GNG1103

Design Project User and Product Manual

A Tale of Two Students

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Table 1: Acronyms

Acronym	Definition
DEI	Diversity, Equity, and Inclusion
UI	User Interface
UX	User Experience
VR	Virtual Reality
BOM	Bill of Materials

Table 2: Glossary

Term	Acronym	Definition
Assets	--	Components used for the development of the experience.
Diversity, Equity, and Inclusion	DEI	A term used to describe implementations and programs used to help make minorities feel included within an organization.
User Interface	UI	The visual and metaphorical design of experience that the user will partake.
User Experience	UX	The experience that the user will have while using the product that depends on its visual and practical aspects.
Virtual Reality	VR	A simulated and immersive experience separate of the real world using a simulation device.
Bill of Materials	BOM	A table that includes the budget as well as the number of units and the expenses of the materials used in order to construct the product.
Experience	--	Refers to 'A Tale of Two Students' simulation opposed to referring to it as a 'game'.

1 Introduction

The purpose of this product is to garner empathy to users on issues of DEI with the use of VR. The users will be able to garner the empathy with the help of the dialogue and animations used in this experience. This product includes issues on racism that might occur to children, hence the target audience are young elementary kids. The assumption that children are malleable was made for this product. Children do not have enough experience to be able to develop their strong opinions/beliefs. This product is meant to help kids develop their beliefs/opinions on race as they go through multiple scenarios in VR.

This User and Product Manual (UPM) provides the necessary information for children who are using this product as well as the adults who are purchasing and are responsible for the child. Since this is a product for children, it is important that this UPM properly highlights how to use the product and all safety precautions for the adults to follow for their children.

The UPM starts off by clearly stating any cautions and warnings for the product. Then the UPM goes on to explain how to use the product. The functionality of the different features is explained with a walkthrough of the experience. The list of materials used to make the product, the troubleshooting and maintenance of the product are included in the UPM. Throughout the UPM, there are multiple figures attached to assist the users/customers on how to use the product.

2 Overview

Racism has been an issue for hundreds of years. Unfortunately, it is still an issue to this day. There are many different forms of racism that occurs like legal injustice and bullying. The media discusses many stories revolving around racism, but not all of it is true. This leads children to not clearly know what are the right actions that they should take when dealing with racism. Children might be negatively influenced by the media or their peers. This product is going to give children an experience where they are allowed to make their own decisions and see what outcomes occur. They will understand how their actions are affecting the people around them. Through the different scenes played in this product, children will be able to develop their own nonracist opinions and beliefs that they can hopefully enforce onto others to help break the cycle of racism.
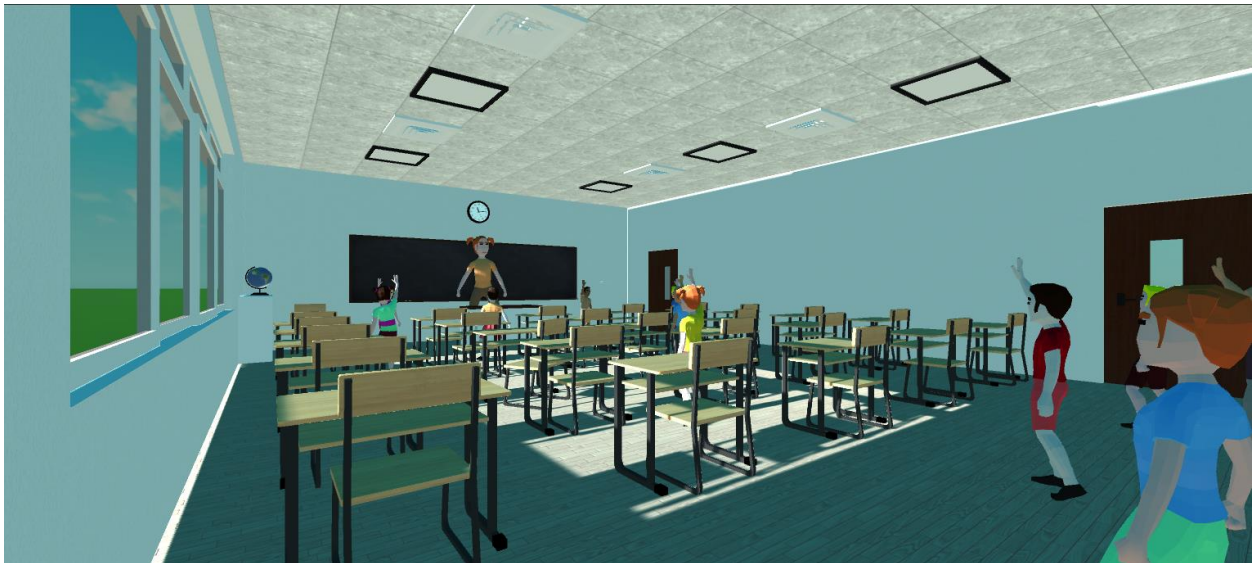
Figure 1: Classroom Scene

'A Tale of Two Students' is a VR experience that allows children to be able to garner empathy with the help of dialogue and animations. The user will follow a script and occasionally be able to get the option on how to act. They can choose to act in a racist manner or not. Different consequences and emotions will occur based on what the user chooses. This way children can learn how their actions impact others. In this storyline, the user will be in a first-person perspective of a bystander. The scenarios chosen to contain subtle racism which is more apparent in schools. This way children can be able to recognize and learn what is the correct way to act in these situations that might happen to them in real life.

2.1 Cautions & Warnings

When using VR, it important to leave a large area for the user to move around. Be sure that there are no obstacles and that other people do not go in this area while the user is using the product. This is because the user will be wearing a VR headset, so they will not be able to see the real world. They can easily crash into people and objects.

In addition to leaving a large area for the user it can also be beneficial to note that for some, V.R can cause motion sickness like car, sea, or air. To best prevent this from happening, ensure the headset is

positioned on the head properly. Settings within the headset can also be adjusted to decrease the amount of eye movement needed.

In terms of the content, the product touches on topics about racism and bullying. This might be triggering and sensitive topics to some, so keep that in mind while using this product. It may be beneficial to warn clients / users before allowing actual use of the product.

3 Getting Started

To get started, begin by downloading the Oculus Rift Software onto your pc/computer. Once the software has been installed, you can create a Oculus account, which will grant you access to the Oculus Store. In this store, you will be able to purchase and view different available games. Next, click 'Devices', then 'Configure Rift', then 'Full Setup' to begin to process of connecting the headset with the PC. Connect the two sensors to USB 3.0 ports. Then, plug one headset cable into another USB port and plug the other into the computers HDMI output. The software will show each devices connection status alongside a green 'OK' if it is connected.

To connect a controller, turn it on and set it to pair. For the remote, hold the center button down. For the left Oculus Touch controller, hold the Menu and Y button down for two seconds. For the right Oculus Touch controller, hold the Oculus and the B buttons for two seconds. Once again, the software will show each devices connection status alongside a green 'OK' if it is connected.

The software will likely update the firmware for the headset, sensors, controllers and remote. This process should only take a few minutes, however, ensure to not unplug anything until it has completed.

Following this, the user will set up the two sensors which track their position in 3D space. We recommend clearing a 10 x 10-foot area, and then placing the sensors three to six feet apart from each other. Ensure the side with the lens (the side with a glossy black side) is facing you. Once these have been placed, click 'Initiate Sensor Tracking Screen'. You will be directed to hold a controller in the play area, and then the system will either present you with a green checkmark and two blue fields, or you will be presented with an error and arrows directing you to rotate the sensors to better capture the play area.

Once the play area has been cleared by the sensors, you can set the boundaries of your area. By holding one of the controllers in front of the computer, and pulling the trigger, you can set up your boundaries.

Once everything has been connected, positioned, and updated, the Oculus Rift is ready for use. The software will direct you to put on the headset, pick up the controllers, and then will guide you through a tutorial on how to navigate it in VR.

Set-up Considerations
- Although a 10 x 10 foot area is recommended for safety and optimal use, a smaller area will also work.
- A boundary does not need to be set if the user is working with limited space.
- The Oculus Rift headset has adjustable straps which the user can adjust to prevent the device from falling off.
- Always clear the play area prior to interacting with the Oculus Rift headset. Ensure any obstructions you may hit with arms outstretched are also cleared.

3.1 User Access Considerations

- Oculus devices are designed for ages 13+. Children under the age of 13 are not allowed to create Oculus accounts or use Oculus devices.

- It is highly recommended to set up boundaries, as the boundary will appear when you are near or touching it while in VR. It is also recommended to leave additional room when setting up the boundary, as this will reduce the risk of accidental collisions with objects or walls.
- When using the Oculus VR system, monitor yourself to ensure you do not develop nausea or dizziness. If you develop any of these symptoms, we recommend you remove the headset until you feel better. Certain experiences may lead users to the symptoms mentioned above, due to camera movement, player motion or disorientating content and effects. It is important users are comfortable with the setting they are in and remain aware that if they have any sense of discomfort, they can remove the headset.

3.2   Accessing the System

- Following the instructions given on one's VR device, set up the device and all its apparatus' including headset and hand controllers.
- When using VR, the system must be accessed through a host like 'STEAM'. From there one is given access to launching the experience. The intro scene will play, and the experience officially begin by clicking the 'START'. Another option to access the system after completion of the experience is to click 'RESTART' which will navigate user back to the first scene where they can replay the experience once more.

3.3   System Organization and Navigation

- The software will navigate the user throughout the experience, and therefore the user should not have issues navigating the system. If the user has trouble, they can press the menu button on the controller to return to the home menu.
- The 'B' and 'Y' buttons will return you to the previous screen/menu.
- The grip buttons, located on the side of the controllers, allows you to grab objects or make a fist when in VR.

3.4   Exiting the System

- There are two opportunities to exit the system when it is in operation. The first is before the experience begins, there is an option to 'QUIT' and exit the simulation. The second is after the experience has finished, there is another option to 'QUIT' and exit the simulation. After quitting, one could use the exiting and disabling features of the VR system and the host system to turn off the experience. To exit the system during the experience, the system must be forcefully shut down or disabled via 'Menu' which is why it is recommended that the simulation is completed before one tries to exit. Turn off device and store it in a safe environment.

4 Using the System

- Once the software mentioned in 'Getting Started' has been installed, and the sensors have been set up accordingly, the Oculus Rift is ready for use. The user can open the Unity VR application and select the game they wish to play. Once the game has been selected, the user will be instructed to put on their headset. From this point, the user will be instructed via VR how to operate and navigate the game.

4.1 User Instructions

This is the detailed instructions of setting up the VR experience.

1. Following the instructions given on one's VR device, set up the device and all of its apparatus' including headset and hand controllers.
2. Access 'STEAM' using an active account.
3. Locate the experience and launch it. This may require a download.
4. When launched, a menu page will open giving one access to begin the experience or leaving the experience. Click 'START' to begin experience and 'QUIT' to leave the experience.
    a. If experience has commenced, it cannot be exited without a forced 'shut down' and must be completed until the completion menu appears.
    b. There are three full scenarios in the experience, an intro and an outro.
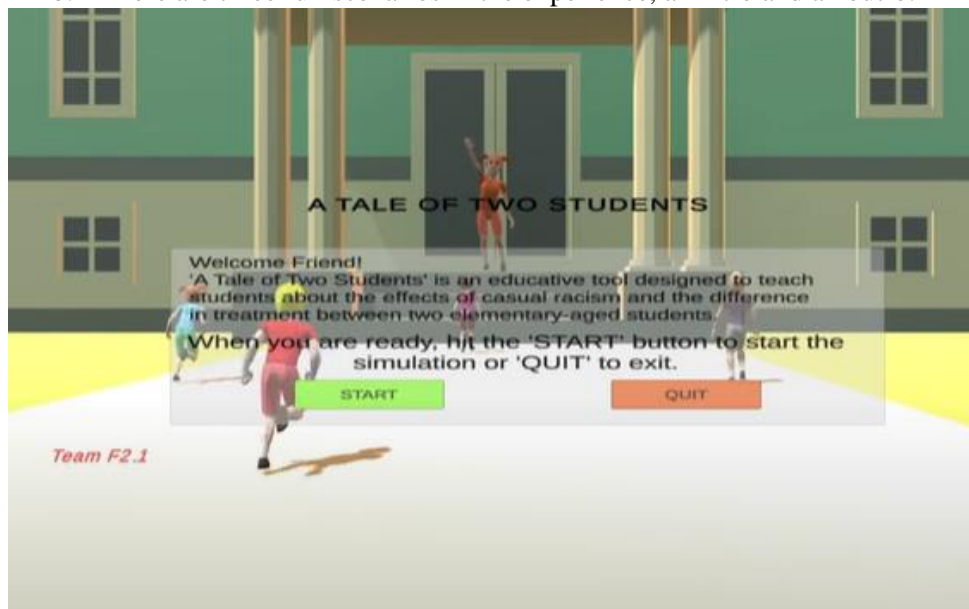
Figure 2: Intro Scene with Menu

5. This experience is fully immersive so one could interact with 'Game Objects' and move around as a first-person character. It is story based so the content comes from the narrative boxes.
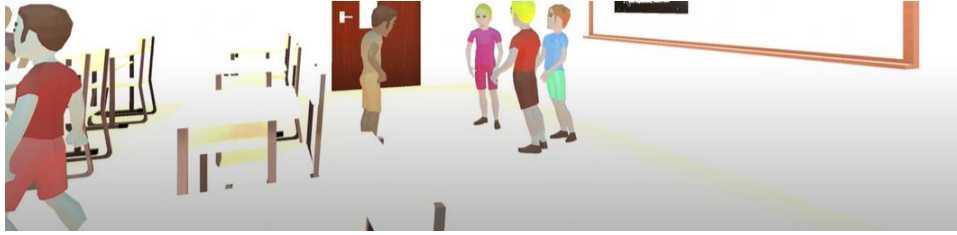
Figure 3: Wide Range FPS View

6. Click 'NEXT' button to navigate between dialogue.

Figure 4: Panel With 'NEXT' Button

   a. There will also be pop up options that will allow users to immerse themselves into the experience as well as influence the experience. Those clickable options further the story.
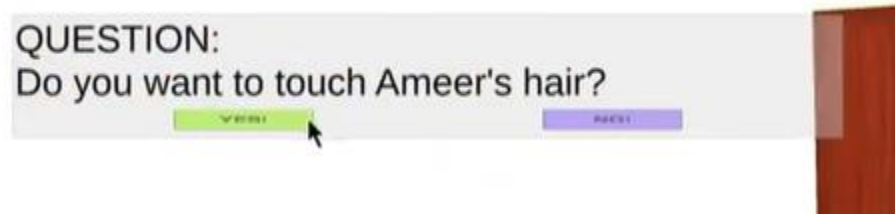
Figure 5: Decision Panel With 'YES' or 'NO'

7. Once the experience is complete, the final menu will show that will allow the user to 'QUIT' and leave the experience or 'RESTART' the experience which will take them back to the first menu.

Figure 6: Outro Scene with Menu

5 Troubleshooting & Support

Plenty of problems can become evident throughout the usage of a vr headset as a result of it being unique technology that many people do not have affinity for. These problems surround many error messages which can be fixed through maintenance of the headset or through the respective headset's support page.

5.1 Error Messages or Behaviors

Throughout using any type of technology, there are bound to be error messages or weird behaviour becoming problematic for the user. Most errors can be fixed by ironically restarting the headset or program itself. This will usually result in better results than most options. Furthermore, using the repair button either in the oculus program itself or the headset will iron out the internal problems of the program or odd behaviours that result from it.

5.2 Special Considerations

Some problems may not be possible to fix with simple restarts or internal repairs. This can be the result of a faulty headset or sensors. At this point, the best option would be to request a replacement for the faulty headset. If the warranty stands, oculus will be able to replace the headset after some time. On the other hand, if you are not under warranty, you may have to replace it manually or repair it through a potential third party.

5.3 Maintenance

Regular care and maintenance of the headset is a substantial way to minimize errors and faults. Simply, keeping the headset away from anything that can harm the lenses like direct sunlight or sharp objects can go a long way in keeping it fully functional. On another note, wiping the non-lens parts with anti-bacterial wipes can help it stay clean. To make sure the lenses are clean, you should wipe them down with any dry lens wipe.

5.4 Support

The main place to troubleshoot problems with your headset or program is to go to the respective support page or team. For oculus, you can find answers to many of your problems at: https://support.oculus.com/. While for our program, a direct email can be sent to our team so we can help you resolve your problem.

6 Product Documentation

Throughout the previous documents, our team has gone over many iterations of our product. While we were prototyping our experience, the changes were not too drastic for our documents. In this section, the latest version of our Bill of Materials, Equipment List, and Instructions will be shown. Also, we will be explaining the results of our final tests and their validation.

6.1 BOM

Figure 7: Complete Official Bill of Materials

6.2 Equipment List

Table 3: Total Equipment List with Units

Item:	Description:	Number of Units:	Source:

Computer and Console	To create, build, and test experience	5		Personal, uOttawa MakerSpace/MakerLab		
VR Headset and Equipment	To simulate experience	1		uOttawa MakerSpace/MakerLab		

6.3   Subsection of Prototype I:
6.3.1   BOM

Table 4: Budget and Bill of Materials for Prototype I

Items:	Description:	Quantity:	Budget:	Unit $:	Costs:	Remainder:
Unity Assets	Access to unique, 3D models and environments in the Unity software.		$50	Varies	~$40 (estimate)	$10 (estimate)
•	*Standard Assets (for Unity 2018.4)* https://assetstore.unity.com/packages/essentials/asset-packs/standard-assets-for-unity-2018-4-32351	1	|	$0	$0	$50
•	9T5 Low Poly Playground https://assetstore.unity.com/packages/3d/characters/9t5-low-poly-playground-102503	1	|	$0	$0	$50
•	Free Stylized Skybox https://assetstore.unity.com/packages/2d/textures-materials/sky/free-stylized-skybox-212257	1	|	$0	$0	$50
Source: https://assetstore.unity.com/						
Storyboard That	Access to storyboard creator website. (Build prototype 1.)	1 (Unit)	$0	$0	$0	$0

Source: **https://www.storyboardthat.com/purchase**						
Unity (Softwar e)	To design and construct the VR experience.	5 (Units)	$0	$0	$0	$0
Source: **https://unity.com/download**						
VR Headset	For testing the VR exp. (Provided)	1 (Unit)	$0	$0	$0	$0
Source: **MakerLab**						
Comput er/Cons ole	To produce and run VR exp. (Provided)	1 (Unit)	$0	$0	$0	$0
Source: **Personal and MakerLab**						
GitHub	Make repository, collaborate.	5 (Units)	$0	$0	$0	$0
Source: **https://github.com/**						
Unity to VR API	Integrate VR to experience.	1 (Unit)	$0	$0	$0	$0
Source: **https://docs.unity3d.com/Manual/VROverview.html**						
Total Budgeted:						$50.00
Total Product Costs Without Taxes + Shipping:						$40.00
Total Remainder:						$10.00
Total Product Costs with Taxes + Shipping:						$45.20

6.3.2   List of Equipment

Table 5: List of Equipment Used for Prototype I

Item:	Description:	Number of Units:	Source:
Computer and Console	To create, build, and test experience	5	Personal, uOttawa MakerSpace/MakerLab

6.3.3   Instructions to Build

1. After coming up with concept designs do a technical benchmarking and compare concept to results found.

Table 6: Technical Benchmarking Done for Concept Design and Prototype I

Specifications:	Equal Reality	Augmented (AR) and Virtual Reality (VR) Learning	Virtual Reality Inclusion Experience	Praxis Labs Virtual Reality-Based Diversity and Inclusion Learning Platform
Company	Equal Reality	GP Strategies Corporation	Development Dimensions International	Praxis Labs
Empathy (Main Goal):	Yes	No	Yes	Yes
Interactive:	Interact with other users/ decision making.	Interact with an immersive VR training environment.	Interact with other live users/speakers. *Character interactions*.	Interact with VR training environment. Receive feedback and recommendations from program.
Cost/Pricing:	Free demo but must make account to use full version. There are different types/levels of VR that costs different prices.	Pricing based on training package.	Pricing details are unavailable on page.	Pricing Based on training package (Either 6 month or 12-month option).
Accessibility:	Accessible on web browser without VR.	Only in workplace settings. Can use non-VR resources.	Request for virtual classroom version if VR is not plausible.	Accessible via web browser, smart phone, or VR.
Usage:	General Knowledge/Real World	Workplace Training	Workplace Training. Used to aide in generating	Workplace Training

				difficult conversations.	
VR Only? (Tech/Resource Type)	Blended or another option	Blended	VR or another option	Blended
Diversity/Inclusion Based? (Topics Covered)	Yes (Different Categories)	Yes (General), however it is only one of the many different training modules.	Yes (General)	Yes (General)
Customizable	Yes, and consumer can co-design.	Training material/content is customizable.	Yes, content and group discussion may be customizable.	Content is customizable and feedback is offered based on the users' culture of equity and inclusion.
User Feedback	Users highly recommend and consider it essential to create equal and accepting workplaces.	This company has been regarded as cutting edge and innovative. They are known for how their solutions have impacted the corporate world.	Praised and recognized for being innovative and is believed to be the change needed to improve the corporate world.	Users believed it helped dealing with difficult situations and difficult conversations.

2. Create a persona table and analyze the target audience as well as the users, the consumer, and the client.

Table 7: Persona Classification Table

Classification:	**Audience:**	**Stereotype:**	**Solution:**
Users	Children 4-10 years old	• Short attention spans. • Likes movement and quick motions. • Limited understanding of certain concepts. • Limited understanding of the technology they are using.	• Use bright, vibrant colours while being conscious of colour scheme. • Use movement and body language as well as objects and imagery to convey

		• Limited understanding of certain vocabulary. • Visual and interactive learners.	emotions, themes, etc. • Focus on early, basic, and foundational concepts. • Use clear and basic vocabulary and grammar in dialog. • Focus on themes and scenarios that the children may experience.
	Adults – Parents, teachers, instructors	• Not very tech-savvy. • Has difficulty using VR console and operating experience. • Stressed from having to take care of a lot of children. • Limited knowledge about various subjects pertaining to diversity and inclusivity.	• Friendly easy setup. • Allows for user independence. • Descriptive and detailed scenarios that open the door for conversations but does not need an explanation.
Consumer	Parents, teachers, instructors, schools, community centres, learning centres and establishments, daycare	• Wants something accessible. • Wants something educational. • Wants something versatile that could be used in more than one circumstance. • Wants something that engages the audience.	• Educational experience. • Broad age range. Maybe used for all ages in elementary schools. • Interactivity allows for students to make decisions in the class.
Client	Hanan Anis	• Garners empathy from VR user. • Uses VR. • Focuses on one or more of the themes. • Passionate about equity, diversity, and inclusion.	• VR experience. • Focuses on empathy. • Main theme is race.

3. Create a plan for the experience. *(See example below)*

Storyboard Concept:

The story will focus on an elementary school and display the nuances of both intentional and unintentional racism within a familiar childhood setting.

Name Of Experience:
A Tale of Two Students
Character Ages:
General elementary school age children. (Ex. Students in and around 3rd grade.)
Settings:
Playground, gym, daycare, classroom.
Total length of experience:
5-10 minutes.
Themes:
Race
Contrast, treatment. (May include minor offence and infractions.)

4. Write a full cohesive script that would resonate with target audience. (See. Appendix I: Scenes and Scripts).
5. Create a storyboard using 'The Storyboard That'.
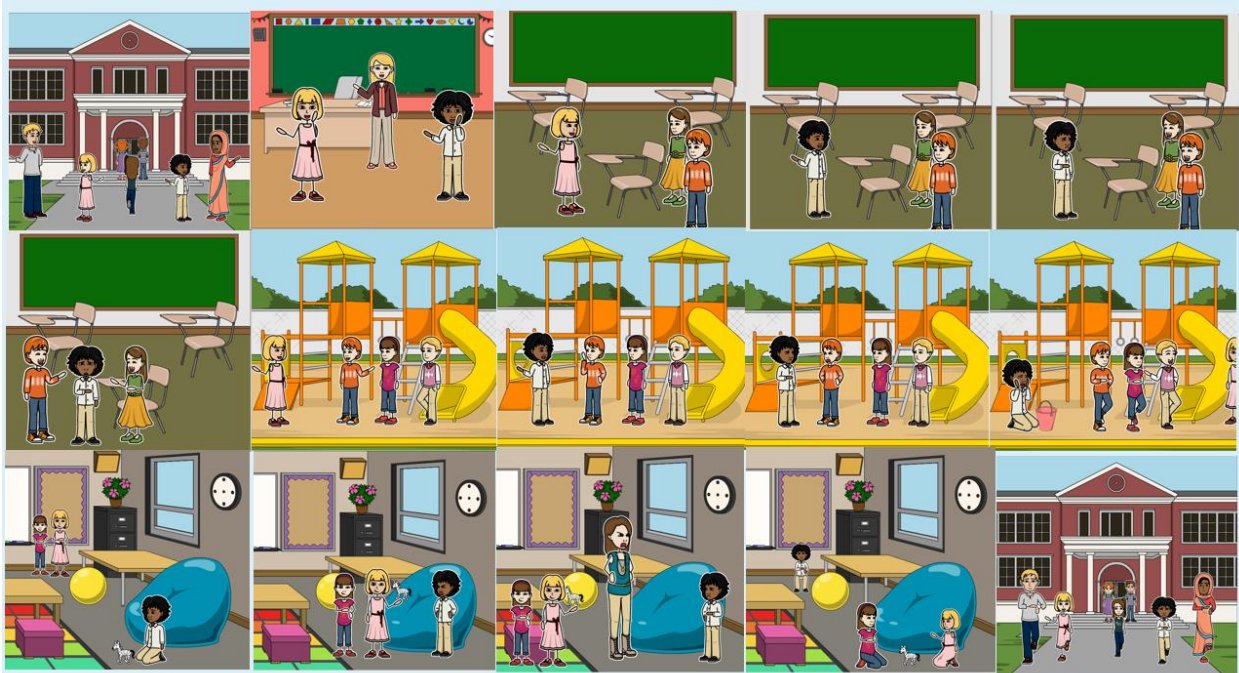
Figure 8: Collage of 15-Panel Storyboard

6. Using Unity, implement scene 2.
    a. The setting is *9T5 Low Poly Playground*. Apply the Demo Scene.
        i. This scene comes with models. They will need to be reposition and recolored using the inspect element and materials that come with the pack.
    b. Add FPS from *Standard Assets (for Unity 2018.4)*. This may need to be repositioned and rescaled.
    c. Add dialogue and buttons using game object features the canvas features and Textmeshpro from Unity. For this prototype the buttons do not have to be functional.
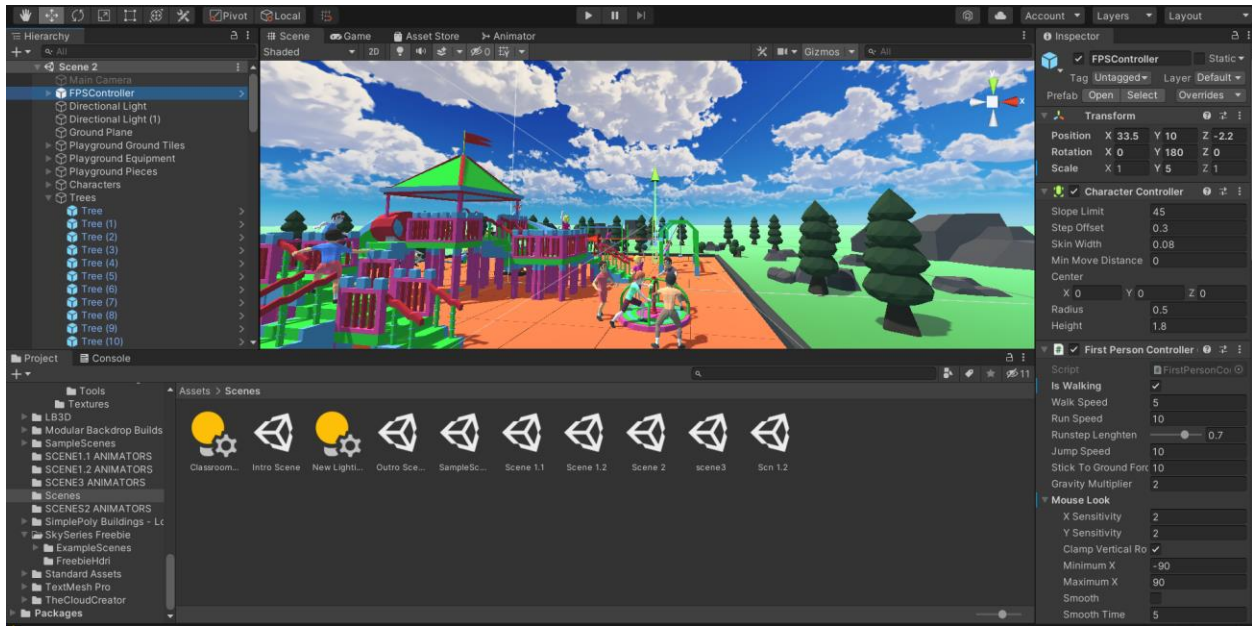
Figure 9: Screenshot of Unity Build Display (including Package Manager, FPS, and Inspector)

6.4   Testing and Validation

This section will detail each prototype as well as the testing that was done for each prototype as well as detail the feedback received, and changes made to ensure the success of the product.

Table 8: Project Plan and Risks

Risks:	What this risk applies to:	How this can be avoided or solved:

While experiencing certain scenarios/storylines, our client(s) may find the situation to emotional causing a bad reaction. In other words, the scenario may hit too close to home.	This risk applies to the emotional side of our clients because depending on the person and their past related to the themes at hand, it may affect them in a variety of ways.	Fixtures may include:
		
		- A quick and easy questionnaire/survey before the client begins their experience
		   ▪ This will allow us or the system to guide the user on what scenario(s) fit best for them.
		- Provide the user with the overall theme on what may or will occur throughout the ensuing storylines.
		   ▪ This provides a pre-emptive warning which will allow the user to decide whether or not the storyline is right for them.
		- Have a group member follow closely with the users choices and reactions (body language, facial expressions, etc.)
		- Create checkpoints.
		   ▪ This will allow group members to check in on the user and see if they are well off to continue.

The user/client may possibly hurt themselves while immersed in the VR experience.	This risk applies to the physical side of our clients. It is up to us to create and safe, usable, and easily accessible environment for the user(s).	Fixtures may include: - Ensure there is a sufficient amount of area surrounding the user. - *View Deliverable C – Target Specifications for (recommend) exact info* - Ensure the users surroundings are clear enough so that nothing can be tripped on or hit. - Provide the client with a basic lesson on how to use/play with V.R. - Always have a group member follow closely with both the screen and the users in person movements.
Our group could waste budget money on assets we do not necessarily need.	This risk applies to our group and the project as it may become very time consuming and lead to wasteful purchases	Although there is no 100% effective way to see if the asset works for us and our project; Fixtures may include: - Before any purchases are made research on past uses and other possible solutions will take place. - Research may include: websites, YouTube videos, reaching out to past groups (successful and un-successful) - This will then set our group up to have a conversation and take a team vote on what is the best route for us.
The program / experience created, may be too complicated for our clients to use. Either scenarios being too complicated for the children; or the setup to complicated for the parent or guardian.	This risk applies to all users as an over complicated program / storyline may lead to less overall usage by the public. It may also cause a misunderstanding between the scenarios purpose and user.	Fixtures may include: - Over the course of prototyping, programming and scenarios created will be tested on different age groups. - Adjustments will be made depending on reactions from users. - Similar to the second risk, the client will be provided with a basic lesson on how to use/play with V.R.

Table 9: Prototyping Test Plans

Test ID	Test Objective	Description of Prototype used and Basic Test Method	Description of Results to be recorded and how these results will be used	Estimate test duration and planned start date
1	To determine whether the code runs correctly in	This test will likely be repeated for each prototype we create, however will largely be targeted towards the first prototype. To perform the test, we will enter the code we have	We will record if certain parts of the code don't work. These results will allow us to then focus on these parts and fix them until the game runs.	This test will take place March 5th. The duration of this task should not be very long, however the time associated

		the Unity Software	written into Unity Software game. Then, we can run the 'game' and see whether issues arise.		with fixing any issues that arise will be determined after the test takes place.
2		Verifying Feasibility	This test will use prototype 1. This test will measure the complexity of the work remaining, as well as the complexity of tasks we would like to include. In order to test this, we will benchmark and look at similar products, and determine the experience and length of time needed to complete them. This will allow for a general idea of the feasibility of our project.	Results we will record will be details and areas of uncertainty among certain systems, such as the environment, movement with 3D models, as well as the option for different choices once in the environment. We can then compare these difficulties to the similar products we have benchmarked, and we will then determine whether the tasks are feasible.	This test will take place between March 1st and March 5th. The duration of this task will be approximately 2 hours, as there is necessary benchmarking.
3		To determine whether the dialogue system works	This test will measure whether the dialogue system will function. To conduct this test, we will enter the Unity game, and we will record the amount of time it takes for each dialogue system, as well as whether the system itself runs correctly.	This test will allow us to record the efficiency of the dialogue system. It will allow us to measure the length of time certain dialogue is presented, as well as allow us to determine whether the dialogue system functions. With this feedback, we may be able to determine whether we need to edit our dialogue system to allow for a more reliable use.	This test will take place between March 1st and March 5th. The duration of this task is approximately 10 minutes, however the time associated with fixing any issues that arise will depend on its complexity.

6.4.1   Prototype I:

Table 10: Prototype I – Critical Components

Components	Cost	Importance (1-5)	Feasibility

3D Models	0-50$	The importance of 3D models is high, considering the scenario which we are planning to present will incorporate two children, and so **our team has given it an importance of 5.**	The incorporation of 3D models will carry issues when we attempt to demonstrate emotions and expressions for the models. Our team will learn how to incorporate these actions into the scene.
Dialogue System	0$	**Our team has given the dialogue system an importance of 3,** as we will still be able to create a scene without this system. However, this system will heavily improve the quality of the scene.	The incorporation of a dialogue system in Unity should not be too difficult, as the dialogue will only be text. There are many online resources which demonstrate how to incorporate this system into Unity, and so our team believes this component will not prove too difficult.
Scenery and Background	0$	**The importance of the scenery and background has been given an importance of 4.** This is due to the fact that the scene which we plan to present would ideally take place at a playground. The game will still be able to run if there is not a proper background, however we believe the playground scenery will cater towards the child-like perspective.	The incorporation of a playground type scenery should not present too many challenges. This is because we have found free playground scenery's in the Unity asset store, which we can easily incorporate into our game.

Goal: To test whether the story was palpable and basic Unity implementation.

Accomplished and Tested: A full script was written, a full 15 panel story board was created using 'The Storyboard That' (See Figure X), Scene 2 (playground scene) was implemented into Unity as a bystander FPS demo without functioning Game Objects and animation, partial dialogue implemented to Unity.

Results: Successful results as this was presented to the client. Changes needed to be made to the script, and the original plan of having speech bubbles was omitted and changed to a narration panel. 'NEXT' buttons were decided as the primary tool of narration navigation and scene manipulation. Omitted use of event colliders to begin scenes.

Feedback: Having more bystander options to immerse the user into the experience, keeping the script simpler for children, add more features to help children feel empathy.

Figure 10: Prototype I Demo Scene

6.4.2 Prototype II:

Table 11: Prototype II Critical Components

Components	Cost	Importance (1-5)	Feasibility
3D Models	$6	The importance of 3D models is high, considering the scenario which we are planning to present will incorporate two children, and so **our team has given it an importance of 5.**	The incorporation of 3D models will carry issues when we attempt to demonstrate emotions and expressions for the models. Our team will learn how to incorporate these actions into the scene.
Dialogue System	$0	**Our team has given the dialogue system an importance of 3,** as we will still be able to create a scene without this system. However, this system will heavily improve the quality of the scene.	The incorporation of a dialogue system in Unity should not be too difficult, as the dialogue will only be text. There are many online resources which demonstrate how to incorporate this system into Unity, and so our team believes this component will not prove too difficult.
Scenery and Background	$18	**The importance of the scenery and background has been given an importance of 4.** This is due to the fact that the scene which we plan to present would ideally take place at a playground. The game will still be	The incorporation of a playground type scenery should not present too many challenges. This is because we have found free playground scenery's in the Unity

	able to run if there is not a proper background, however we believe the playground scenery will cater towards the child-like perspective.	asset store, which we can easily incorporate into our game.
Creation of a Second Scene	$0	**Our team has given the creation of a second scene an importance of 5.** We have decided to do this as we would like our game to offer multiple experiences as to convey to the user the idea that racism can be present in any situation, and that it takes many different forms.	The creation of a second scene should not prove too difficult for our team considering we know have the base knowledge after creating scene 1. There are many online resources we can take advantage of if we need to.
Integration of Colliders and Triggers	$0	**Our team has given the integration of colliders an importance of 3.** We would like to implement this feature in this prototype as colliders will allow for the objects in the game to have physical collisions, and triggers will trigger events to happen when objects intersect/collide.	Our team is aware of the difficulties associated with implementing this feature, and so we are aware of the possibility of this feature being included in Prototype 3. However, we are working to implement a relatively simple portion of this feature into Prototype 2, so that we are able to develop it further in time for Prototype 3.

Table 12: Prototype II - Target Specifications

	Difficulty for User	Weight	Dimensions	Number of Items	Peripherals
Empathy (Main Goal):	N/A	N/A	N/A	N/A	N/A
Interactive environment:	2 minutes (Depends on user to set up local space)	N/A	Room-Scale: (Recommended Minimum) 6.56 x 4.9' / 2 x 1.5 m Any Chair in play environment	Minimum 2	N/A

Cost/Pricing:	N/A	1.55 pounds (HTC Vive Cosmos) 1.1 pounds (Oculus Quest 2)	(HTC Vive Cosmos) Box Dimension: 21 x 12.5 x 8" (Oculus Quest 2) Box Dimension: 17 x 7.6 x 5"	Minimum 2 items (Computer, vr headset, and vr peripherals required)	Vr compatible computer (Minimum $1299) Minimum $1000 for HTC Vive Cosmos headset Minimum $459 for Oculus Quest 2
Accessibility:	Easy to use for ages 7+	Any weight	Room-Scale: (Recommended Minimum) 6.56 x 4.9' / 2 x 1.5 m Any chair in play environment	Minimum 3 items (Computer, vr headset, and vr peripherals required)	Accommodations for personal user needs Examples: wheelchairs, chairs, custom controllers, etc...)
Usage:	N/A	N/A	N/A	N/A	Work based background

VR Only:	2 weeks average to get used to VR	N/A	N/A	N/A	Accommodations for personal user needs Examples: prescription lenses, batteries, glasses divider, etc.) Cost: $9 for divider (Oculus Quest 2) $96 for lenses $17 for AA batteries
Diversity / Inclusion Based:	N/A	N/A	N/A	N/A	N/A
Customizable:	Simple to customize VR gear Unable to customize our product	N/A	Room Dimensions	N/A	Storage (128GB or 256GB for Oculus Quest 2)

Goal: To test whether the animation, dialogue, user interface and user experience, scene settings, and full scene implementation on Unity.

Accomplished and Tested: Tested various animation and user interface and experience formats. Built out scenes with various settings and positioned characters in the ideal location.

Results: Omitted using facial expression as a source of empathy as the facial expression are unchangeable with the current model being used. Decide to use translucent panel on canvas for UX as it did not obstruct the experience. Fully built all scenes without dialogue, partial animation, non-functioning Game Objects. Omitted characters being able to change coordinate positions via animation.

Feedback: Add more features to garner empathy, make it simpler for kids.

Table 13: Prototype II Test Plans

TEST ID	TEST OBJECTIVE (why)	DESCRIPTION OF PROTOTYPE USED AND OF BASIC TEST METHOD (what)	DESCRIPTION OF RESULTS TO BE RECORDED AND HOW THESE RESULTS WILL BE USED (how)	ESTIMATED TEST DURATION AND PLANNED START DATE (when)
1	Adjustment of prototype 1 – scene	Unity / scene script Depending on equipment and place of tests a full VR (Virtual Reality) test or script read through will take place	Results to be recorded: - what clients/testers took away from the scene (in terms of what they learned) - How it affected clients/testers physically and emotionally How they will be used: - Depending on how and what our testers took away from our first scene; user's & or A. I's response will be altered. - Similarly, if the tester is physically or emotionally touched in an unwanted way – changes will be made to ensure no future problems occur.	March 7th – 13th
2	Creation of prototype 2 – additional scene(s)	Unity scene(s) Once completed group members will mainly test out V.R scene for functionality (if it all runs smoothly).	Results to be recorded: - Take into account prototype 1's results as they will be useful whilst making the new scene - How we as a group feel our audience should respond to the new scene(s) created. How they will be used:	March 13th – 15th

			- Predicting what we think should happen will aid in making better, more well approached changes after client testing	
3	Integrate Dialogue System	Unity Scene Our team will attempt to assemble a dialogue system within the Unity game. Once this has been set up, we will test the functionality of the system.	Results to be recorded: - We will check whether this system is functional while in game by having a user attempt different actions where dialogue is involved. - We will record areas which demonstrate poor functionality. How they will be used: - With the results of the tests we have run, we will determine the areas in which the dialogue needs to be upgraded or changed to enable for a better experience.	March 8th – 15th
4	Upgrade Background and Scenery	Unity Scene(s) Our team will further improve the background and scenery in which the game will take this. This includes the creation of the background which the second scene will take place in.	Results to be recorded: - We will record areas in scene 1 which could be improved. - We will record the feedback provided by our partner regarding scenery and background. How they will be used: - We will improve the scenery for scene 1, as well as construct the scenery for scene 2.	March 8th – 15th

Figure 11: Prototype II Animation Test 1

Figure 12: Prototype II Sample Classroom Scene
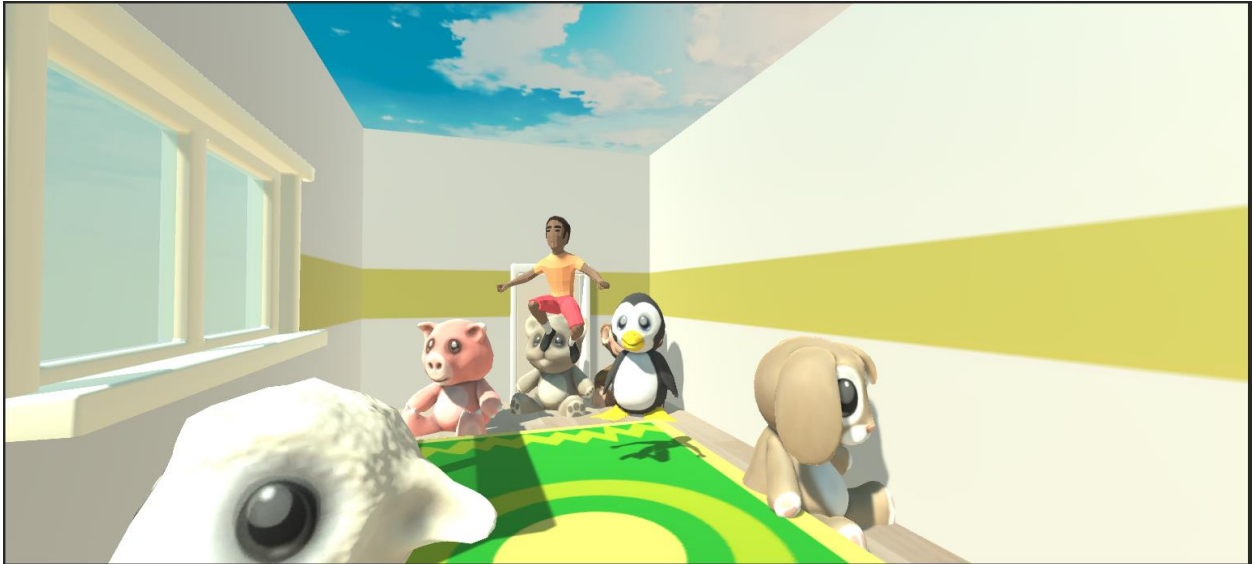
Figure 13: Prototype II Sample Daycare Scene and Animation Test 2

Figure 14: Prototype II Sample Classroom Scene 2 and Animation Test 3

6.4.3   Prototype III:

Table 14: Prototype III Critical Components

Components	Cost	Importance (1-5)	Feasibility
3D Models	$6	The importance of 3D models is high, considering the scenario which we are planning to present will incorporate two children, and so **our**	The incorporation of 3D models will carry issues when we attempt to demonstrate emotions and expressions for the models. Our

		team has given it an importance of 5.	team will learn how to incorporate these actions into the scene.
Dialogue System	$0	**Our team has given the dialogue system an importance of 3,** as we will still be able to create a scene without this system. However, this system will heavily improve the quality of the scene.	The incorporation of a dialogue system in Unity should not be too difficult, as the dialogue will only be text. There are many online resources which demonstrate how to incorporate this system into Unity, and so our team believes this component will not prove too difficult.
Scenery and Background	$18	**The importance of the scenery and background has been given an importance of 4.** This is because the scene which we plan to present would ideally take place at a playground. The game will still be able to run if there is not a proper background, however we believe the playground scenery will cater towards the child-like perspective.	The incorporation of a playground type scenery should not present too many challenges. This is because we have found free playground sceneries in the Unity asset store, which we can easily incorporate into our game.
Creation of a Second Scene	$0	**Our team has given the creation of a second scene an importance of 5.** We have decided to do this as we would like our game to offer multiple experiences as to convey to the user the idea that racism can be present in any situation, and that it takes many different forms.	The creation of a second scene should not prove too difficult for our team considering we know have the base knowledge after creating scene 1. There are many online resources we can take advantage of if we need to.
Integration of Colliders and Triggers	$0	**Our team has given the integration of colliders an importance of 3.** We would like to implement this feature in this prototype as colliders will allow for the objects in the game to have physical collisions, and triggers will trigger events to happen when objects intersect/collide.	Our team is aware of the difficulties associated with implementing this feature, and so we are aware of the possibility of this feature being included in Prototype 3. However, we are working to implement a relatively simple portion of this feature into Prototype 2, so that we are able to develop it further in time for Prototype 3.

Table 15: Prototype III - Target Specifications

	Difficulty for User	Weight	Dimensions	Number of Items	Peripherals
Empathy (Main Goal):	N/A	N/A	N/A	N/A	N/A
Interactive environment:	2 minutes (Depends on user to set up local space)	N/A	Room-Scale: (Recommended Minimum) 6.56 x 4.9' / 2 x 1.5 m Any Chair in play environment	Minimum 2	N/A
Cost/Pricing:	N/A	1.55 pounds (HTC Vive Cosmos) 1.1 pounds (Oculus Quest 2)	(HTC Vive Cosmos) Box Dimension: 21 x 12.5 x 8" (Oculus Quest 2) Box Dimension: 17 x 7.6 x 5"	Minimum 2 items (Computer, vr headset, and vr peripherals required)	Vr compatible computer (Minimum $1299) Minimum $1000 for HTC Vive Cosmos headset Minimum $459 for Oculus Quest 2
Accessibility:	Easy to use for ages 7+	Any weight	Room-Scale: (Recommended Minimum) 6.56 x 4.9' / 2 x 1.5 m	Minimum 3 items (Computer, vr headset, and vr	Accommodations for personal user needs Examples: wheelchairs, chairs,

			Any chair in play environment	peripherals required)	custom controllers, etc...)
Usage:	N/A	N/A	N/A	N/A	Work based background
VR Only:	2 weeks average for a person to get used to VR	N/A	N/A	N/A	Accommodations for personal user needs Examples: prescription lenses, batteries, glasses divider, etc.) Cost: $9 for divider (Oculus Quest 2) $96 for lenses $17 for AA batteries
Diversity / Inclusion Based:	N/A	N/A	N/A	N/A	N/A
Customizable:	Simple to customize VR gear Unable to customize our product	N/A	Room Dimensions	N/A	Storage (128GB or 256GB for Oculus Quest 2 – Comes with headset)

Goal: Full implantation of all scenes and animations, fully functioning Game Objects implementation, full dialogue implementation, cleaned up user interface and experience, full animation, VR implantation, App implementation.

Accomplished and Tested: Fully functioning Game Object implementation (buttons, FPS, scene change), full dialogue and decision narrative system implementation, full animation implementation, app implementation.

Results: Due to unforeseen events and lack of resources, we were unable to fully implement the experience to VR, however, it is VR compatible. Prototype was fully functional and ready for final client meeting presentation. Increased the user age from four years old to seven due to extensive changes.

Feedback: Add more languages and accessibility options for users.

Table 16: Prototype III Test Plans

TEST ID	TEST OBJECTIVE (why)	DESCRIPTION OF PROTOTYPE USED AND OF BASIC TEST METHOD (what)	DESCRIPTION OF RESULTS TO BE RECORDED AND HOW THESE RESULTS WILL BE USED (how)	ESTIMATED TEST DURATION AND PLANNED START DATE (when)
1	Adjustment of prototype 2 – scene 2, dialogue, animation, intro, outro	Unity, scene script Unity walk through or script read through will take place.	Results to be recorded: - what clients/testers took away from the scene (in terms of what they learned) - How it affected clients/testers physically and emotionally - How engaged were clients with new dialogue and animation - Did clients feel animation and dialogue felt realistic How they will be used: - Depending on all results taken above changes to scene 2, dialogue and or animation will be made to best accommodate our overall goal and our clients overall needs.	March 14th – 20th

| 2 | Creation of scene 3 | Unity scene with updated dialogue / animation

Once completed group members will mainly test out unity scene for functionality (if it all runs smoothly).

If all is run smoothly clients will also test to dialogue and animation within experience. | Results to be recorded:

- Take into account prototype 2's results as they will be useful whilst making new scene
- How we as a group feel our audience should respond to new scene – its dialogue and animation
- Did clients feel the dialogue and animation was realistic

How they will be used:

- Predicting what we think should happen will aid in making better, more well approached changes after client testing
- Depending on client reviews dialogue and animation may or may not be changed to best accommodate their and our needs. | March

18th - 20th |
| 3 | Implementing V.R | Implement all unity scenes into a useable V.R experience. | Results to be recorded:

- Do our unity scenes run smoothly and with ease on V.R
- Is it relatively easy to use (as children will be our main clients)

How they will be used: | March

14th – 27th |

			- If our group deems easy and smooth to use, we will move to client and user testing --- If not changes will be made - Depending on client results changes may or may not be made as well.	

Figure 15: Prototype III Classroom Scene Sample

Figure 16: Prototype III Playground Scene Sample

Figure 17: Prototype III Daycare Scene Sample

See *(4.1: User Instructions)* for more figures of completed product. ***

7   Conclusions and Recommendations for Future Word

While using the design thinking process, this product was developed while considering the client's needs. Instead of making a product used for the office like most existing products, this product is made for children to garner empathy on issues with racism. The product is intended to be distributed in schools for students to use. Parents are also able to purchase the product as well.

The lessons learnt is that there is a lot more skills associated with teamwork than expected. We needed to learn time management, communication, and conflict management. Our team as always shown great time management skills as we always handed in our work on time. We did this by assigning different tasks to members and giving deadlines for each task. Wrike was a big help in organizing all this. Communication is something that our team took time to improve on. During the process in creating this product, we were progressively getting more comfortable expressing our opinions and ideas. Also, asking for help when we need has helped us to learn more from each other and waste less time. Our team as not faced very many conflicts but with the very few that we have, our solution would be to ask for all team members opinions of the conflict. Then decided as a team what solution would work best.

If our team had more time, we would add more audio. All the script is only written in text so maybe we can add audio for the dialogue. This can keep the children more engaged, and it will help them understand the situation better. The different pitches and tones in the voiceovers will also show some emotion. Also, we would like to add more facial expressions to the characters. This was out of budget, but it will add a more obvious indication of the different emotions for the kids to understand quicker. Since garnering empathy is the goal of this product, anything that show as much emotion to the user will greatly help.

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Appendices

9   Appendix I: Scenes and Scripts:

This is just the first rough draft of the script.

The user is an (uncharacterized) student of the class, and they can directly interact with the characters and make decisions about the progression of the story.

> **Legend:**
>
> *** is *Transition*
>
> ~~~ is *User Decision options*
>
> *Ameer: Racialized New Student*
>
> *Ariana: Non-racialized New Student*

9.1   Intro: Outside of School

Fades in from white

First day of school sees the return of previous students at the school after summer break, as well as two new students. This school is a predominantly white institution however, there are other students of colour around the school. This class has been together for 3 years already (since the 1st grade.)

Ameer: Student of colour who moved in from another country.

Ariana: White student who moved in from another country.

Both students enter the building after bidding their respective family's farewell.

They both join their classmates as they enter the school with clean slates, and they have virtually the exact same entrance.

~~~User has one clickable option. "Enter School."

Fade out to black

Figure 18: Appendix - Scenes and Scripts Storyboard Panel 1

9.2 Scene 1: Classroom

Fades in from white

New students are being introduced by the teacher. After class is over and during a break time, the students begin to mingle with each other. Ariana is treated his classmates are treated. Ameer is asked invasive and inappropriate questions about themselves and their lives. Ameer also experiences a barrage of inappropriate jokes and comments. Ariana is welcomed into the school and isn't being violated by the others.

Teacher: "Welcome back, we have some new faces this year."

Ameer: "Hello, my family is from South Asia and East Africa. My name is Ameer."

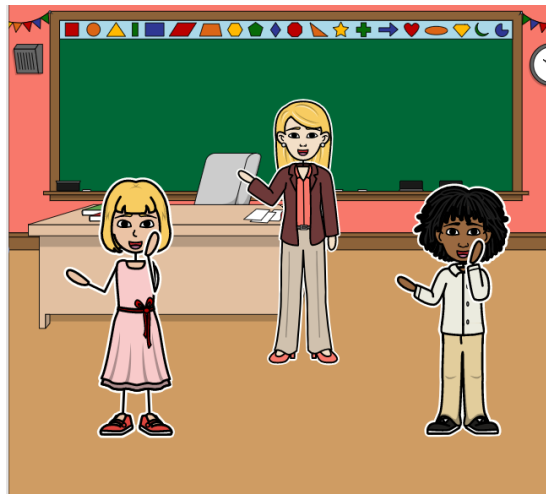Ariana: "Hi my name is Ariana. My family is from Southern Europe."

Figure 19: Appendix - Scenes and Scripts Storyboard Panel 2

Fades out then fades back in to indicate time skip

Ariana is getting asked about their experiences in their home country. All the classmates gush about how cool Ariana is and how much fun they plan on having with them.

Figure 20: Appendix - Scenes and Scripts Storyboard Panel 3

Figure 21: Appendix - Scenes and Scripts Storyboard Panel 4

Classmate 2: "Wow so your name is Ameer, that is a strange name." They give a laugh before moving on.

Classmate 3: "Yea, Ariana has a cool normal name, but yours is just weird."

Ameer feels uncomfortable by the statement.

~~~ User has two clickable options for the following prompt. "Do you think Ameers name is funny?"

~~~ Option 1: "No."

~~~ You: "That is not very nice to say about someone's name."

~~~ System: 'Ameer has appreciated that answer.'

~~~ Option 2: "Yes."

~~~ You: "Hahahahahahahhahahhahhahahahahhhhahhahahahhahhhahhahah. It is pretty funny."

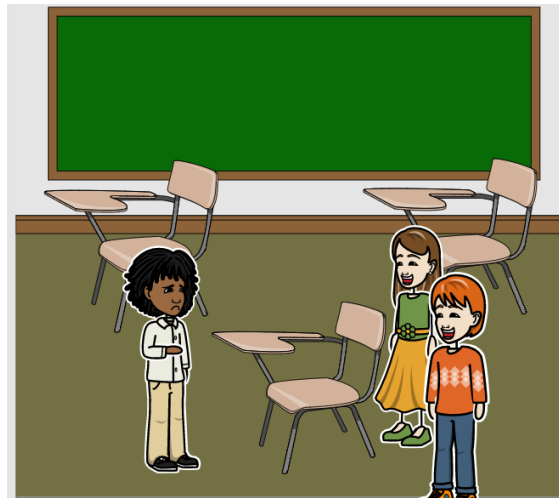~~~ System: 'Ameer is hurt by that answer.'

Figure 22: Appendix - Scenes and Scripts Storyboard Panel 5

Classmate 2: "Hey your accent is funny. Why do you pronounce things like that? And your hair is so different."

Classmate 3: "Let me touch the hair!"

Ameer: "No, I don't feel comfortable if you do that."

Classmate 3 and Classmate 2 start trying to touch Ameer's hair. Ameer starts trying to avoid them, but they keep picking at him and making him uncomfortable.

~~~ User has two clickable options for the following prompt. "Should you touch Ameers hair?"

~~~ Option 1: "No."

~~~ You: "You shouldn't touch anyone without their permission."

~~~ System: 'Ameer has appreciated that answer.'

~~~ Option 2: "Yes."

~~~ You: "I want to touch it to."
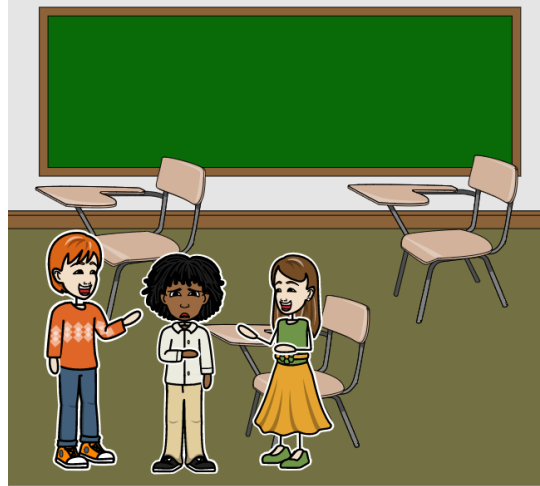
~~~ System: 'Ameer is hurt by that answer.'

Figure 23: Appendix - Scenes and Scripts Storyboard Panel 6

Ameer flees the situation

Fades out to black

9.3   Scene 2: Playground

Fade in from white

All the students are at the playground for recess. Ariana is invited to play games with the other students. Ameer is excluded under the assumption that he doesn't know the rules and that he would probably steal their toys.
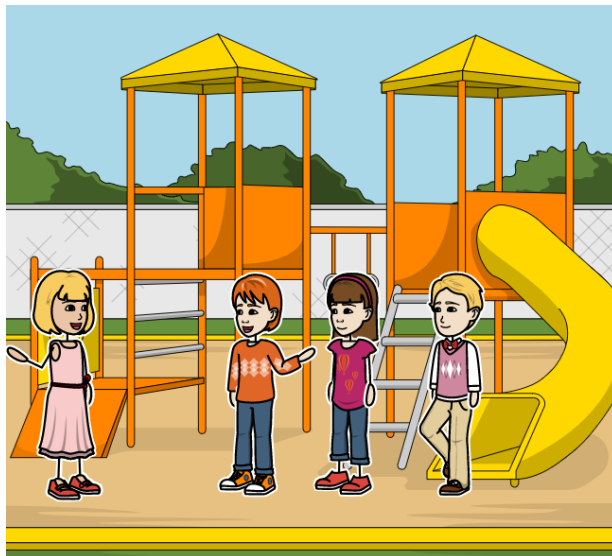

Figure 24: Appendix - Scenes and Scripts Storyboard Panel 7

Ariana has all the attention on him as the novelty of his entrance has not worn off yet. Ameer is being ignored by some students, though he did get a few courtesy interactions.

Ameer properly introduces himself and asks other students to play.

Some students are okay with it, other students are not.

Classmate 1: "Sure, you can."

Some classmates agree, no one outwardly stands up for them though.

Figure 25: Appendix - Scenes and Scripts Storyboard Panel 8

Classmate 2: "No, you can't play with us! They don't play this game where you are from."

Ameer: "I can try to learn the rules."

Classmate 3: "My mom told me that people like you don't know how to share, and that you play too rough."

Classmate 4: "Yea, my brother said you would probably break and steal our toys if we invited you to play with us all the time."

Classmate 2: "We are not allowed to play with you."

Figure 26: Appendix - Scenes and Scripts Storyboard Panel 9

Other classmates start to agree.

~~~ User has two clickable options for the following prompt. "Would you like Ameer to join?"

~~~ Option 1: "Yes."

~~~ You: "Sure, Ameer can play with us!"

~~~ System: 'Ameer has appreciated that answer.'

~~~ Option 2: "No."

~~~ You: "You heard them; we don't want to play with you."

~~~ System: 'Ameer is hurt by that answer.'

Classmate 2: "We only want Ariana to play with us."

Classmate 3: "I bet Ariana knows all the cool games from their country."

The group of students leave and Ameer behind in search of Ariana.

Ameer plays by himself in the sand with a bucket.

Figure 27: Appendix - Scenes and Scripts Storyboard Panel 10

Fades out to black

9.4   Scene 3: Daycare
Fades in from white

Ameer has their boundaries disrespected. When they try to fight back against it, they are punished and used as an example. The other student who began the altercation (Classmate 2 and Ariana) do not get punished and instead get a warning. The staff member who punished Ameer does not believe them and makes assumptions about the students involved.

Figure 28: Appendix - Scenes and Scripts Storyboard Panel 11

Ameer is playing with a toy that they found in the corner.

Other classmates see this, and they want to play with it as well.

Classmate 2: "Hey we want to play with that. Give it here!"

~~~ User has two clickable options for the following prompt. "Would you like to take the toy away from Ameer?"

~~~ Option 1: "No."

~~~ You: "It's not alright to take things from other people."

~~~ System: 'Ameer has appreciated that answer.'

~~~ Option 2: "Yes."

~~~ You: "We want to play with it now!"

~~~ System: 'Ameer is hurt by that answer.'

Classmate 2 snatches toy from Ameers hand.

Ameer: "Hey I was playing with that."

Ariana: "Now we are playing with it."

Figure 29: Appendix - Scenes and Scripts Storyboard Panel 12

Ameer starts to cry and fight back. The guardian sees and starts to come over.

Daycare Worker: "What is going on over here?"

Ariana: "He started this."

Ameer: "That's not true, I had the toy first."

Classmate 2: "Of course he is going to lie when he gets caught."

Figure 30: Appendix - Scenes and Scripts Storyboard Panel 13

~~~ User has two clickable options for the following prompt. "Did Ameer lie?"

~~~ Option 1: "No."

~~~ You: "We wanted the toy, and we took it from them."

~~~ System: 'Ameer has appreciated that answer.'

~~~ Option 2: "Yes."

~~~ You: "He stole it from us. He's been hogging it all day"

~~~ System: 'Ameer is hurt by that answer.'

Daycare Worker: "In any case, Ameer, you need to learn how to share. In this country we do not keep things away from our classmates."

Ameer: "But I-"

Daycare Worker: "No buts. Until you learn to share, you cannot use any of our toys, and you will sit with me for the remainder of the day. I will be advising your parents to teach you some manners."

Daycare Worker: "I will give a warning to the rest of you. You can go back to playing, but I don't want to see that happen again.

Figure 31: Appendix - Scenes and Scripts Storyboard Panel 14

Fades out to black

9.5   Outro: Children getting ready to get picked up.
Fades in from white

You can clearly see the distraught expression on each student's face. One had a welcomed day while the other is sad because he was being picked on and bullied by the other student and even some staff members who made them feel uncomfortable.

User witnesses Ameer crying to their mom about how bad of a day they had at school. Ariana is laughing and smiling with their dad gushing about how good of a day they had a school.

Figure 32: Appendix - Scenes and Scripts Storyboard Panel 15