

# **Collaborative Creation in Virtual Reality**

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## Introduction

#### Purpose

Explore the feasibility of students and educators collaborating with each other to create 3D objects in physical and digital workspaces. Using this research, create free and accessible tools for them to do SO.

Although Virtual Reality is exploding in the educational world, little research has been done on the feasibility of connecting Virtual Reality (VR), Computer-Aided Design (CAD), and 3D printing into a seamless process. We hope to demonstrate what is possible with these apps in order to

#### Background

inform future research.

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### How can we use Virtual Reality tools to learn and create in the classroom?



## Research Visual

Our aim was to create tools for students to easily move back and forth between 2D and 3D spaces in the digital world in order to produce products in the physical world.





### The Users

An educator in the Navajo Nation was interested in bringing virtual reality tools to his middle-school classroom, so we specifically designed our tools for young students. However, the tools should be helpful for anyone interested in learning more about CADding in Virtual Reality.

## Research Objectives

Our goal was to create tools that would allow students to achieve these objectives:

1	Student creates an object in either Virtual Reality
2	Student can save the file, convert to a different for file in a different setting (created in BlocksCAD the
3	Student can edit, share, and collaborate on the art real-time interaction online
4	Students can save and 3D print the finished artifactor world to the physical world.



or in a CAD App

rmat if needed, and open the en opened in VR, or vice versa)

tifact with other students via

act to bring it from the digital

### Hardware

#### **Oculus** Quest 2

The Oculus Quest 2 is a commonly used and commercially available method of interacting in a virtual space. It's easy-to-navigate and mostly user-friendly system have made the process of sharing and documenting our progress simple. However, a noted constraint with this device is that it requires users to login with Facebook accounts, which could pose privacy issues for students and educators.

#### Laptop

Having access to a laptop or desktop computer was necessary for downloading and sending files between the VR Workspace, CAD software, and 3D printer.

#### Prusa MINI+

For our work, we used a Prusa MINI+ to 3D print objects. The board is 7x7x7 and we primarily printed with PLA filament. However, the processes we researched should be applicable to almost all types of 3D printers.

### Software

#### **Gravity Sketch**

Gravity Sketch is a 3D CADding software available on Oculus Quest 2. It is a powerful tool that offers complex editing options and gives users a high level of control over their designs. It also has a great feature that allows users to collaborate with others in shared workspaces.

#### BlocksCAD

BlocksCAD is a 2D CADding software available on computers. Its easy-to-use controls are remniscent of Scratch and allow newcomers and experts alike to create seamlessly. Many educators appreciate BlocksCAD for the ease with which they can integrate lessons in mathematics.

#### PrusaSlicer

PrusaSlicer is an opensource 3D Slicer that converts digital 3D models into printing instructions for a given 3D printer to build an object, We chose to use this slicer because it correlated with out Prusa MINI+ printer.

### Process

I spent the summer experimenting with these tools and becoming an expert in their capabilities. I had no experience in CADding prior to this summer, so I was the ideal candidate to develop tutorials for people who had also never used CADding software before. One I mastered the tools, I created a website where I posted blog posts and tutorials for others to learn from my findings.

### Click here to view site

## Findings

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It is possible to import and export out of GravitySketch; however, importing from 2D platforms is finicky and objects often import at strange angles

There is no clear way to measure dimensions in GravitySketch. For users wanting to create precisely sized objects, 2D CADding platforms such as BlocksCAD are the better choice.

Users can use GravitySketch collaboration rooms to collaborate with users on the other side of the world

It is possible to create objects in 2D or 3D and move them back and forth while making edits. However, the object often gets warped.



## What I Learned

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How to use various software and hardware products including Oculus Quest 2, GravitySketch, BlocksCAD, PrusaSlicer, and PrusaMINI+

The importance of creating tutorials that are accessible to complete beginners (I was a complete beginner when I started and I found so many tutorials that made no sense to someone who had never used the platform before)

How to present my research findings to industry professionals (some employees at LEGO came to learn more about our work in the lab).

In research, sometimes finding what doesn't work is just as valuable as finding what does work



## Future Steps

This exploratory work is still in its early phases and much more research is needed to see if 3D collaborative CADding has a future in the classroom. Future steps include:

- Conducting user research to see how users respond to the develop tutorials
- Exploring other 3D CADding platforms besides Gravity Sketch, as the platform gave users a limited amount of control over their object dimensions.
- Determining whether 3D CADding makes more sense for younger or older students

## Thank You!

Feel free to reach out with any questions, comments, or concerns:

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