representation of 3D shapes in the PlayMax application. The **Shape3D** class is designed as an abstract class to be extended by concrete shape classes such as **Cube**, **Cylinder**, and **Sphere**. These concrete shape classes will provide the implementation for the **drawDifferentShapes()** method according to their specific shape requirements.

GitHub Link: https://github.com/Plymouth-University/main-coursework-playmax/blob/main/src/com/playmax/shape3d/Shape3D.java

Development Application Screenshots

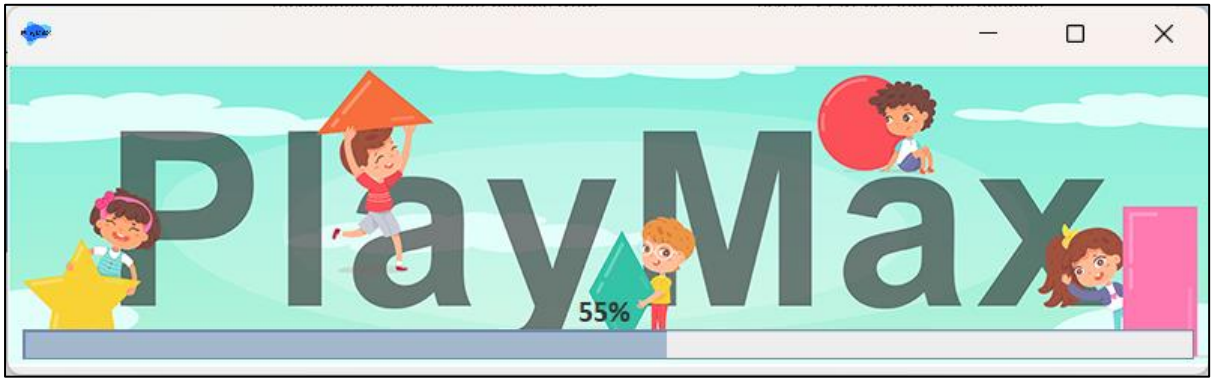

Figure 28 - Loading UI

Figure 29 - Home UI

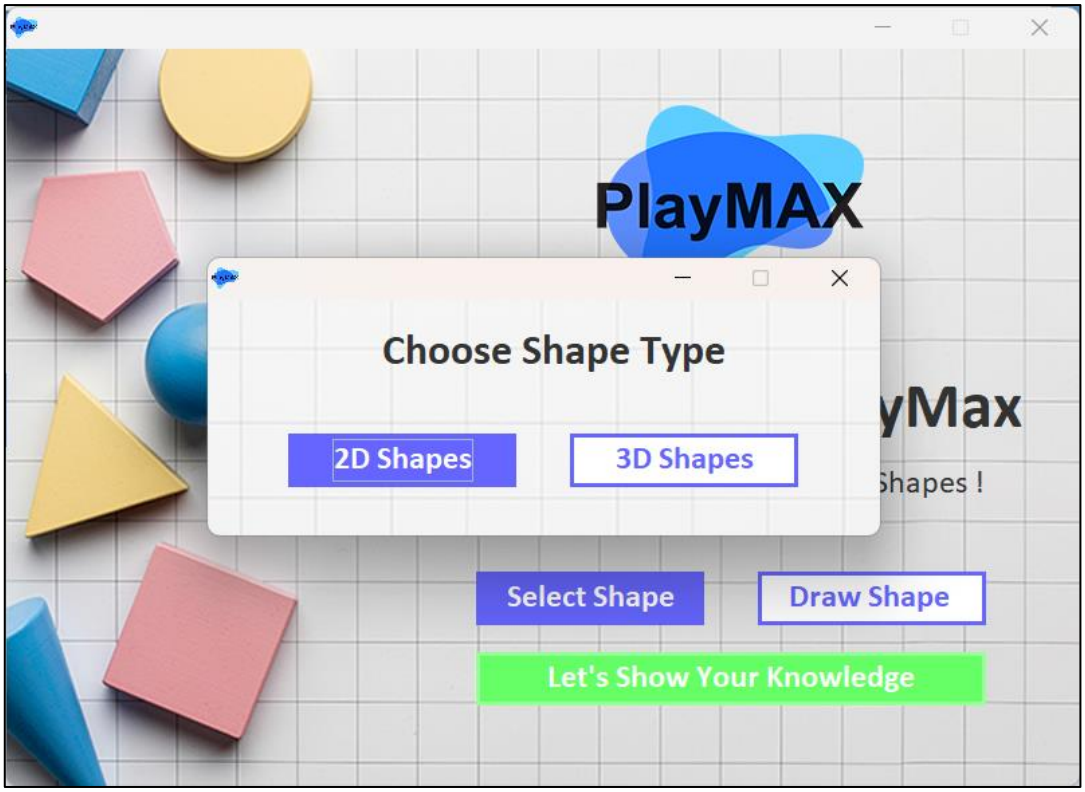

Figure 30 - Selecting Shpe Type UI

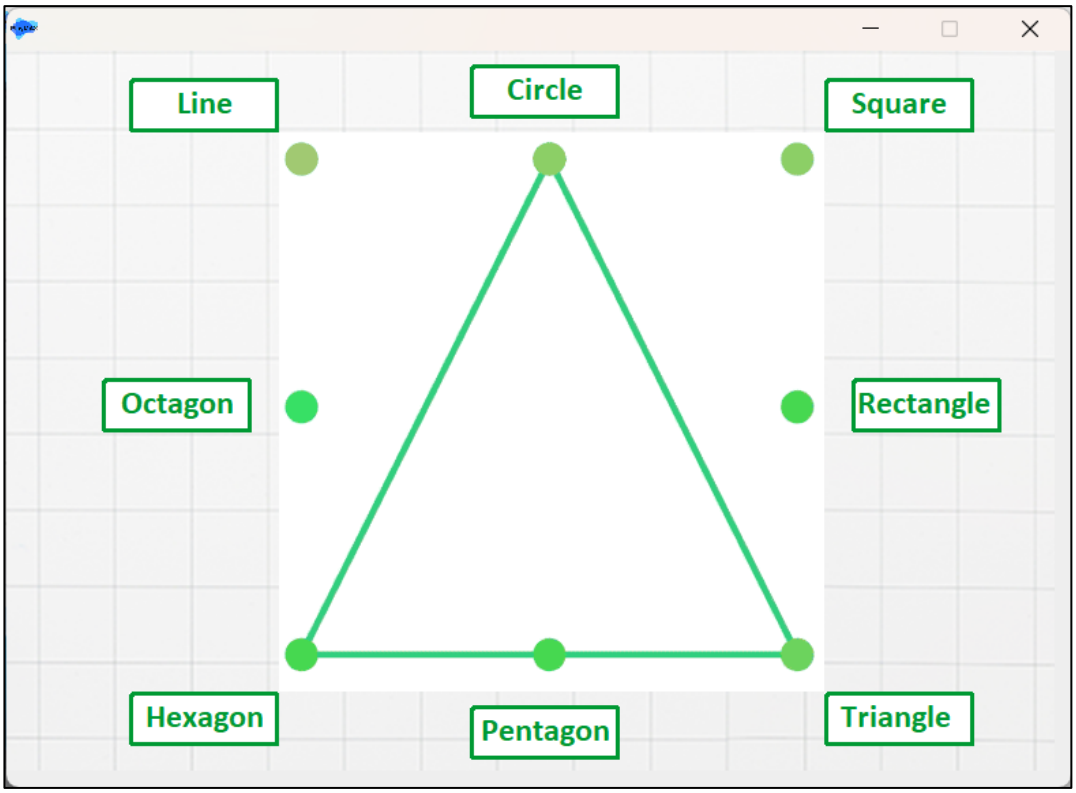

Figure 31 - Drawing 2D Shapes UI

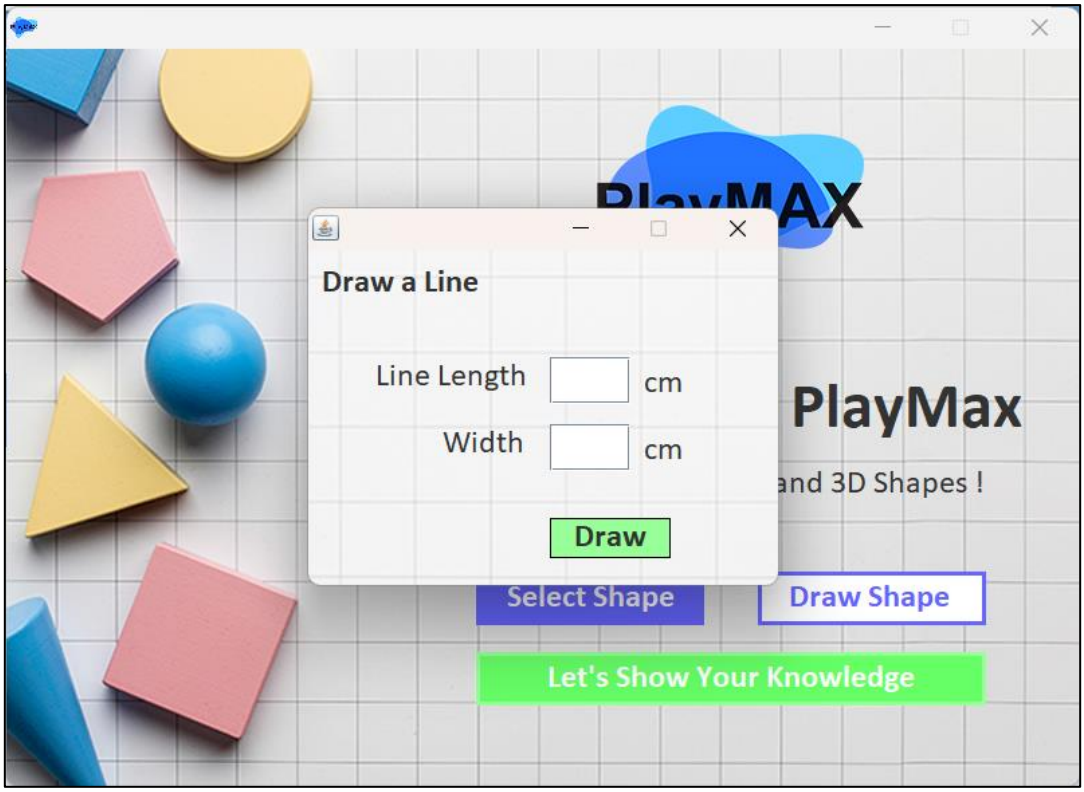

Figure 33 - Draw Line Interface

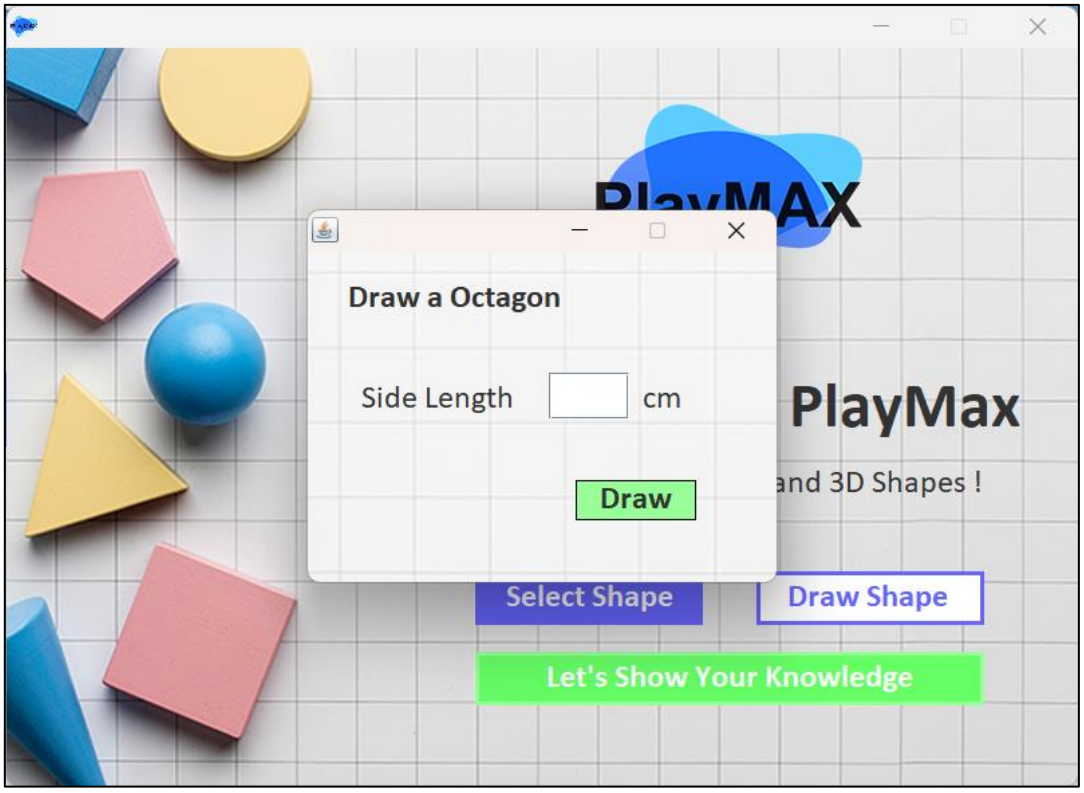

Figure 32 - Draw Octagon Interface

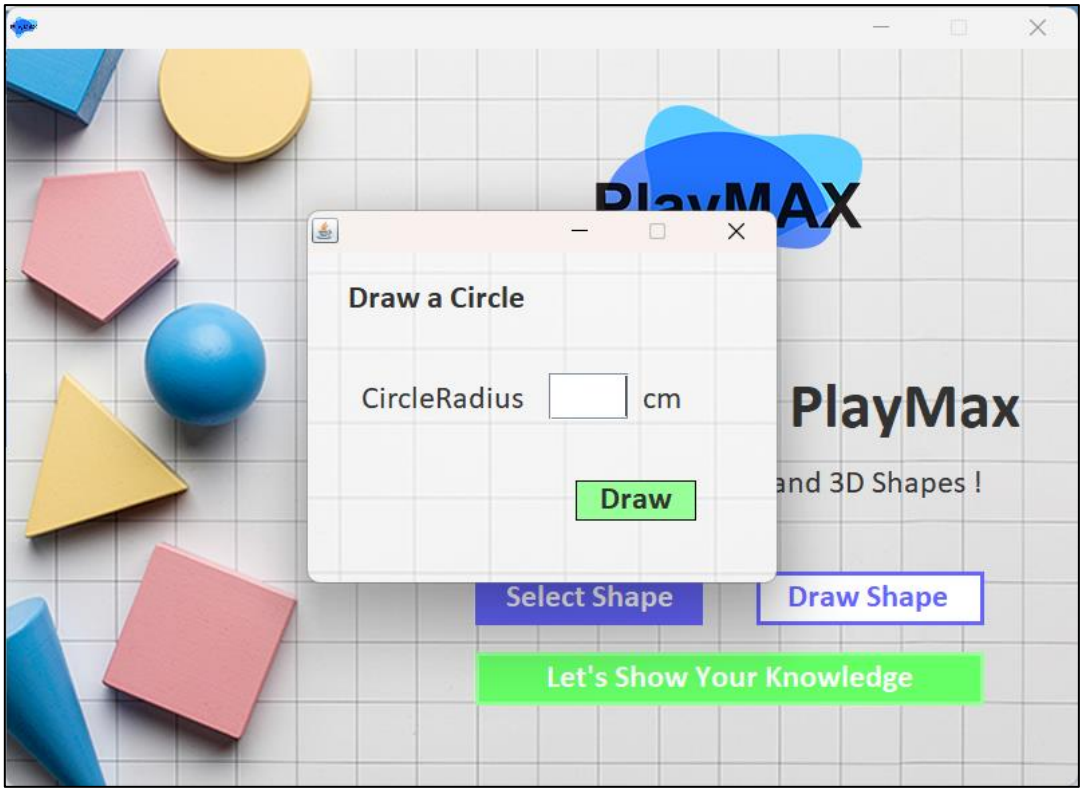

Figure 35 - Draw Circle Interface

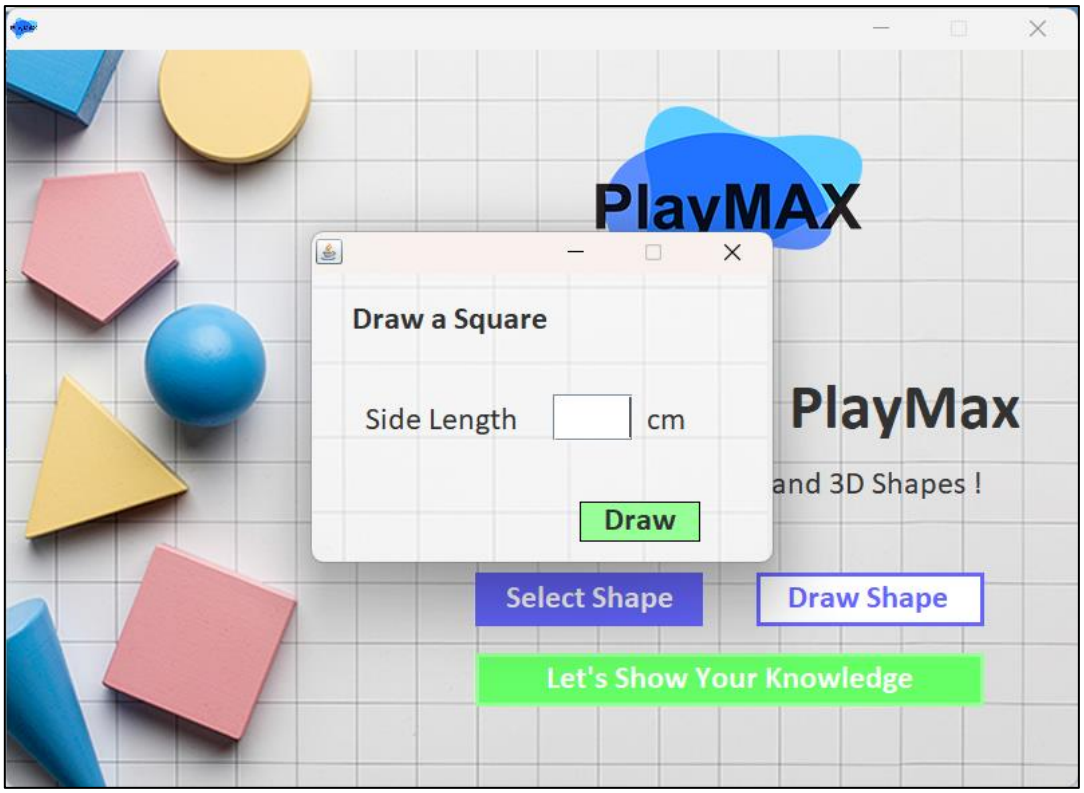

Figure 34 - Draw Square Interface

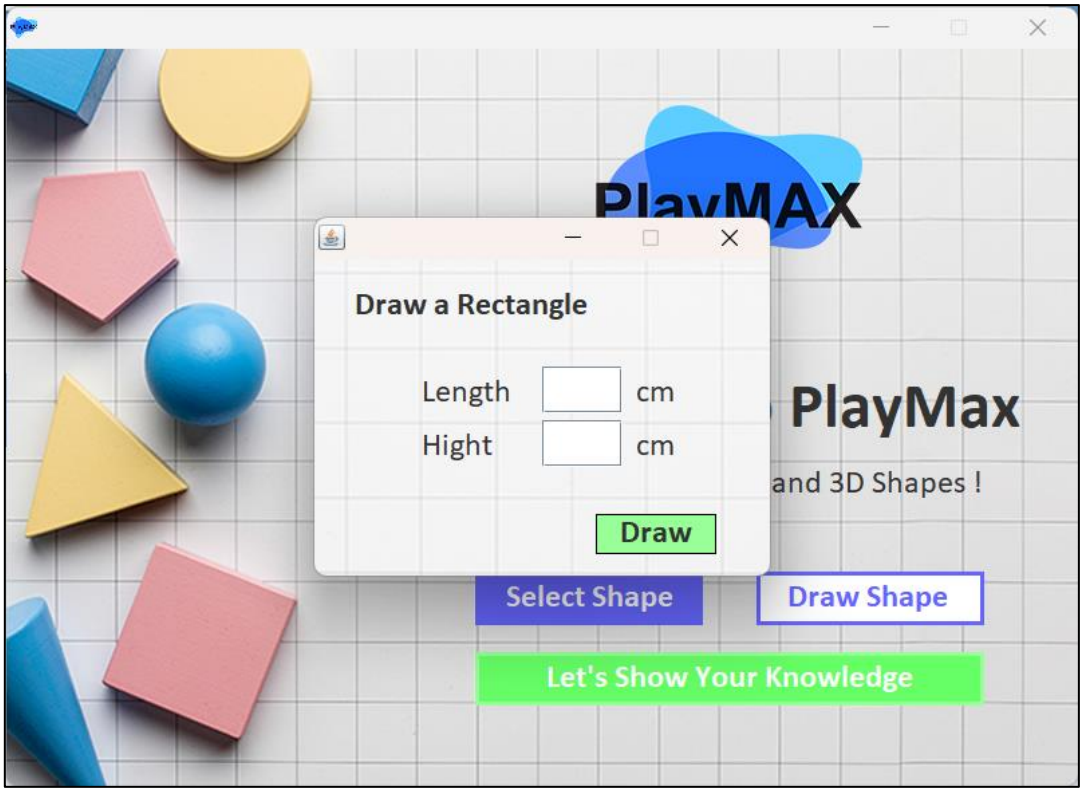

Figure 37 - Draw Rectangle Interface

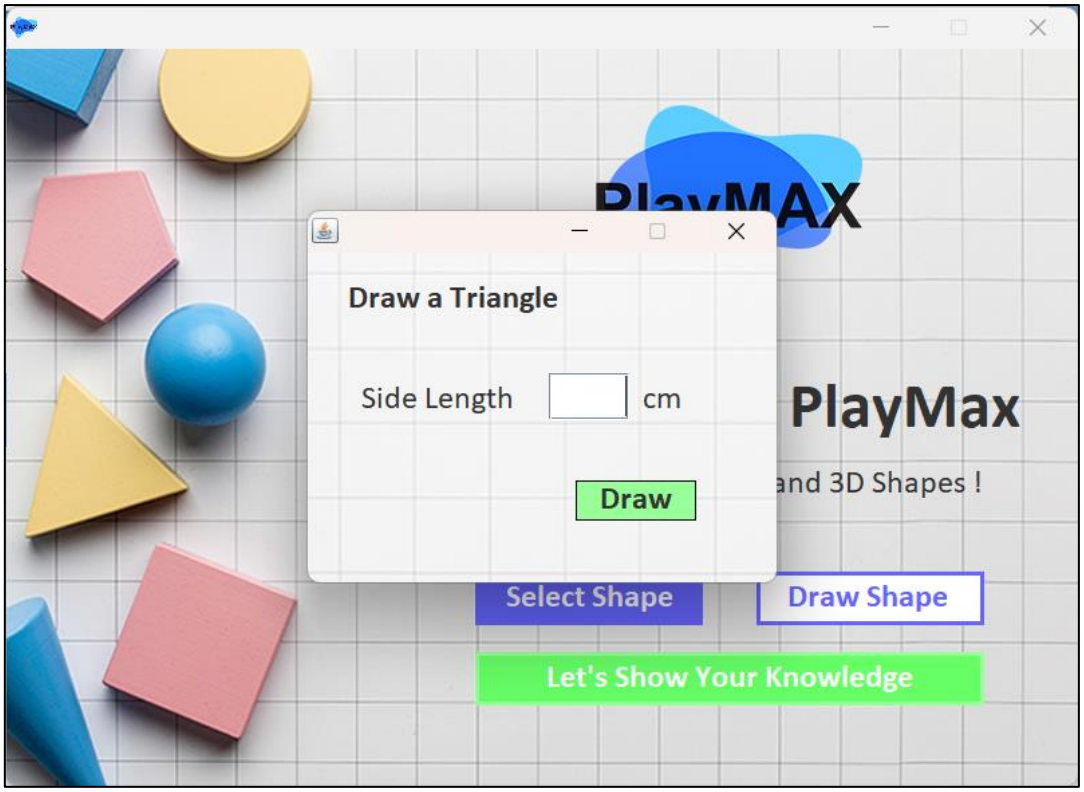

Figure 36 - Draw Triangle Interface

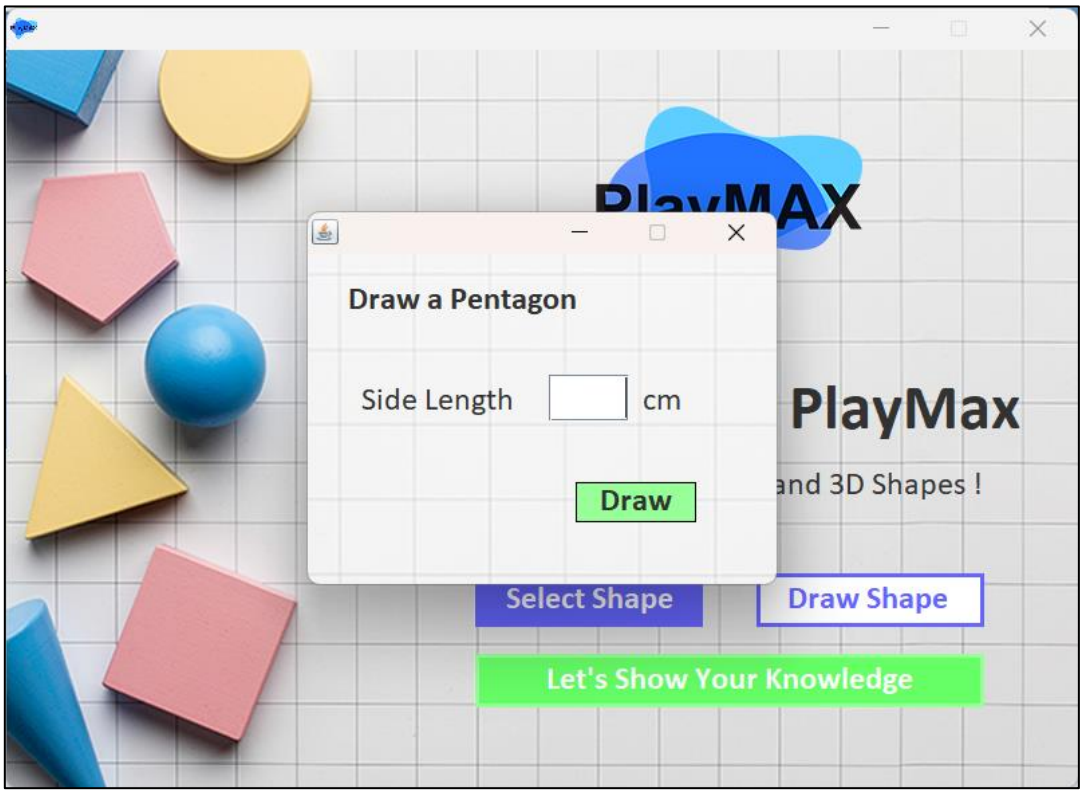

Figure 38 - Draw Pentagon Interface

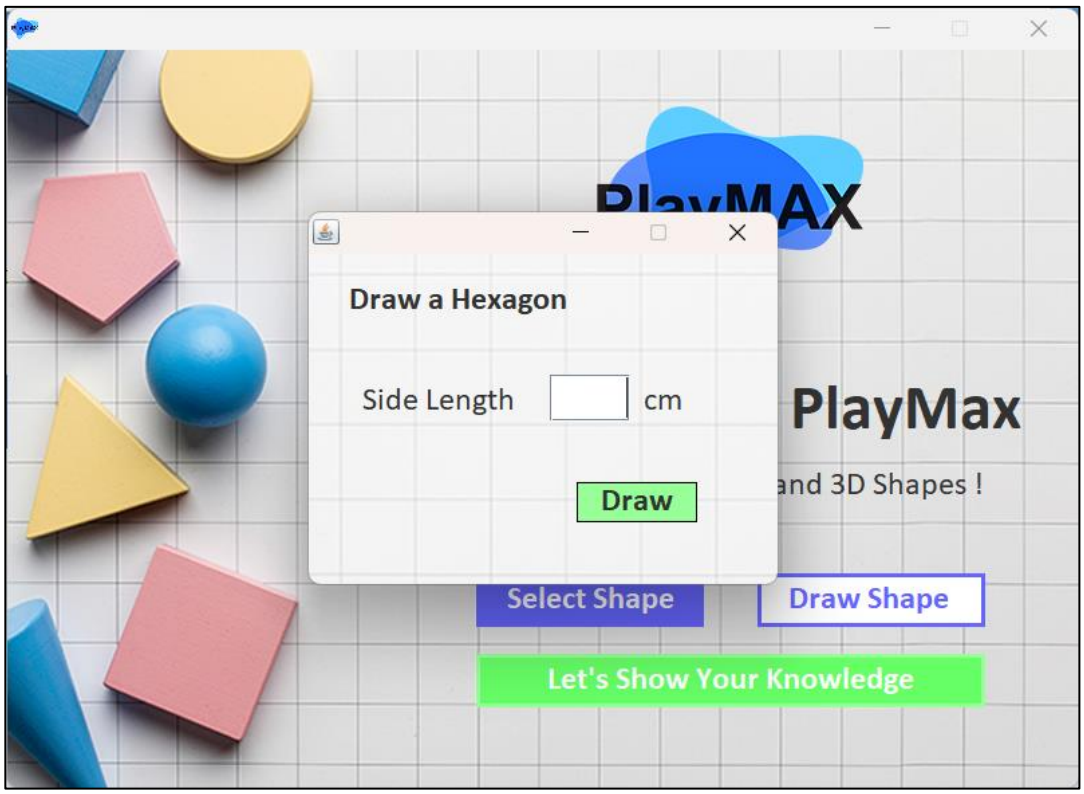

Figure 39 - Draw Hexagon Interface

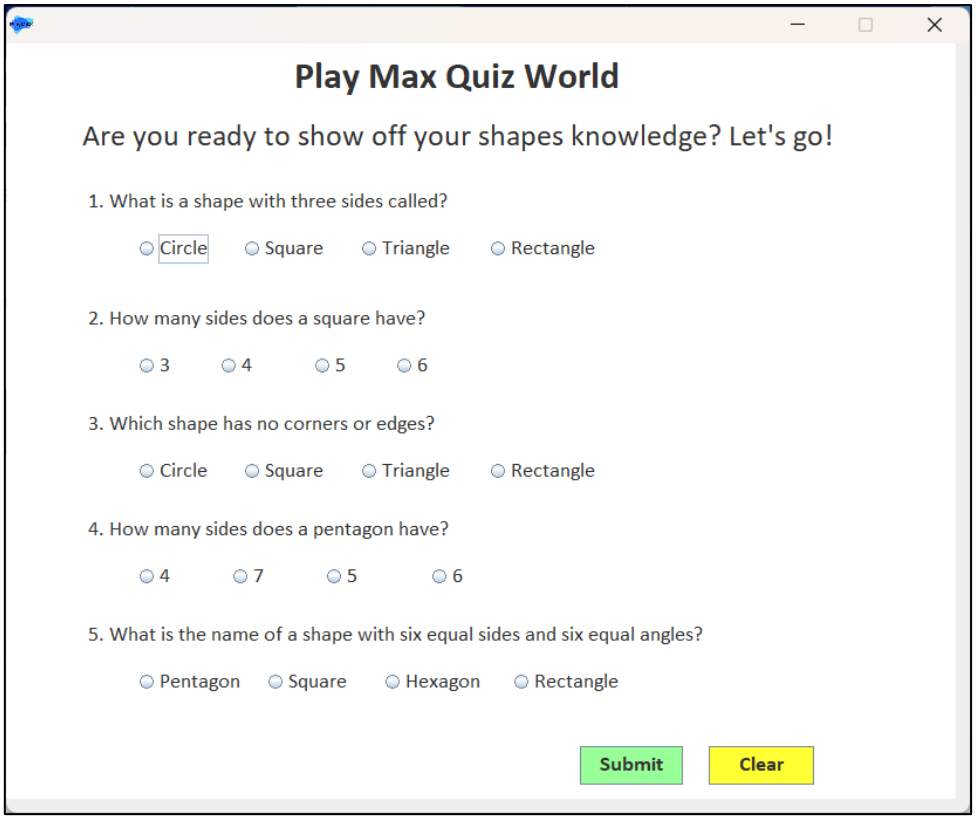

Figure 40 - Quiz Interface

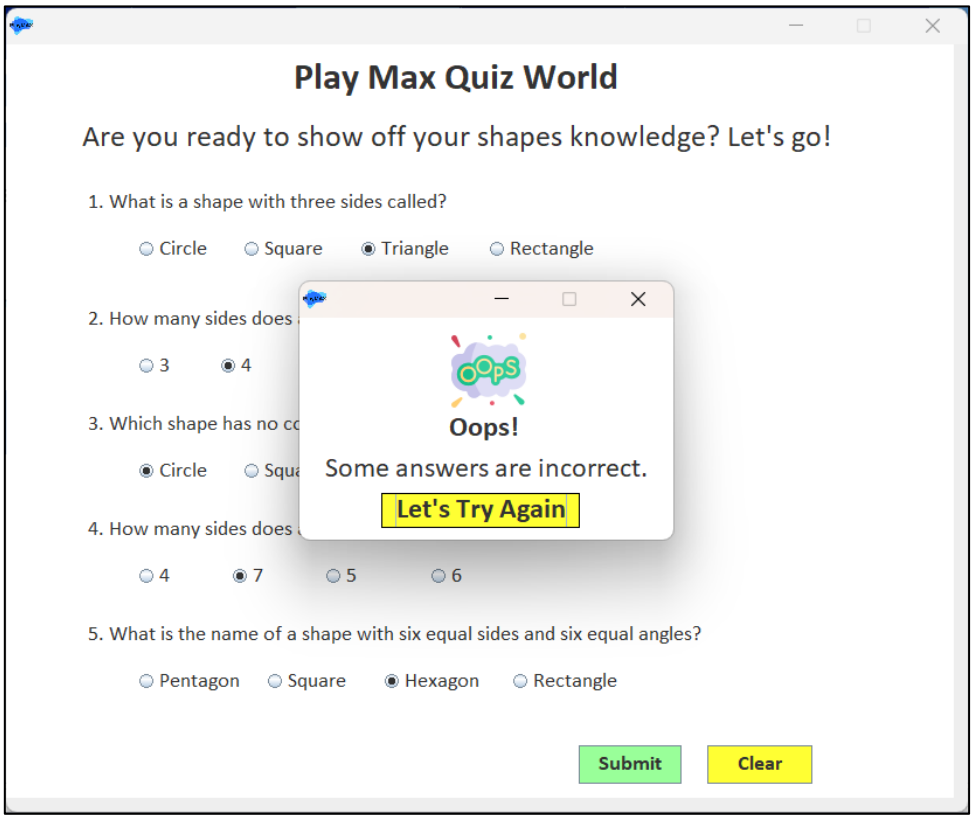

Figure 41 - Quiz Pop up "Let's Try Again"

Figure 43 - Quiz Pop up "Congratulations!"

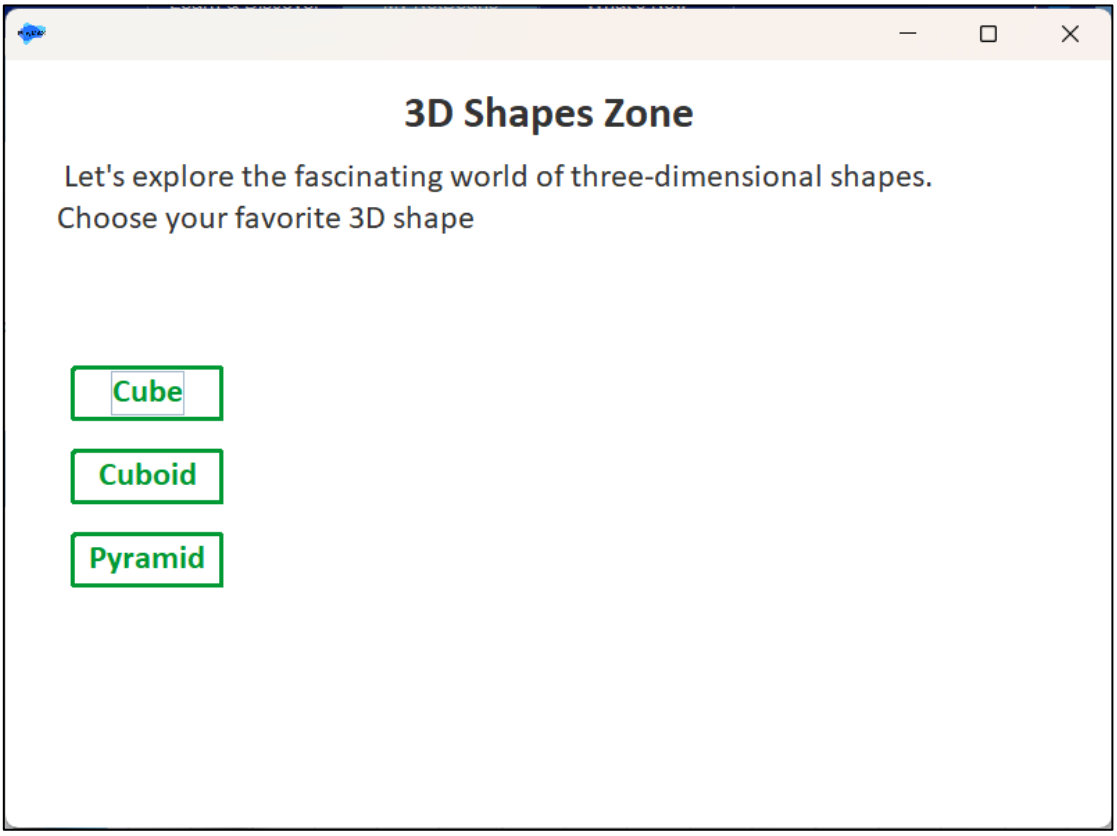

Figure 42 - 3D Shapes UI

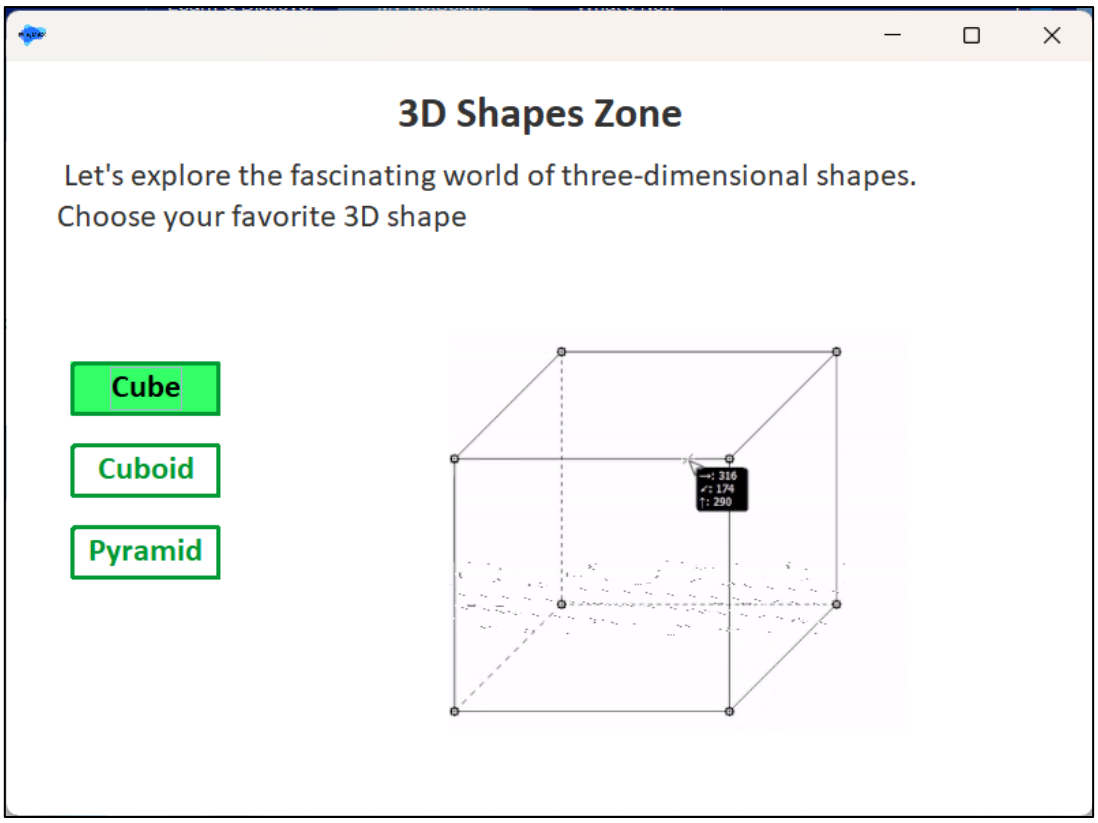

Figure 45 - 3D Shape Cube

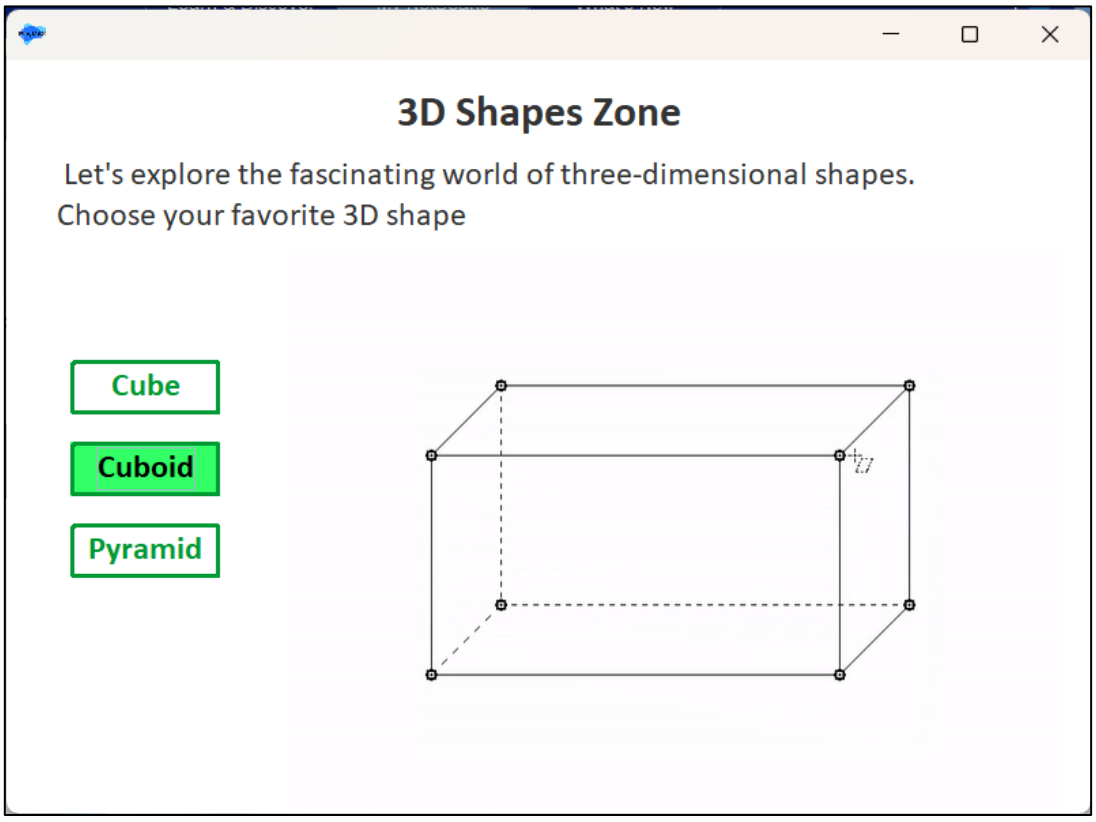

Figure 44 - 3D Shape Cuboid

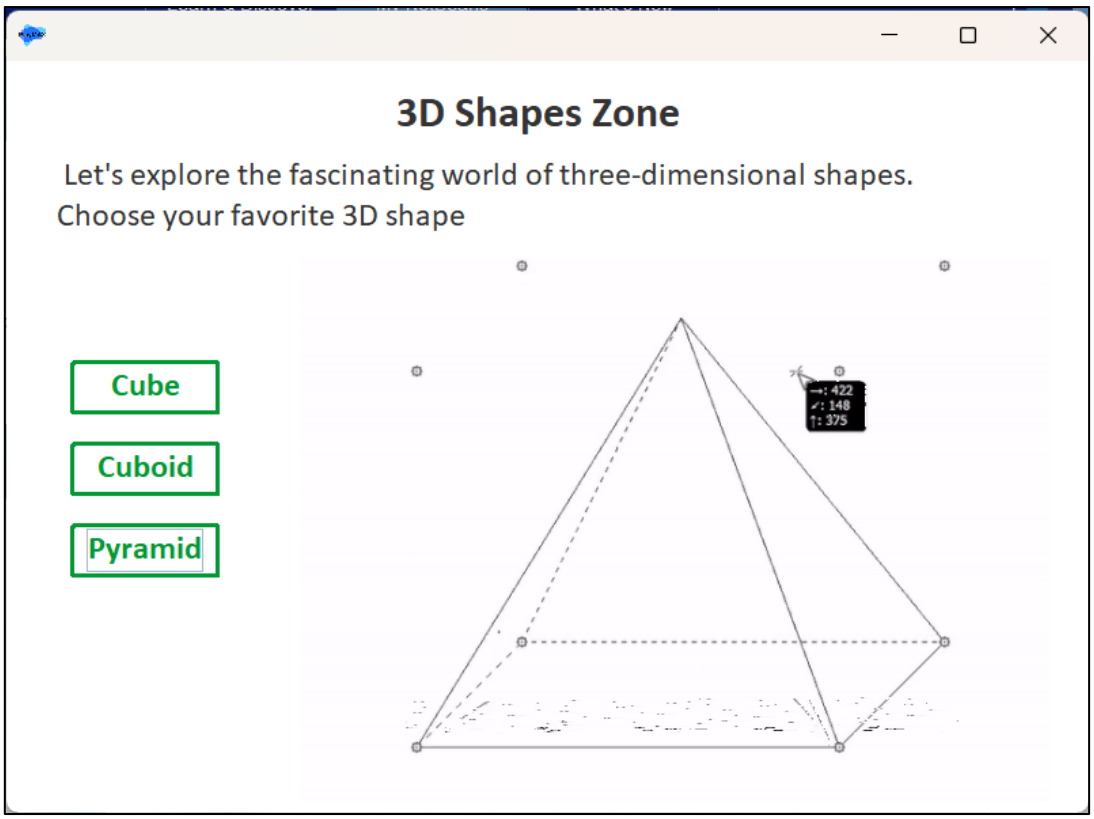

Figure 47 - 3D Shape Pyramid

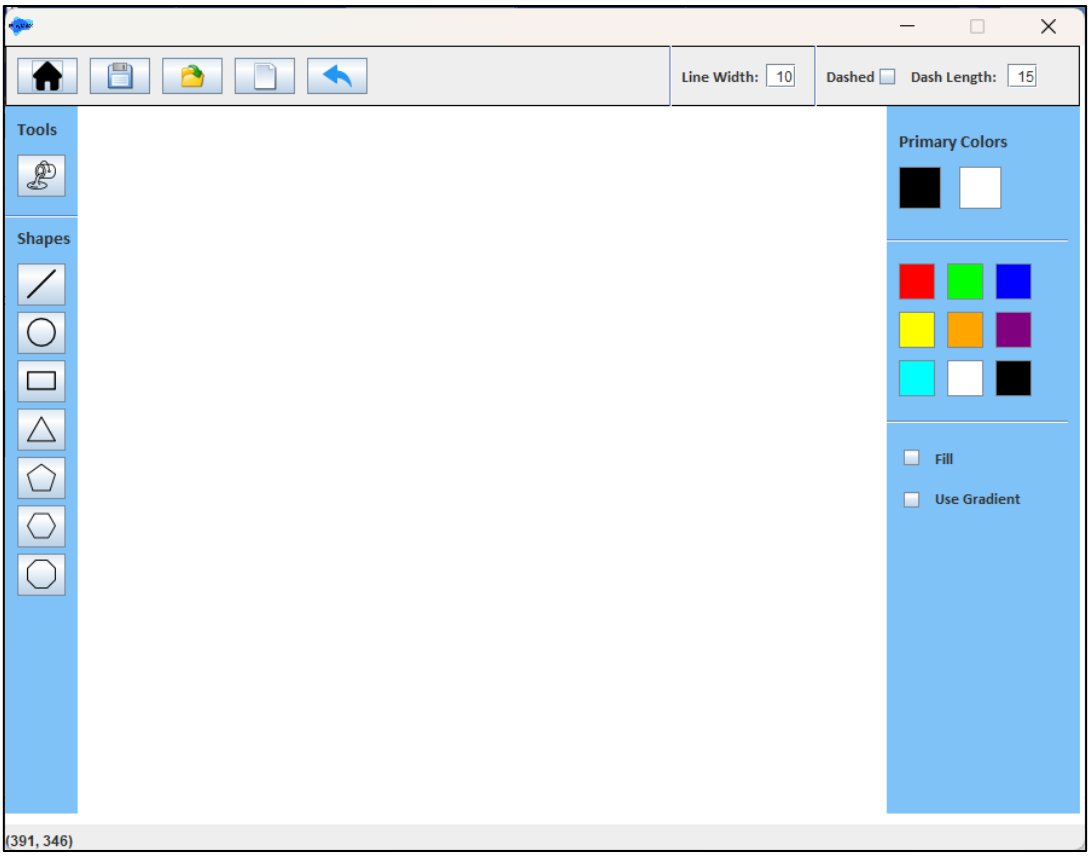

Figure 46 - Drawing Interface

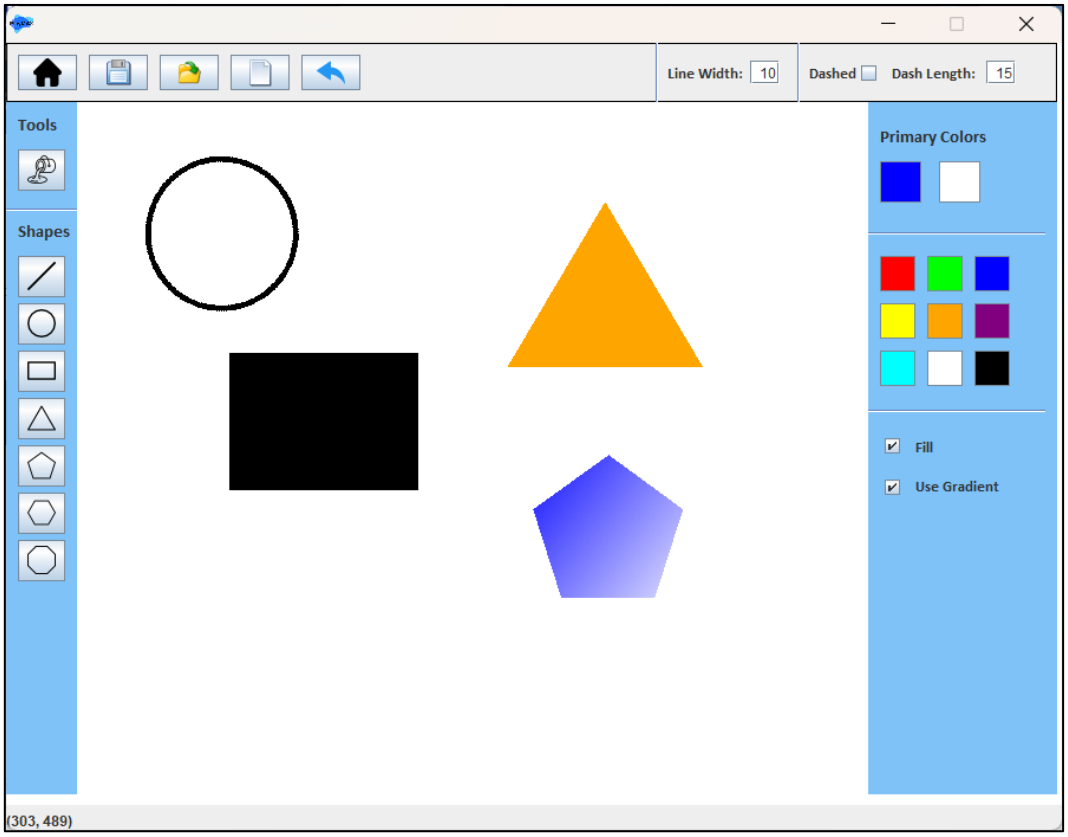

Figure 48 - Drawing 2D Shape Interface

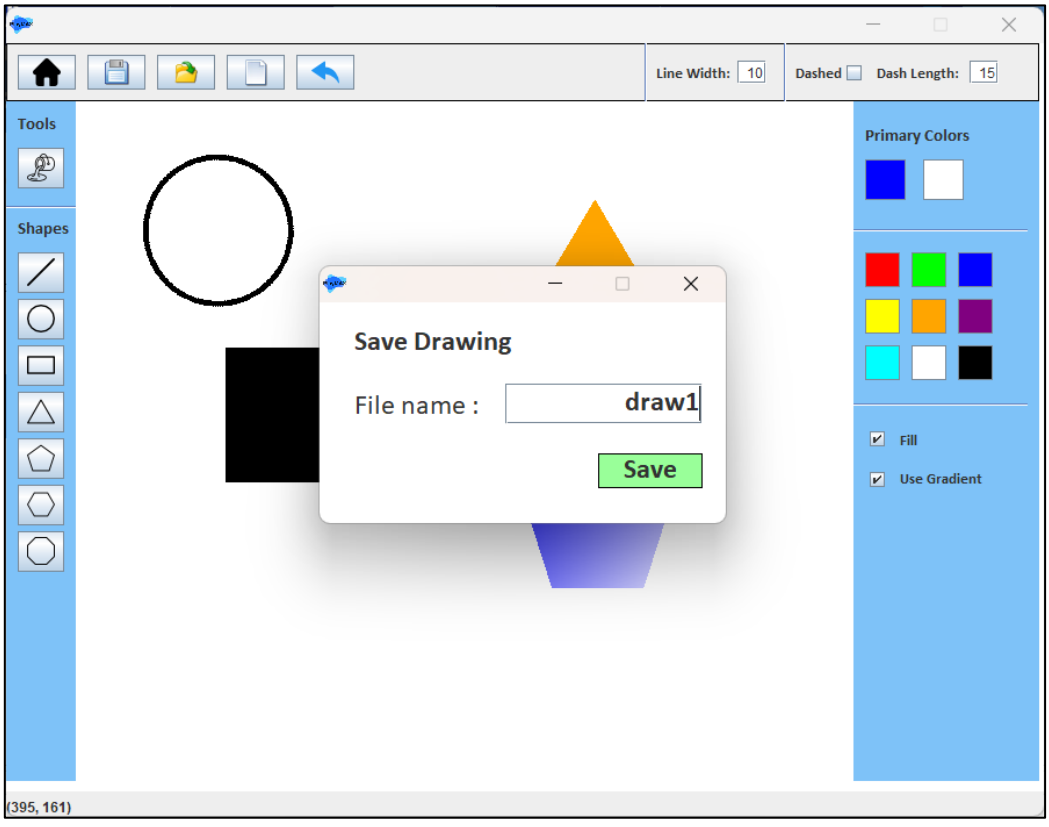

Figure 49 - Save Drawing Interface

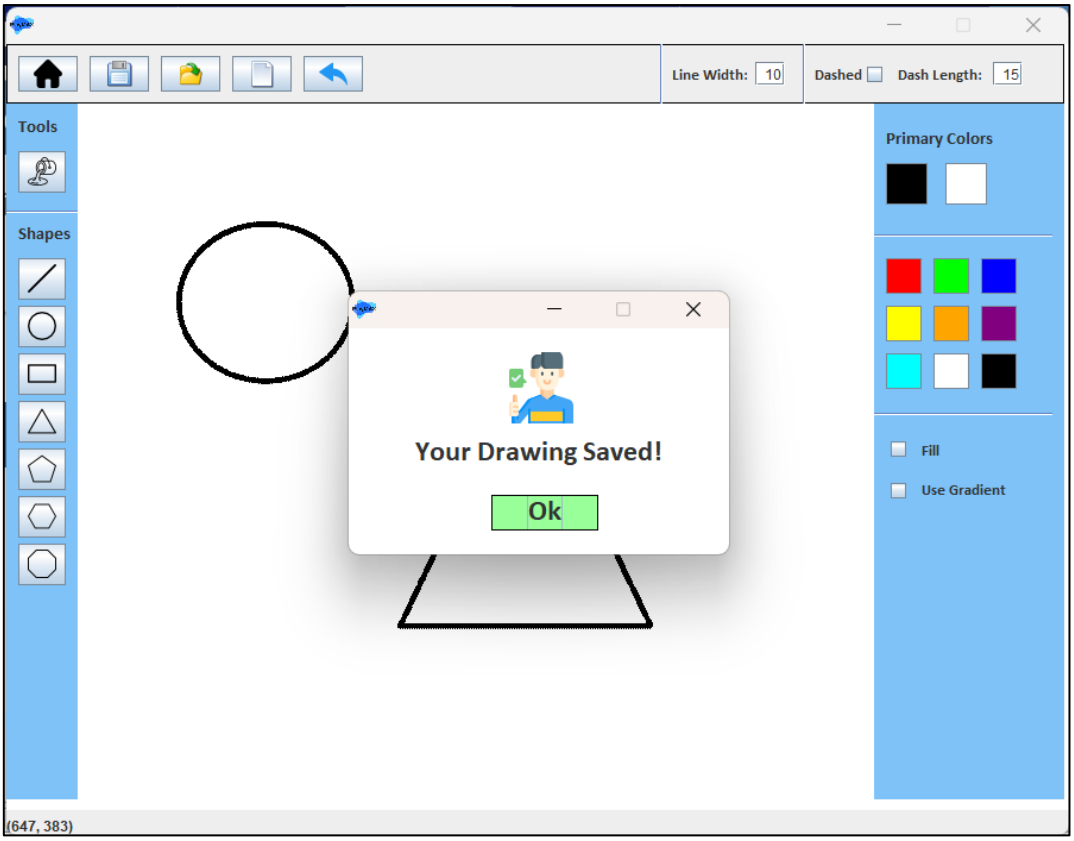

Figure 50 - Saved Pop up Notification

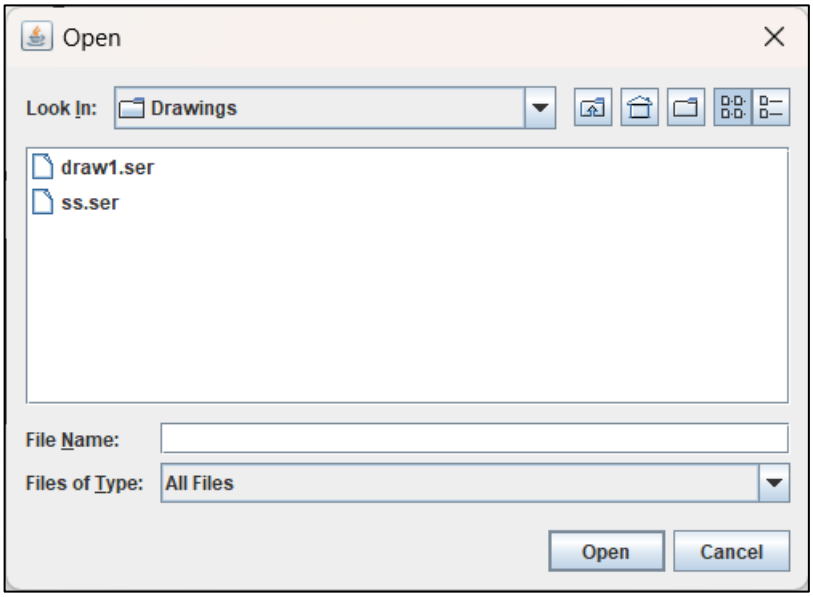

Figure 51 - File Open Interface

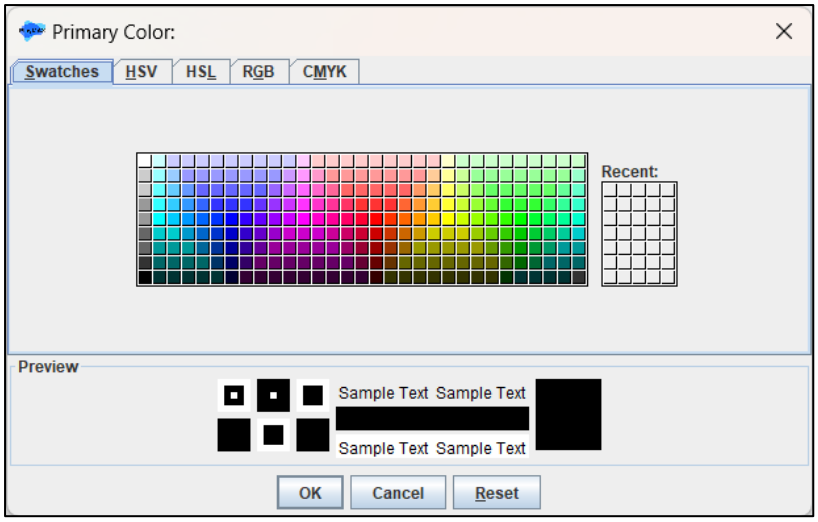

Figure 52 - Colour Palette

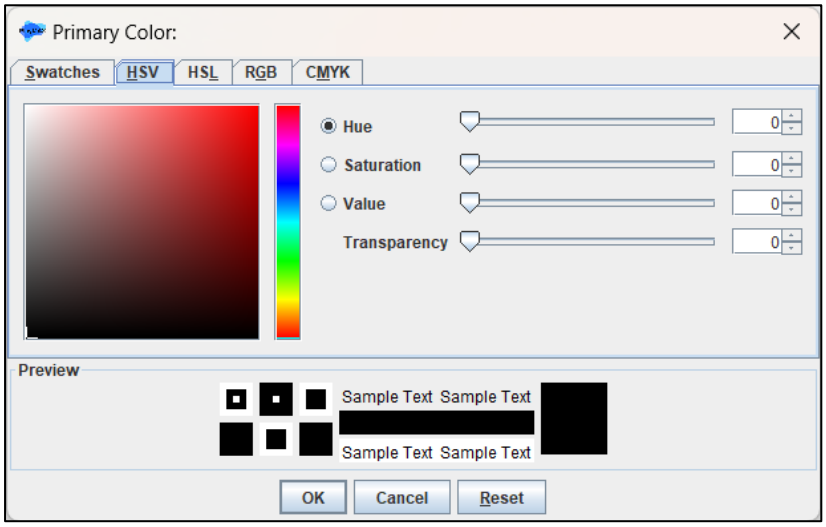

Figure 53 - Primary Colour Selection Interface

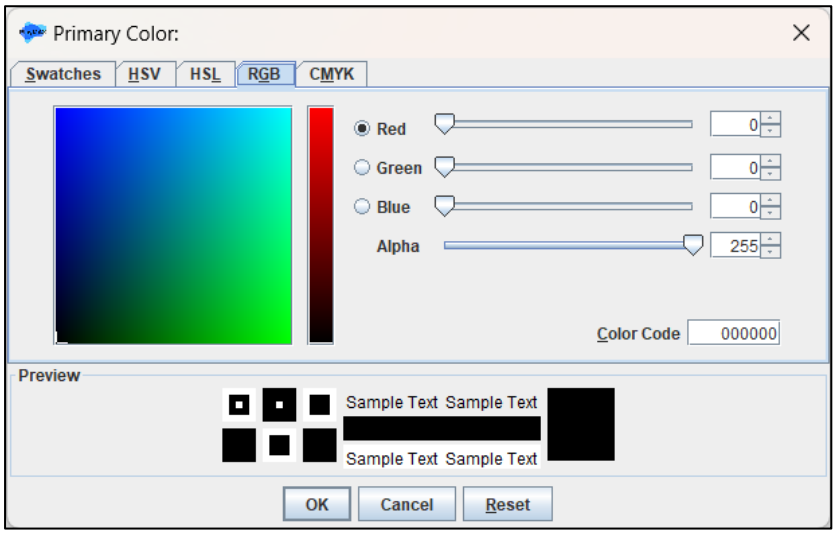

Figure 54 - Colour Gradient Mixture Interface

Evaluation

1. **Participants Selection:** Our objective was to engage a varied pair of 2 participants for our initial usability study. The individuals selected were aged between 23 and 35, embodying a range of technological expertise. The intention behind this selection was to ensure that our sample captured a comprehensive representation of potential users that the PlayMax application might cater to.

2. **Evaluation Methods:**

   i. **Usability Testing:** Participants were asked to complete a series of tasks in a controlled environment. The tasks included drawing shapes, coloring, and using the app features. The purpose was to assess the app's usability, understandability, and effectiveness.

   ii. **Interviews:** After the usability test, participants were individually interviewed to gather their feedback on the application. Questions were focused on the app's ease of use, layout, design, and any improvements they would suggest.

   iii. **Surveys:** A post-interaction survey was also carried out to gather quantifiable data on the user experience. This included questions about user satisfaction, any difficulties faced, and the likelihood of the participant recommending the app to others.

3. **Methods of Study:**

   i. **User Testing Sessions:** In these sessions, we observe the participants as they navigate through the application. These sessions are crucial to identify any usability issues. We'll focus on both first-time users for their fresh perspective, and experienced users for their deeper understanding of the application.

   ii. **Focus Groups:** We will conduct focus group discussions with a mix of parents, teachers, and children. This will facilitate an open discussion about their experience with the application, what they like and dislike, and what they would like to see improved or added.

4. **Justification of Methods:** Usability testing was chosen because it provides real-time data on how users interact with the app and identifies any stumbling blocks in the user experience. Interviews were conducted to gather qualitative insights directly from the users. Surveys were used to collect broad, quantitative data on user satisfaction and experience.

5. **Conducting the Evaluation:** Each participant was given a brief introduction to the app and its functionalities. They were then asked to perform specific tasks while observers took notes on their performance. Afterward, participants were interviewed for their feedback, and then asked to complete the survey.

6. **Areas for Further Work and Improvement:**

   - **Navigation:** Some users found it difficult to locate certain features. This suggests the app's navigation could be improved to be more intuitive.
   - **Tutorial:** Some users struggled with understanding how to use certain features. A tutorial or guide would be beneficial for new users.
   - **Performance:** Some users experienced lag when using the app. Future work could focus on improving the app's performance.
   - **3D Implemented -** As a user, I'd love to see more interactive options for the 3D shapes in PlayMax. It would be so engaging if I could rotate the 3D shapes, scale them to different sizes, or even break them down into their constituent 2D shapes. This way not only would the application be more fun, it would also serve as an excellent learning tool to help understand the connection between 2D and 3D geometric shapes.

Summary

This project is presented in the report in several sections. It is introduced that a desktop application has been created for primary kids using the GUI tool java swing with IntelliJ software. This project was done according to agile scrum methodology. The name used for the application is PlayMAX and data was collected through a questionnaire at the beginning of the project. The number of responses received was 50. Giving primary kids an understanding of 2D and 3D shapes is done in an engaging and fun way through various activities. This is completely under the supervision of parents, teachers, and guardians. A user story was created by interviewing a group of 2 people and an application was created accordingly. After that, the procedure is shown as a storyboard. The prototype of the application is classified as low-fidelity and high-fidelity, and Figma was used to create the high-fidelity prototype. After that, the screenshot of the developed application has been included and the report and finally report has been completed by evaluation. Implementation was done related to main, loading, quiz, algorithm package, dimensions, 2D shapes and 3D classes. The evaluation methods used here are usability testing, interviews, and surveys. Also in this section, the areas for further work and implementation have been introduced and they are navigation, tutorial, performance, and 3D illustration.

References

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[2].Smith, A., Johnson, B., & Thompson, C. (2017). Interactive learning applications for primary school children. Journal of Educational Technology, 21(3), 45-56. [URL: https://www.journalofedutech.com/article/interactive-learning-applications-for-primary-school-children]

[3].Brown, E., & Davis, M. (2018). Enhancing visual learning in primary school children through interactive shape applications. International Journal of Educational Technology, 15(2), 89-102. [URL: https://www.ijet.org/article/enhancing-visual-learning-in-primary-school-children]

[4].Stevens, R., & Patel, S. (2020). The impact of color and shape on children's cognitive development. Journal of Child Psychology, 38(4), 567-578. [URL: https://www.journalofchildpsychology.com/article/impact-of-color-and-shape-on-cognitive-development]

[5].Johnson, L., & Smith, P. (2022). Shape visualization in educational apps: A user-centered design approach. In Proceedings of the 2022 International Conference on Human-Computer Interaction (pp. 234-245). Springer. [URL: https://link.springer.com/chapter/10.1007/978-3-642-12345-6_20]

Appendixes

Appendix – A

Downloadable Resources

I. **GitHub Repository** – https://github.com/Plymouth-University/main-coursework-playmax

II. **Application File –** https://liveplymouthac-my.sharepoint.com/:f:/g/personal/10749896_students_plymouth_ac_uk/EpzZ__TVjSdBhlsDVad1IXQBJcuszc4ldY8GJVf-MJvcbw?e=XLyz5I

III. **Presentation Video –** https://liveplymouthac-my.sharepoint.com/:f:/g/personal/10749896_students_plymouth_ac_uk/ErdNnG9uS-xDsTU5nAJPTloB5MATUMGnw4dl2PJ-7RSpNA?e=v9xfcS

IV. **Diagrams -** https://liveplymouthac-my.sharepoint.com/:f:/g/personal/10749896_students_plymouth_ac_uk/EuEo74UBIL1LqLMXpFMW_w4BxO6kXwJHMYQgm-lthSGQpA?e=6qKj3O

Appendix – B

Consent Form

PlayMax Application User Study Consent Form

Dear Participant,

We appreciate your interest in participating in the usability study of our application, PlayMax. This form is designed to ensure you understand the nature of your participation and your rights in this study.

Purpose of the Study The purpose of the study is to understand how users interact with the PlayMax application and to collect feedback to enhance its usability and functionality.

Study Procedure The study will involve interacting with the PlayMax application and performing specific tasks under the guidance of our researchers. You will also be asked to provide feedback about your experience.

Voluntary Participation Your participation in this study is completely voluntary. You may choose to withdraw at any time without facing any consequences.

Anonymity and Confidentiality Your personal information will be kept strictly confidential. Any data collected will be anonymized and used only for the purpose of this study. No identifying information will be published or disclosed to third parties.

Risks and Benefits There are no known risks associated with this study. Your feedback will contribute to improving the PlayMax application.

Consent By signing below, you acknowledge that you have read and understood the above information and agree to participate in the PlayMax application user study.

Name of Participant: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Signature of Participant: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Date: 15th May 2023

Thank you for your participation.

Sincerely,

PlayMax – Group 01

Plymouth University

B.Sc. (Hons) in Software Engineering

Appendix – C

Response from the Google Form Sheet

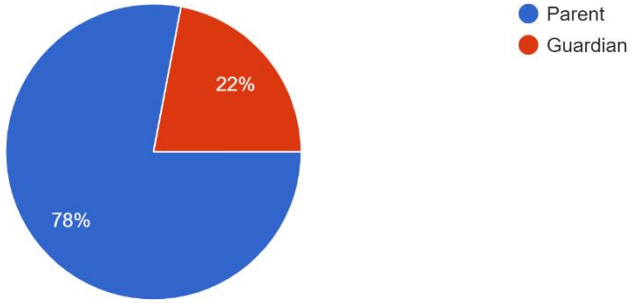
Timestamp	Email address	1. What is your relationship to the child?	2. Which age group does your child?	3. Would you be interested in using a desktop application to help your child learn about shapes?	4. What features would you like to see in a shape learning application? (Check all that apply)	5. Would you prefer if the application focuses solely on 2D shapes or includes both 2D and 3D shapes?	6. Would you prefer the application to be free with in-app purchases or a one-time paid application without any additional purchases?	7. Would you like the application to have a feature that allows your child to save and share their drawings or creations?	8. How important is it for the application to have visually appealing graphics?	9. How likely would you recommend a shape learning application to other parents or guardians?	10. How frequently do you think your child would use the shape learning application?	11. What is your preferred learning approach for your child?	12. Would you be interested in receiving educational resources or tips related to shape learning to support your child's learning outside of the application?
5-20-2023 0:31:28	mallikaathukorala@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 7:54:33	chanurilokuge@gmail.com	Guardian	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Several times a week	Self-paced learning	Yes, I would be interested.
5-20-2023 11:43:20	nirashaherath@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Once a week	Guided instruction by a parent or guardian	Yes, I would be interested.
5-20-2023 11:45:00	maheshwasantha@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	3	4	Occasionally	Self-paced learning	No, I would not be interested.
5-20-2023 11:46:19	samadhiliyanage@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 11:47:36	dasunramanayake@gmail.com	Parent	7-8 years	Maybe	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Several times a week	Self-paced learning	Yes, I would be interested.
5-20-2023 11:48:29	thusharihansika@gmail.com	Guardian	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	Self-paced learning	No, I would not be interested.
5-20-2023 11:50:02	ganganidilshika@gmail.com	Guardian	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Occasionally	A combination of self-paced and guided learning	No, I would not be interested.
5-20-2023 11:54:49	warsharanaweera@gmail.com	Parent	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Once a week	Self-paced learning	Yes, I would be interested.
5-20-2023 11:55:34	rathnaweerasaman@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 11:56:12	samanthichapa@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 11:57:05	janakakelum@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Once a week	Guided instruction by a parent or guardian	Yes, I would be interested.
5-20-2023 11:57:55	nilminishalika@gmail.com	Guardian	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Once a week	Self-paced learning	Yes, I would be interested.
5-20-2023 11:58:40	dhammikadias@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	Yes, I would like that feature	3	5	Once a week	Guided instruction by a parent or guardian	Yes, I would be interested.
5-20-2023 11:59:41	nayanaalwis@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	No, I prefer not to have that feature	3	5	Once a week	Guided instruction by a parent or guardian	No, I would not be interested.
5-20-2023 12:00:31	madhupriyanwada@gmail.com	Parent	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	No, I prefer not to have that feature	3	5	Once a week	Self-paced learning	No, I would not be interested.
5-20-2023 12:44:33	ransimenaka@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 12:45:11	roshanipieris@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 12:46:26	ayeshamadhuwanthi@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Once a week	Guided instruction by a parent or guardian	Yes, I would be interested.
5-20-2023 12:47:09	prasannaamarasinghe@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Once a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 12:48:50	achinidulanjali@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Once a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 12:49:45	ahinsashrimalee@gmail.com	Guardian	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	3	4	Once a week	Self-paced learning	No, I would not be interested.
5-20-2023 12:50:31	nirmalthilakarathne@gmail.com	Guardian	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	No, I prefer not to have that feature	3	4	Once a week	Self-paced learning	No, I would not be interested.
5-20-2023 12:51:15	samarasinghedilshan@gmail.com	Guardian	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:01:16	anurakumara@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Daily	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:05:39	sajeewalakmal@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	Yes, I would like that feature	4	4	Daily	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:06:17	wathsalasamaranayake@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	No, I prefer not to have that feature	3	3	Several times a week	Guided instruction by a parent or guardian	Yes, I would be interested.
5-20-2023 13:06:56	inokashyamalee@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	No, I prefer not to have that feature	2	3	Once a week	Guided instruction by a parent or guardian	No, I would not be interested.
5-20-2023 13:07:40	sunilgamage@gmail.com	Parent	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Once a week	Self-paced learning	No, I would not be interested.
5-20-2023 13:08:20	nirmaladamayanthi@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	No, I prefer not to have that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:09:05	kithminiweerasinghe@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Once a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:09:47	basuruliyanage@gmail.com	Guardian	9-10 years	Maybe	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	Self-paced learning	No, I would not be interested.
5-20-2023 13:10:43	pubudumalshan@gmail.com	Guardian	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:12:37	kamalperera@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	Self-paced learning	No, I would not be interested.
5-20-2023 13:13:23	dushenisamadara@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:14:28	rahalabhishek@gmail.com	Guardian	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	No, I prefer not to have that feature	2	3	Once a week	Guided instruction by a parent or guardian	No, I would not be interested.
5-20-2023 13:15:18	yashmigunawardhane@gmail.com	Guardian	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	No, I prefer not to have that feature	3	4	Several times a week	A combination of self-paced and guided learning	No, I would not be interested.
5-20-2023 13:16:02	vindyapathirana@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	4	4	Once a week	Self-paced learning	Yes, I would be interested.
5-20-2023 13:16:50	pasanranaweera@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:17:26	dewnianjali@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	No, I prefer not to have that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:18:09	maheshadunusinghe@gmail.com	Parent	9-10 years	Maybe	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	One-time paid application	Yes, I would like that feature	3	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:18:43	pahandanthanarayana@gmail.com	Parent	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	3	4	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:19:56	sandmalihadapangoda@gmail.com	Parent	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	3	4	Once a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:20:33	manushaperera@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	No, I prefer not to have that feature	3	4	Several times a week	Self-paced learning	Yes, I would be interested.
5-20-2023 13:21:12	damithudagedara@gmail.com	Parent	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:24:17	isharaduleep@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	Guided instruction by a parent or guardian	Yes, I would be interested.
5-20-2023 13:25:00	nimaliwaduge@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Only 2D shapes	Free with in-app purchases	No, I prefer not to have that feature	5	5	Several times a week	Guided instruction by a parent or guardian	Yes, I would be interested.
5-20-2023 13:25:53	samanthiweerasinghe@gmail.com	Parent	5-6 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:26:31	gayathriesilva@gmail.com	Parent	7-8 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.
5-20-2023 13:27:16	kalharinanayakkara@gmail.com	Parent	9-10 years	Yes	Interactive games and puzzles, Different shapes in 2D and 3D formats, Various colors for the shapes, Step-by-step instructions on how to draw shapes and polygons	Both 2D and 3D shapes	Free with in-app purchases	Yes, I would like that feature	5	5	Several times a week	A combination of self-paced and guided learning	Yes, I would be interested.

Appendix – D

Questionnaire Form

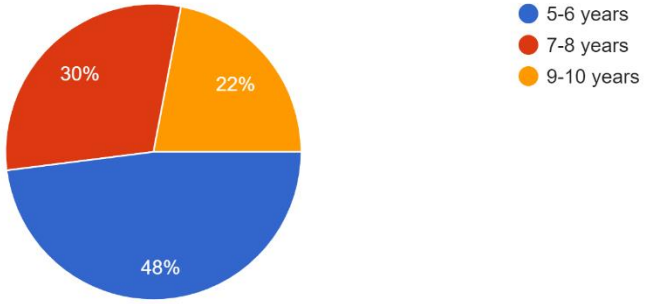
1. What is your relationship to the child?

50 responses



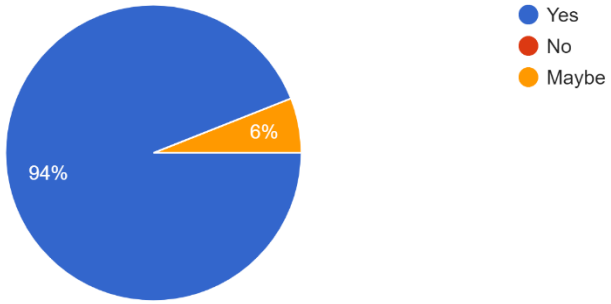
2. Which age group does your child?

50 responses



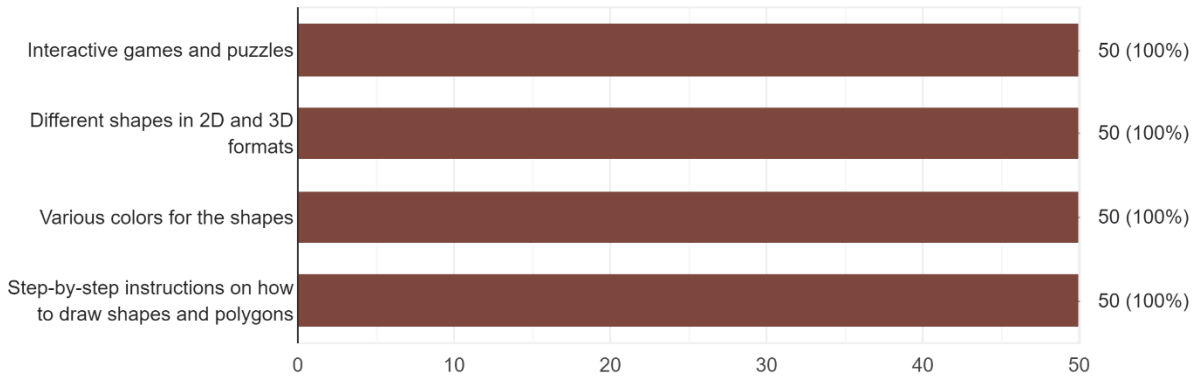
3. Would you be interested in using a desktop application to help your child learn about shapes?

50 responses



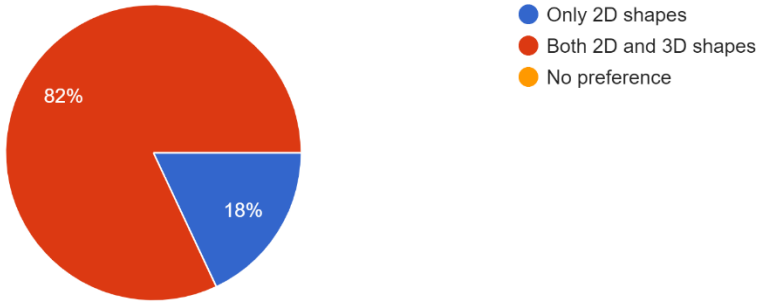
4. What features would you like to see in a shape learning application? (Check all that apply)

50 responses



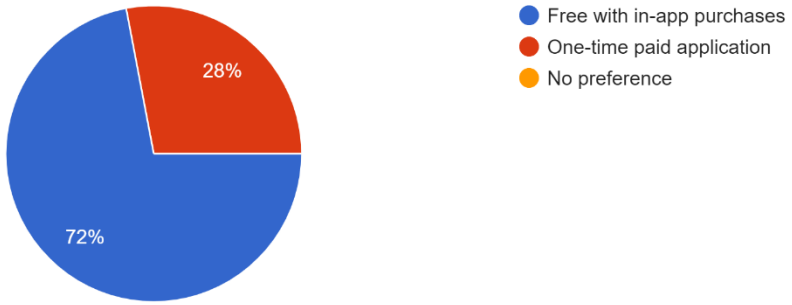
5. Would you prefer if the application focuses solely on 2D shapes or includes both 2D and 3D shapes?

50 responses



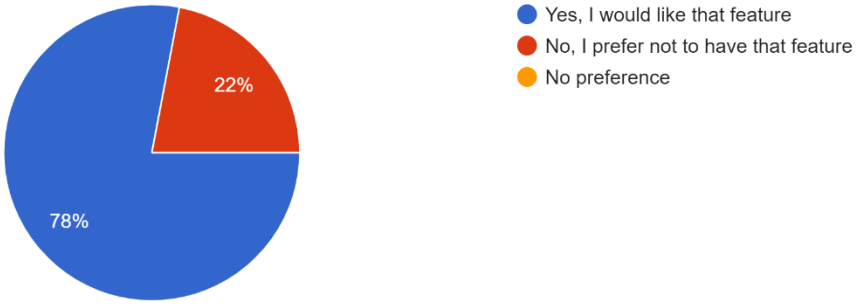
6. Would you prefer the application to be free with in-app purchases or a one-time paid application without any additional purchases?

50 responses



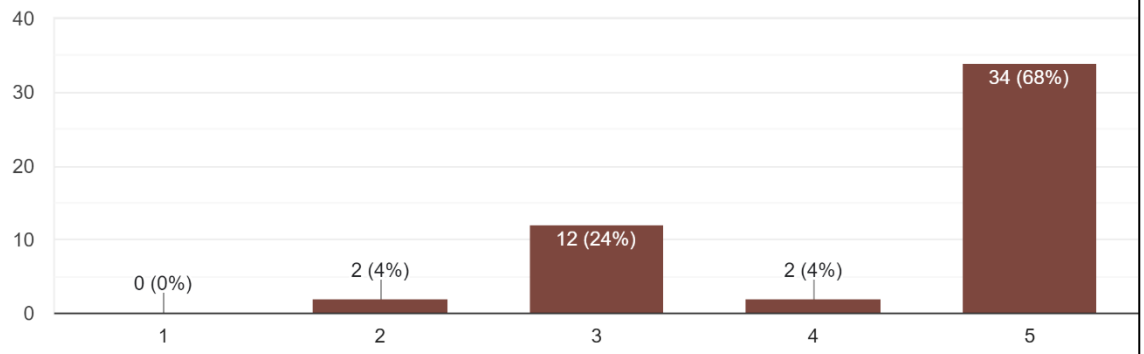
7. Would you like the application to have a feature that allows your child to save and share their drawings or creations?

50 responses



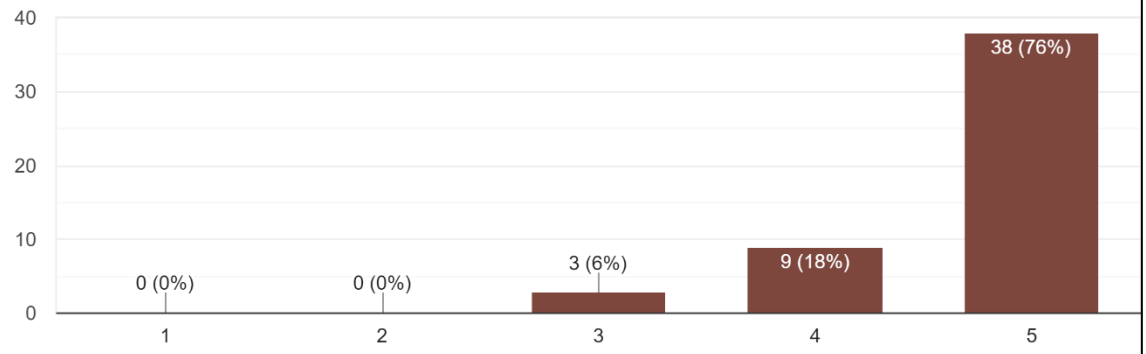
8. How important is it for the application to have visually appealing graphics?

50 responses



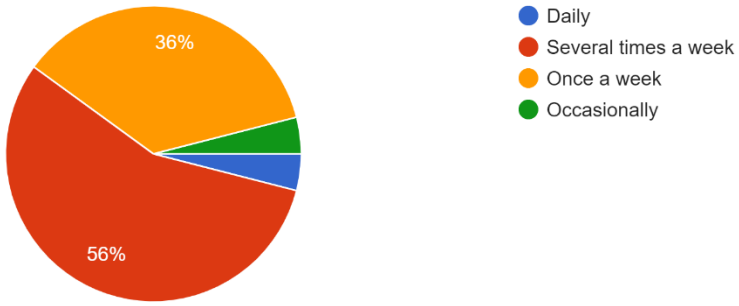
9. How likely would you recommend a shape learning application to other parents or guardians?

50 responses



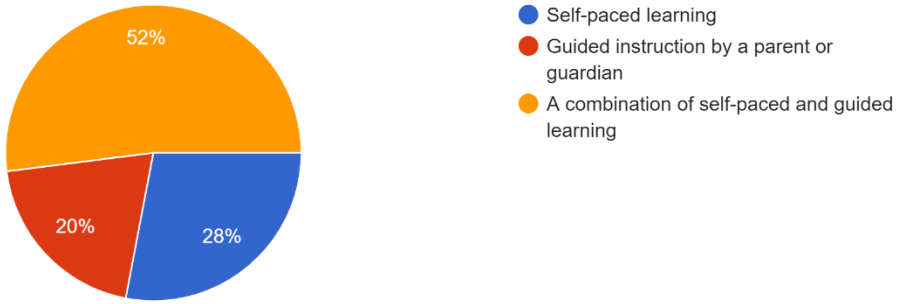
10. How frequently do you think your child would use the shape learning application?

50 responses



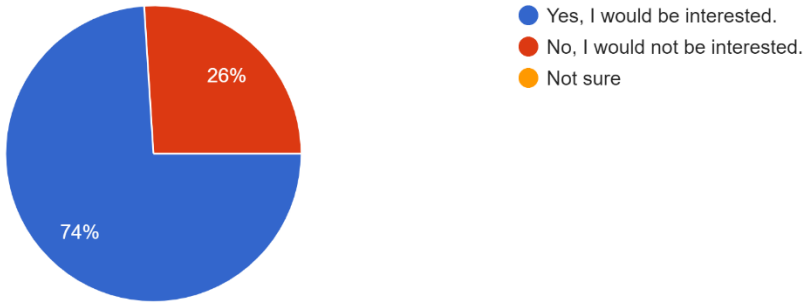
11. What is your preferred learning approach for your child?

50 responses



12. Would you be interested in receiving educational resources or tips related to shape learning to support your child's learning outside of the application?

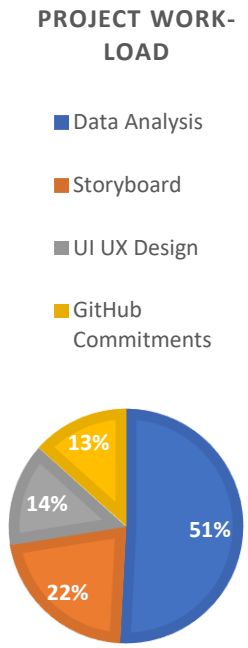
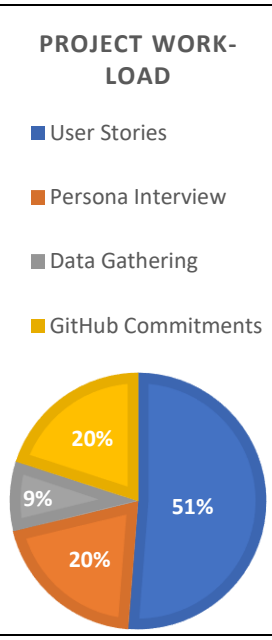
50 responses

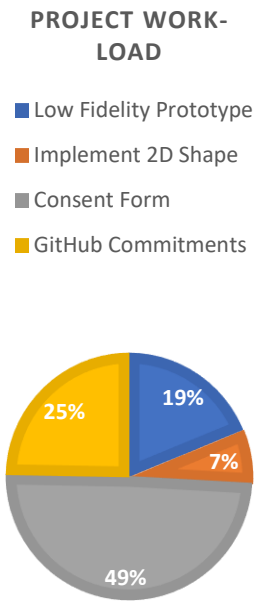
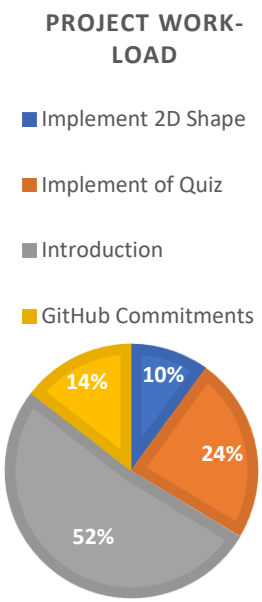


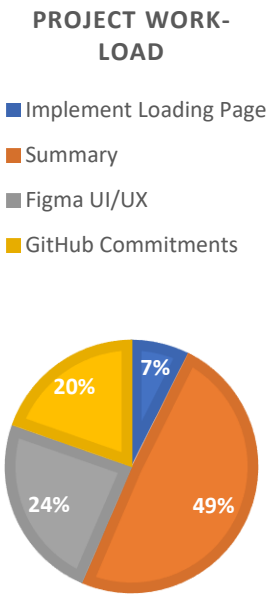
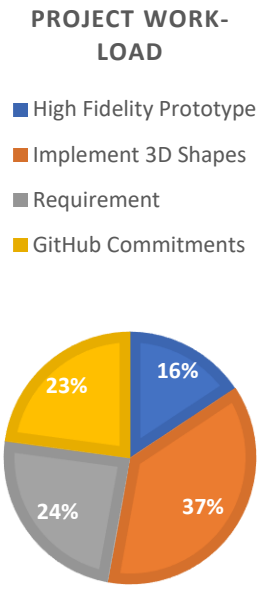
Appendix – E

Team Plan & Responsibility Matrix

Note: **This is to note this project is a part of Group-01, and as the group leader, the workload is divided equally among every member as assigned in the below chart.*

Contributor Name	Plymouth ID	Individual Contribution	
		Graphically Chart	Statement
S.Y.T Silva	10749896		At the beginning of the project, the environment was introduced, the questionnaire form was created, and the storyboard was created. All the icons of the drawing shapes and all the related functions were created. View the commitments through the GitHub link given below. https://github.com/yasirutishan
H.A.A Madhushani	10749947		Creation of user stories, presentation of the summary of the complete project, and the implementation part were done. Analysis part was done according to the gathered data. The functions of drawing, coloring, and saving of shapes drawing were created. Commitments can be viewed through the GitHub link below. https://github.com/awanthikamadhushani

L.L.C Bhagya	10749938		The low fidelity prototype was created, and the consent form was created for data gathering. The implementation related to 2D shapes was done. The GitHub link for commitments is given below. https://github.com/Chanuri-lokuge
I.G.I.S Lakshan	10749954		Implementation was done for 2D shapes hexagon, pentagon, and triangle. Implementation was done for the quizzes in the last stage of the application. The GitHub link for commitments is provided below. https://github.com/Lakshan-393

D.J.D De Silva	10707166		The loading page seen at the beginning of the application was created. Implementation work was done for the home page and the square and rectangle of the 2d shapes. The commitments can be viewed through the GitHub link given below. https://github.com/JayanDsilva
D.P.U Perera	10707306		The high-fidelity prototype was created with Figma. 3D shapes were implemented for the zone. 3D shapes were implemented for cube, cuboid, and pyramid. The commitments can be viewed through the GitHub link below. https://github.com/Pubudu14