Coding using OpenGL was a journey for me. There were many new concepts for me to learn and understand. It all started with me learning how to code vertices and then draw lines to create a triangle. Once that concept was within my knowledge, I moved on to coding 2 more vertices to a pyramid. After that, things felt like they moved quickly. I learned how to program a camera, and then add an image(texture) to a 3D object I created. The last item I learned about was how to create different types of lighting and implement them onto different objects, to create a more realistic image.

For the final project, I had to create a 3D scene that combines all the techniques I have learned in the past 6 weeks. My 3D scene was chosen with objects around my house that I could use while also giving myself a challenge. I had one simple box that included a unique pattern I would have to replicate. I used a candle that would then give me some curved edges. My third object was a small ping-pong ball that looked like an eye. My last item was my complex item. The complex item had to be an object made up of 2 or more shapes. Mine was a top with a picture of a ghost. The item required me to program a cone and a cylinder that line up together to a single shape. I top also cant stand up straight, to it gave me the challenge of position as well.

Going into more detail about navigation, I used a programmed version of a camera. With OpenGL, I was able to assign functionality to different keyboard keys and the mouse. This was accomplished using the GLFW library. With this functionality, I was able to allow the A,S,D, and W to move the camera from side to side and zoom in and back. The Q, and E keys were programmed to allow movement up and down within an arch fashion until the camera was directly above or below the scene and still facing it. I programmed a callback so the computer knew where the cursor would be on the window and allowed the camera movement to follow suit. The mouse scroll was programmed to either increase or decrease the movement speed of the camera.

Accomplishing all of this was no easy feat. I utilized many different functions and methods. One of the most important functions I had to use was shader functions. There was a vertex shader and a fragment shader which worked hand in hand to help draw the shapes to the window. Another important function is the create texture. Some of the functions allowed color, while others intensity. Most of the OpenGL code that was used in the project is reusable. If I took the time to switch out textures and change the position, scale, and rotation I could potentially create a completely new scene. If I went ahead and added more shapes the scene could have endless possibilities.

**Citations**

*OpenGL*. LearnOpenGL. (n.d.). https://learnopengl.com/Getting-started/OpenGL

*Event processing*. GLFW. (n.d.). https://www.glfw.org/docs/latest/input\_guide.html