GNG2101

Design Project Progress Update

<GROUP NAME AND B 3.2>

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University of Ottawa

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List of Acronyms and Glossary

Table 1. Acronyms

Acronym	Definition
SEDTI	School of Engineering Design and Teaching Innovation
EDI	Equity, Diversity, Inclusion
VR	Virtual Reality

Table 2. Glossary

Term	Acronym	Definition

1 Introduction

Our team was tasked with designing and creating an immersive virtual reality (VR) experience that provides an opportunity for individuals to experience the perspective of someone living with a disability. This tool was created to improve inclusivity by promoting empathy regarding disabilities. Allowing participants to understand another's point of view by demonstrating implicit bias through VR will prove to be educational. Our use of VR will immerse users in a unique, hands-on manner to foster inclusion and introspection.

2 Business Model Canvas and DFX

Business model and sustainability report

<table>
<tr>
<td rowspan="2">Key Partners

• Meta,
• Microsoft
• Samsung
• Apple
• Unity (3)</td>
<td>Key Activities

computer, headset, sensors, software, audio system (2)</td>
<td rowspan="2">Value

Proposition

Improving inclusivity by promoting empathy regarding disabilities.

Allowing individuals to experience living with a disability will provide a new perspective.</td>
<td>Customer Relationships

Personal relationship through uOttawa

Online/social media</td>
<td rowspan="2">Customer Segments

The client: SEDTI

Schools

People and organizations associated with EDI</td>
</tr>
<tr>
<td>Key Resources

Sensory feedback, interactivity

Virtual world (1)</td>
<td>Channels

Direct sales

Through the client

Online sales</td>
</tr>
<tr>
<td colspan="3">Cost Structure

Marketing costs; Project development; General and administrative; Licencing (software and hardware)</td>
<td colspan="2">Revenue Streams

Donations; Government and foundation grants</td>
</tr>
</table>

Core Assumptions:

- Our business would be a non-profit company, focusing on social and public benefits rather than net profit or capital. The immersive experience would be used to raise awareness of our social issues and generate revenue through donations and grants from groups desiring more development with immersive tools. With our product it’s

the most feasible business model as it's mainly used for educational purposes rather than a service.

- Our product would attract clients that are interested in spreading awareness of equality, equity, diversity and inclusion. This would include organizations and schools who want to use the VR as an empathy tool for training and education.
- Our product will provide an opportunity for individuals to participate in a new perspective. This tool will allow users to experience living with a disability which will improve inclusivity by promoting empathy. Participants may be able to better understand the perspective of individuals with a disability after experiencing it first-hand.

Sustainability Report:

The immersive tool aims to train empathy and inclusivity towards people of different background and abilities. Our mission to improve how people think and make our product as accessible as possible to all backgrounds and economic levels has a positive social outcome for the groups utilizing the tool and peoples of different backgrounds. Our product also encourages other organizations or companies to make tolerance towards other backgrounds and training people on empathy a higher priority.

Design for X

- Design for Simplicity: The client strongly insisted we focus more on the story we tell instead of the technology or advanced virtual reality software. She expressed that

in the past, other groups prioritized the technology and didn't focus on making an experience that worked and provided an accurate experience of what its truly like to be a person living with a disability.

- Design for Usability: Usability is critical for our experience because we want it to be simple and easy to use while still maintaining a valuable empathetic experience. Our goal is to create a program that is simple to use for anyone no matter their past experiences, race, religion, or abilities. We want anyone to be able to put on the virtual reality headset and receive a quality experience of what each day looks like from the perspective of someone living with a disability.
- Design for Empathy: Empathy is the reason we are doing this project and how we execute everything should be to improve the overall empathetic experience. The experience will only be a few minutes long so to create empathy in a short period of time will require a carefully planned out story. To create our story, we will talk to people with our disability and ask questions such as how you perform basic daily tasks, how does your disability affect your personal and professional relationships, and how does your disability affect your education or career.
- Design for Reuse: Our virtual experience will be used for teaching students about empathy, so we want it to be easy for students to use it repeatedly. We want our program to be easily reusable so when a new student tries to use it, it will seamlessly restart the experience from the beginning. We also want all our information to be accurate so that for many years people can use our program to educate themselves or other on empathy.
- Design for Quality: During our meeting with the client, she made it very clear that the most important aspect of this project is the quality of the story we tell. She

explained that we should spend most of our time talking with people who live with disabilities and making sure we get an accurate representation of their lives and daily struggles. The quality of the story is how we can drive empathy into the users and give the experience of daily life from the perspective of someone living with a disability.

3 Problem Definition, Concept Development, and Project Plan

C1: Problem definition

1. After the first meeting and getting to know the client, it quickly became apparent what she valued and expected from this project. She made it clear that in previous attempts many students prioritized technology over the quality of the story they told and overlooked the accuracy of their information. The client said it was irrelevant which disability we chose and what way we displayed the experience. The client gave us free reign to execute the project in the best way we see fit that will accurately give the user a quality empathetic experience. Listed below is the order in which the client described her priorities.
    - Quality of story depiction in the simulation.
    - Accuracy of story based on talking to students who have Dyslexia.
    - Create an empathetic experience that immerses you in the perspective of someone living with Dyslexia.
    - Interactive experience.
    - The experience must include information and facts educating the user about Dyslexia.
    - The experience must be designed for new students and assume the user knows nothing about the disability.

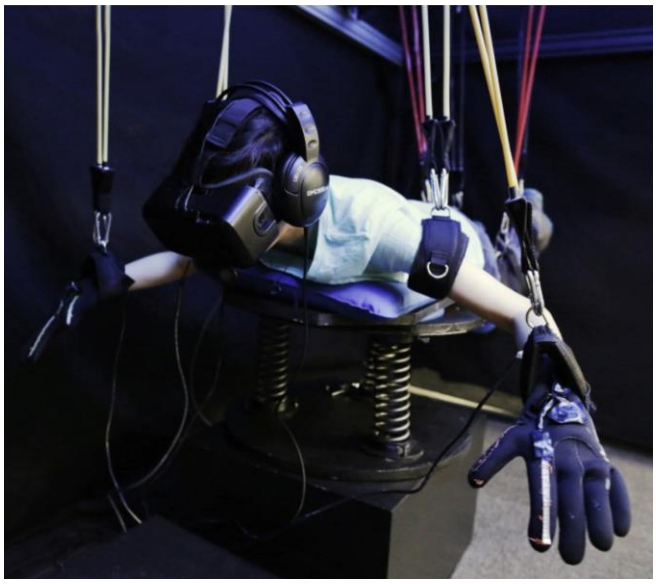
2. Problem statement: The head of the SEDTI has a need to use empathy to train people on implicit bias and inclusivity using a VR experience that will allow the users to immerse themselves in the experiences of someone different.

3. Value scale of 1 to 5. (1 being lowest, 5 being highest in importance)

	Metric	Unit	Value
1	Quality storyline and characters	Subj	4
2	Different type of dyslexia experiences	Subj	3
3	Immersive experience	Subj	5
4	Interactive experience	Subj	5

Benchmarking:

1. Dhruv Jain's disability-simulating VR (4) lets the user experience what it is like to go scuba diving while being deaf, as Jain himself is partially deaf. This VR simulated what Jain experienced when taking out his hearing aid which he described as "liberated".



2. Brock University and Niagara College co-developed a VR (5) that has four scenarios with characters from different backgrounds that simulates physical and mental disabilities. The project is called it's an Idea which stands for inclusion, diversity, equity and accessibility.

4. When developing the problem statements and describing the customers prioritized needs, it made it easy to set target specifications that align with the priorities of the client. The target specifications listed below if executed according to plan will provide an empathetic experience that would truly give the user a brief stint from the perspective of someone living with dyslexia.

- Create a virtual experience that demonstrates empathy.
- The experience shows three distinct scenes displaying three various effects of Dyslexia.
- The experience is between 5-10 minutes in length.
- The user interacts with the environment from the perspective of someone who has Dyslexia.
- The experience contains 5 facts explaining the struggles and attributes of Dyslexia.

C2: Concept development

- VR experience demonstrates what it feels like to live with Dyslexia. More specifically, it will be set in a school setting. We will use Unity to create a classroom setting to show different situations in which students with Dyslexia experience learning.

- Below is an example of a classroom VR experience that we would create using a 3D software.

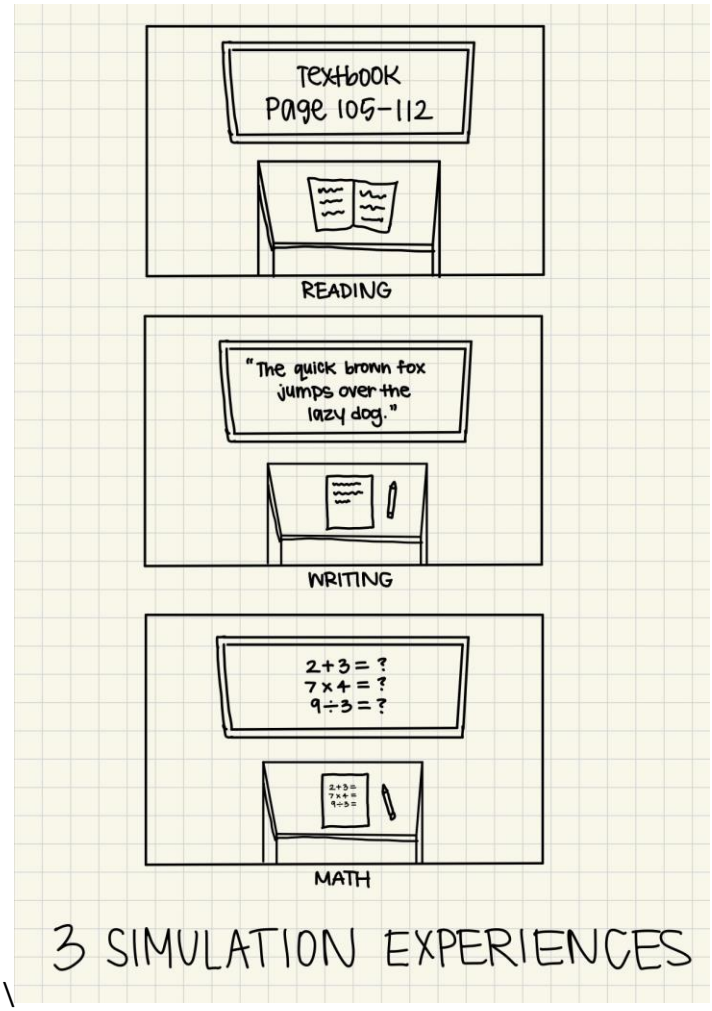
View from the student's perspective on entering the VR classroom... | Download Scientific Diagram (researchgate.net)

- This is a POV example of a student doing tasks such as picking up and reading a book.

[Simply Psychology]

- We have evaluated our options and have decided to go with a POV perspective of a student learning in the classroom. Specifically, we will demonstrate reading, writing, and math Dyslexia.

- We will integrate the POV concept into our VR experience to allow for the most realistic perspective of an individual learning in a classroom setting with Dyslexia. We will create different scenes that show a variety of experiences that those individuals may deal with. For example, we may show a student trying to read and comprehend a book, attempting to write a sentence, or solve a math problem.



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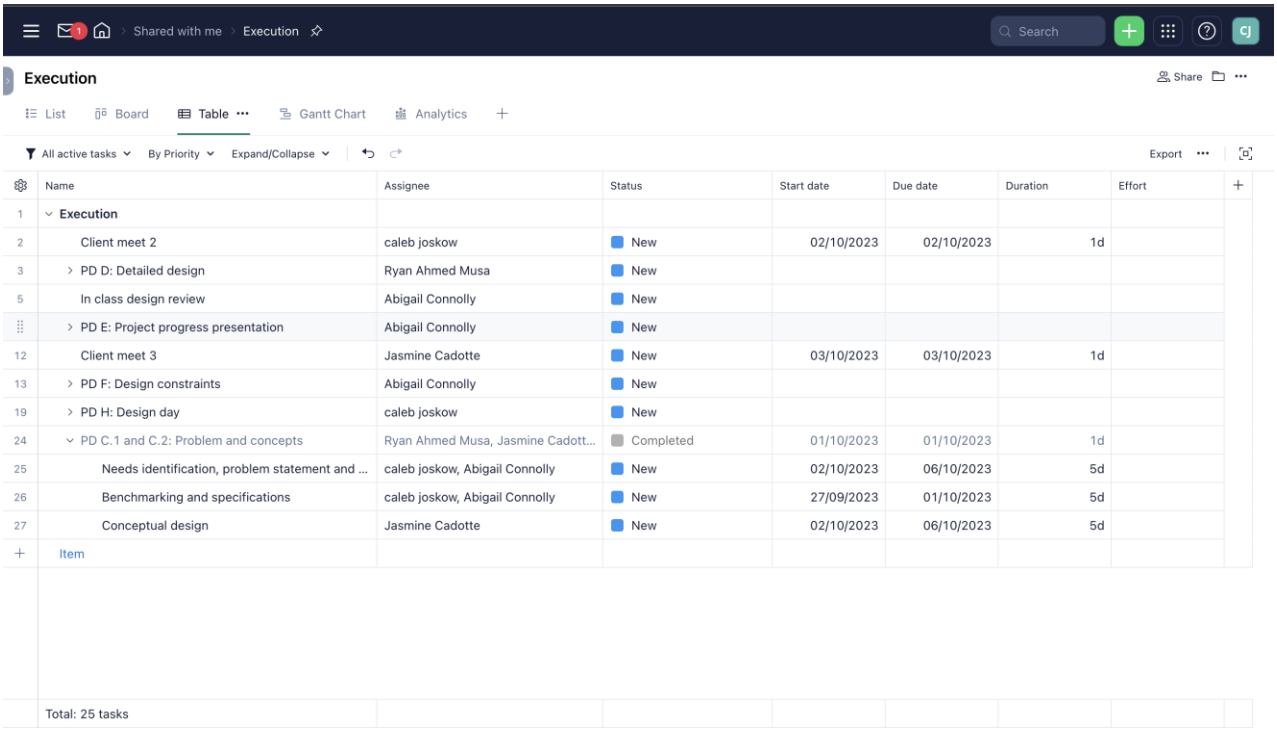
- Recreating three specific experiences in which individuals with Dyslexia may have difficulties will create good user immersion. This will allow users to develop empathy through experiencing struggles first-hand. Having a perspective where the user needs to conduct tasks in the classroom is very beneficial in demonstrating how Dyslexia can affect learning. It may prove difficult to create an experience that validates all individuals with Dyslexia. The experience can vary between people but mitigating this drawback by showing three different situations will provide variety.

C3: Project plan



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Execution

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List | Board | Table | Gantt Chart | Analytics

All active tasks | By Priority | Expand/Collapse | Export

	Name	Assignee	Status	Start date	Due date	Duration	Effort
1	**Execution**						
2	Client meet 2	caleb joskow	New	02/10/2023	02/10/2023	1d	
3	PD D: Detailed design	Ryan Ahmed Musa	New				
5	In class design review	Abigail Connolly	New				
	PD E: Project progress presentation	Abigail Connolly	New				
12	Client meet 3	Jasmine Cadotte	New	03/10/2023	03/10/2023	1d	
13	PD F: Design constraints	Abigail Connolly	New				
19	PD H: Design day	caleb joskow	New				
24	PD C.1 and C.2: Problem and concepts	Ryan Ahmed Musa, Jasmine Cadott...	Completed	01/10/2023	01/10/2023	1d	
25	Needs identification, problem statement and ...	caleb joskow, Abigail Connolly	New	02/10/2023	06/10/2023	5d	
26	Benchmarking and specifications	caleb joskow, Abigail Connolly	New	27/09/2023	01/10/2023	5d	
27	Conceptual design	Jasmine Cadotte	New	02/10/2023	06/10/2023	5d	
	Item						

Total: 25 tasks

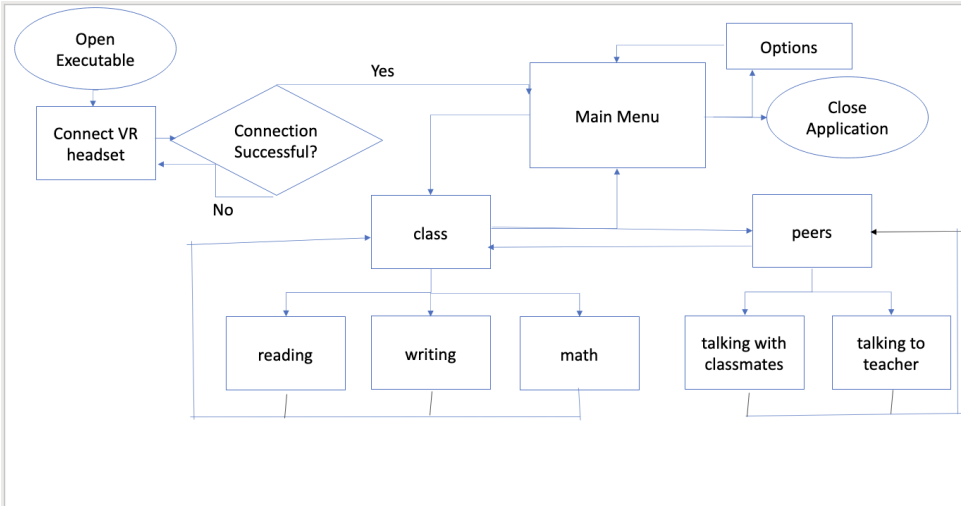
3 Detailed Design and BOM

1) Summarize the client feedback that you received during your second client meeting and clearly state what needs to be changed or improved in your design.

When we presented our idea to our client in the next meeting, she had a few things to say. Overall, she did like the idea we had about someone who is dyslexic. She wanted us to empathize with people who are struggling with dyslexia. When people see our VR, they can be in the shoes of someone who is dyslexic. By having a storyline full of empathy, this will give the user a chance to be in the shoes of someone dyslexic. To get more information on how to do so, we also interview multiple students who are dyslexic.

Our client mentioned that the VR didn't have to be long, it could be 2-3 minutes. The target audience should be students in undergrad/grad.

2. **Detailed Design:**



Our game starts with connecting the required hardware, then putting the player into the main menu. From there, the player can start the game and enter the class, configure options, and

close the game. The first time joining the class the player is given a short introduction to the vr controls (moving, grabbing objects, selecting) and story. The player can than choose to talk with their peers or teacher to get advice on the next task. The player can choose which task they want to do out of 3 options that test reading, writing, and mathematics under a timer, showcasing the difficulties and stress of dyslexia in a learning setting. Tasks are around 3-5 minutes each. Players are graded based on their performance in the task. When a player is finished a task, they are sent back to the classroom to choose another or talk with their peers again. This repeats twice until all tasks have been finished for the first time, and the player is shown their final overall grade.

3) We have a quality set of diverse skills that are well suited to for this project and will help us be successful throughout the semester. First, considering this is primarily a software engineering project, we have 2 members who are studying software engineering are and very proficient in coding which is an important skill for our given project. We also have a group of people who work well as a team and can use their personal experiences to help create empathy for the user. Our group has a good mix of creativity and execution which will be invaluable for designing the story line and creating the virtual experience. Our groupmates have some experience with virtual reality software and that will help us have some basic knowledge of how we must design the experience and build on their existing knowledge. We also know some people who live with Dyslexia which is important so that we can interview them and use their personal experience to create a deeper understanding of their daily life.

Although I personally believe we have an elite set of skills and resources, there are always weakness that we will have to work on. The biggest weakness we have is that we chose Dyslexia to bring light to this learning disability and show how it affects the lives of people who have it. However, none of our groupmates have this learning disability so to create a more accurate

experience we must search out and interview people who do live with Dyslexia. This is an added challenge and will make it harder for us to truly understand Dyslexia and to represent it properly without simply describing the symptoms and effects it has on people. The other issue we have faced so far is trying to create a story line instead of just spitting out facts and information. As engineers we are used to using information and facts to outline and prove our ideas. However, in this project that's not the goal, and if anything, these skills will hinder us more than help. We must learn to develop other skills and use the information and facts to build a storyline and help drive empathy for the user.

4) The average time it takes to make a VR training environment is 4 weeks. This includes designing the program, the creation of the environment, characters etc. and the programming and development. Depending on the complexity and length of the VR, the time it takes to complete a program can vary. Of course, in order to create a VR, there must be a development team that has the skills needed to design and program the VR. The more experience one has in this type of project the quicker they would be able to produce it. Because our team has 5 members that have various skill sets to contribute to the creation of our VR and roughly 3 months to complete our VR program, it is expected that we will be able to finish on time. We are currently in the creation phase where we are designing our storyline and our characters. Soon we will be moving into the programming and development of the VR which puts us on track to finish our project by the due date. Due to having to complete weekly deliverables and labs we are able to stay on track with our project. These help us stay organized and moving at a consistent pace so that we are able to complete our VR environment by design day and to make sure we have designed a VR that meets the requirements of the client to the best of our abilities.

5) Define any other critical product assumptions that could affect your ability to implement your design. For example: the acceptable values for a specification, availability of material/component, or a critical functionality.

We assume that users will develop empathy towards users with dyslexia after participating in our immersive experience. This can be achieved by carefully crafting realistic scenarios that allow the user to understand and relate to struggles that dyslexic individuals encounter. We assume that our experience will shed light on challenges that accompany dyslexia accurately, but to ensure this we must research and interview many different sources to validate our information. We assume that Unity will be a credible software for creating this VR experience, but we must analyze all our options and attempt to learn how to use the software before making this critical assumption. We assume that VR is a user-friendly tool that will allow us to properly demonstrate our idea, but we must first understand that not everyone is experienced in that domain. We must ensure that our VR experience is easily usable and comprehensible for all individuals regardless of skill or experience.

6) Provide a detailed preliminary bill of materials and parts (BOM) for your final prototype, which will be presented to your project managers for approval and purchase. Include web links for each item in your BOM (including $0 items). You will be given up to $50 or $100 (depending on your project) for the development of your final prototype only.

Item	Description	Units of measurement	Quantity	Cost	Link

Mock HMD	Unity plug-in to simulate a VR headset.	amount	1	$0	https://docs.unity3d.com/Packages/com.unity.xr.mock-hmd@1.3/manual/index.html
Unity Student Plan	For game development engine	Months available	16	$0	https://unity.com/pricing#plans-student-and-hobbyist
Total Cost (without tax nd shipping)				$0	
Total Cost				$0	

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=h22yUBWPQY5eK0Av7KPJyNpDhhCeZNGY%7CIE2DSNZVHA2DELSTGIYA

4 Prototype 1, Project Progress Presentation, Peer Feedback and Team Dynamics

Project Progress Presentation

https://uottawa-my.sharepoint.com/personal/jcado007_uottawa_ca/Documents/VR%20Experience.pptx?d=w9c209e5d7bc24bdda409335bc7f877ca&csf=1&web=1&e=ZrKu8H

Project plan update

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=5dWUaya21BePq5u51GYpHn7hxbVSTMuP%7CIE2DSNZVHA2DELSTGIYA

5 Design Constraints and Prototype 2

Design constraints:

1. Displaying dyslexia that is the most accurate and will create the most empathy.

We can use the prototypes to test different designs in our virtual reality environment and ask for feedback on them from various contacts with dyslexia in order to understand which one will be the best representation of dyslexia and what kind of emotions it induces for the user. It is important that we take advantage of the feedback we receive so that we can implement it into each prototype and into our final design. As our project is based around creating empathy for people with dyslexia, we must experiment with different visuals in order to understand how we can make it in the virtual reality environment and what would be best for empathy training for dyslexia.

2. Compatibility

It is important that our virtual reality environment is compatible with the types of computers that our client will be using. The headsets must also be compatible. This is something we can discuss with our client to determine what type of devices they will be using for the training. As this program is to be used to empathy training, it is important that it can be used in different locations and is not complicated for the user to set up. Currently our program is compatible with any headset in the Oculus, PlayStaion, Meta, Vive, Valve SteamVR, HoloLens, and Windows Mixed family, as well as any headset that uses OpenXR. However, it's very easy to make it compatible with other headsets through Unity, which would allow our client to use the program with a wide variety of technology.

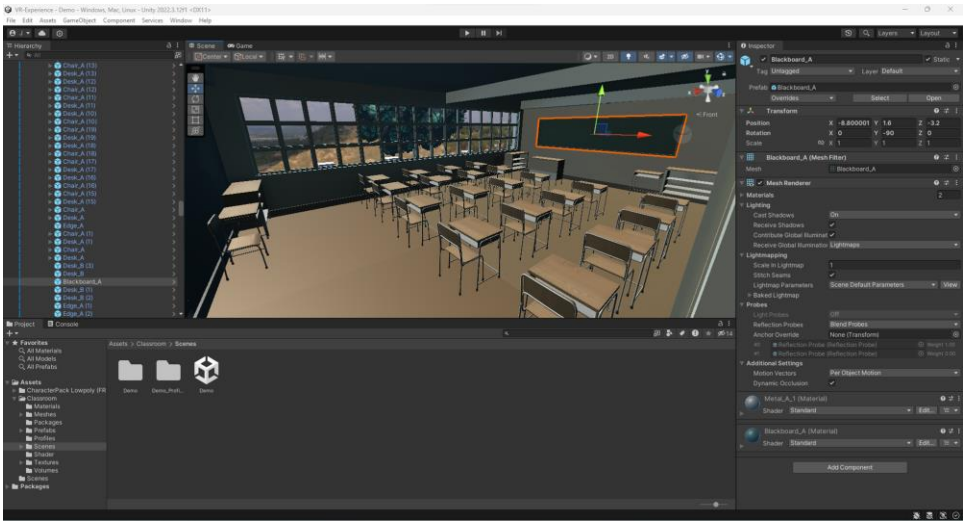
Prototype 2

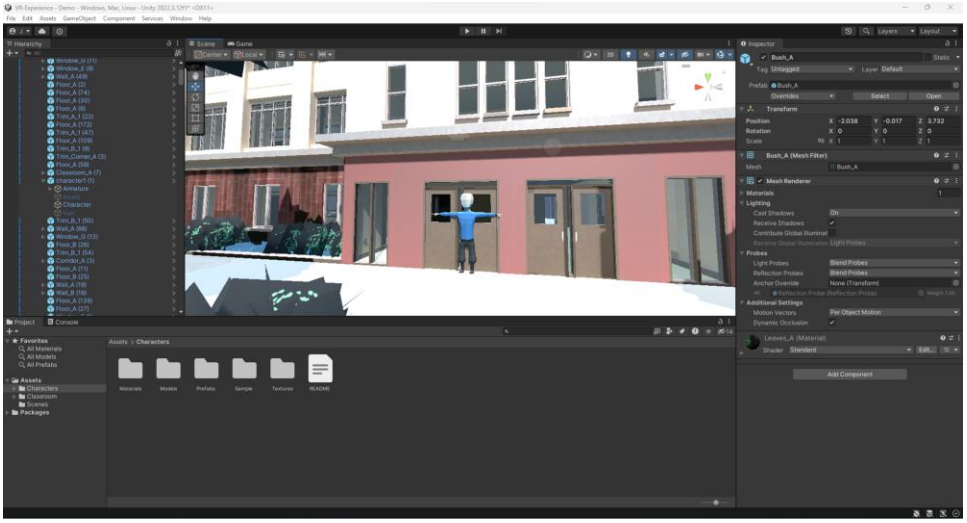
Our first prototype was mainly to experiment with the capabilities of Unity and get to grips with the new software. For our first prototype, we wanted to establish version control in our project, as that was fundamental for our entire project.

Now moving onto our second prototype, we wanted to add our first placeholder models that would form the basis for prototype 2, such as our placeholder environment, player models, and NPC models. After setting up our project, we now wanted to focus on implementing the other fundamentals of the VR experience before we could move onto scene development. These include walking, grabbing objects, sockets, lighting, object physics, etc. These are the fundamentals of our software that we will build off to develop the actual scenes the player will go through.

Below is an updated table of our target specifications and which specifications we have in our prototype. You may notice we've added new specifications from our old table.

Screenshots from Unity:





	Target Specification	Unit(subjective value of importance)	Expected Value	Actual Value

1	Quality Storyline and characters	4	Not implemented	Not implemented
2	Different Types of Dyslexic Experiences	2	Not implemented	Not implemented
3	Immersive experience	4	Not implemented	Not implemented
4	Interactive experience	5	Not implemented	Not implemented
5	Player input	5	Implemented	Implemented
6	Avatar movement	5	Implemented	Implemented
7	Version Control	5	Implemented	Implemented
8	Grabbable Objects	3	Implemented	Implemented
9	Audio	2	Not implemented	Not implemented
10	Environments	2	Implemented	Implemented
11	Player Models	3	Placeholder Implemented	Placeholder Implemented
12	NPC models	2	Placeholder Implemented	Placeholder implemented
13	Object physics	3	Implemented	Implemented
14	Walk animations	3	Not implemented	Not implemented

The most critical assumptions that we have not yet tested are that the game feels well to play; the game isn't buggy; the game immerses the user in its setting/story; and, most importantly, the game leaves the player feeling more empathetic and more understanding towards people with dyslexia than when they entered. We hope to solve all of these in the next prototype when more has been implemented and designed.

Our next prototype delves into more intricate components that'll make our project into more of an actual VR experience and lay the foundation for what we will iterate off. These include NPC dialog, menus, and event flags. We hope to show the client our updated table of target specifications and our screenshots of prototype 2 to gain feedback on the pace of our progress and if we need to make changes to our project plan or the scope of our project. We also want comments on the structure of our experience.

Project plan update

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=5dWUaya21BePq5u51GYpHn7hxbVSTMuP%7CIE2DSNZVHA2DELSTGIYA

6 Other Considerations

Economics report

Intellectual property report

Project plan update

Add your wrike snapshot link. Don’t forget to include assignees.

7 Design Day Pitch and Final Prototype Evaluation

Write your design day pitch and plan your prototype demo.

8 Video and User Manual

Video pitch

Add link to video.

User manual

See separate template for the user manual.

9 Conclusions

Summarize your lessons learned and your work related to your project. Discuss any outstanding issues or implications for the project.

10 Bibliography

1) https://www.engati.com/glossary/virtual-reality#:~:text=%E2%80%8D-,What%20are%20the%204%20elements%20of%20Virtual%20Reality%3F,%2C%20sensory%20feedback%2C%20and%20interactivity.

2) https://www.educative.io/answers/what-are-the-basic-components-of-virtual-reality

3) https://www.freshconsulting.com/insights/blog/meet-the-key-players-in-the-vr-ar-game/

4) Couch, C. (2016). *Disability-Simulating VR Promotes Empathy.* MIT Technology Review. https://www.technologyreview.com/2016/04/29/160444/disability-simulating-vr-promotes-empathy/

5) Barto, A. (2021). *How Long Does It Take To Develop Virtual Realty Training?* eLearning Industry. https://elearningindustry.com/time-needed-to-develop-virtual-reality-vr-training