Microsoft HoloLens 2: Changing How Students Create 3D Models

Joseph Stipan

Arizona State University

EDT 511 (Fall-B)

Professor Mary O'Malley

12/4/2020

Mixed Reality (MR), the merging of virtual objects within a physical space, has been discussed for many years; however, the technology seems far from accessible to the public. Mixed reality unlocks the link between computer and physical environment, initially thought of in 1994 by Paul Milgram and Fumio Kishino. According to an article called “What is Mixed Reality,” by Brandon Bray (2020), Milgram and Kishino explored the idea of computerized items interacting with the real world; however, it was thought to be science fiction for the longest time. Within recent years the ideas have become a reality. Mixed reality is a combination of human-computer interaction, conventional reality, and perception (Bray, 2020).

Smartphones have changed our lives due to the capability of having a computer within our pocket. Mixed reality is changing our lives by revolutionizing how we interact with the world. According to "Mixed Reality Education" by VR Pro (2020), geology, biology, and astronomy all use mixed reality within their field of work; however, MR has yet to be used within the educational system (VRPro, 2020). Mixed reality is still years behind the use of classroom use; however, according to "Mixed Reality for Education, from Microsoft's official website (2020), states that MR has the capability of improving test scores by 22% while increasing students' engagement by 35% when learning with immersive and 3D technologies (Microsoft, 2020).

Detailed Description:

The best use of mixed reality is with Microsoft’s HoloLens, the first mixed reality headset with highly advanced virtual interaction features. According to an article called “What You Need to Know About Microsoft HoloLens,” written by Anatolii Landyshev (2020), states that users can interact with holograms via hand gestures and or artificial intelligence (AI) voice

commands. These features are possible through the holographic lens that allows the user to see the real world, while the holograms are displayed on top of it. (Lanyshev, 2020). While augmented reality has virtual objects placed in physical environments, items go through physical objects such as chairs, desks, or people. Mixed reality allows the digital objects to interact with the physical objects as if they were real and interact with physical touch. Microsoft's HoloLens 2's software is similar to a hands-free computer. According to Microsoft's HoloLens 2 website (2020), the headset goes where you go, sees what you see, and does what you say (Microsoft, 2020). With this technology becoming more available in the future, healthcare, retail, and manufacturing companies will require the technology more frequently, making mixed reality mandatory for future employers.

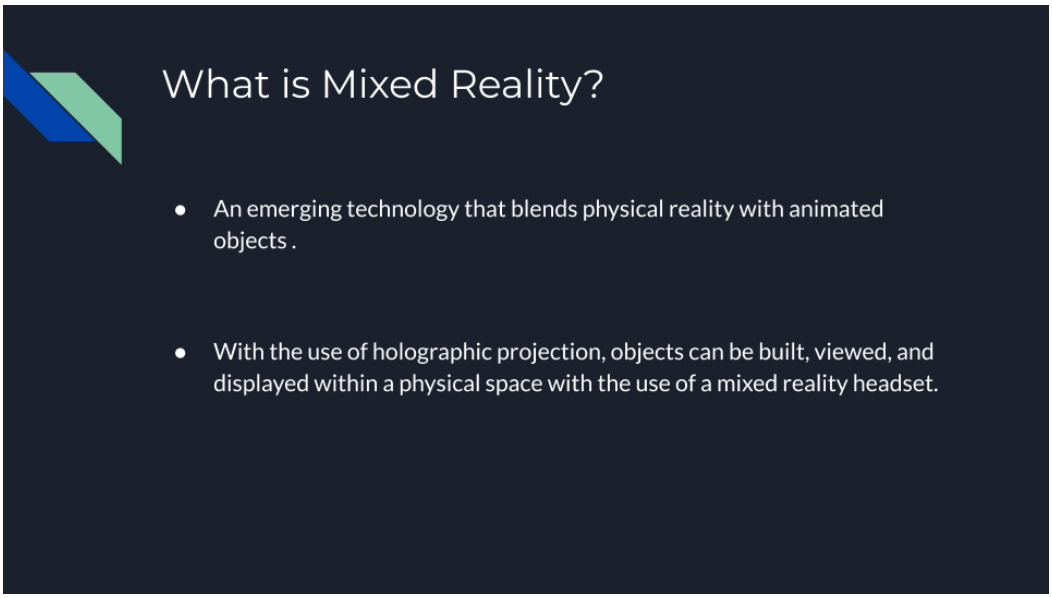
Microsoft provided a video in 2015 demonstrating how mixed reality can be used within daily life. The footage includes watching television on a virtual screen and viewing the weather on the kitchen counter. The video can be viewed below:

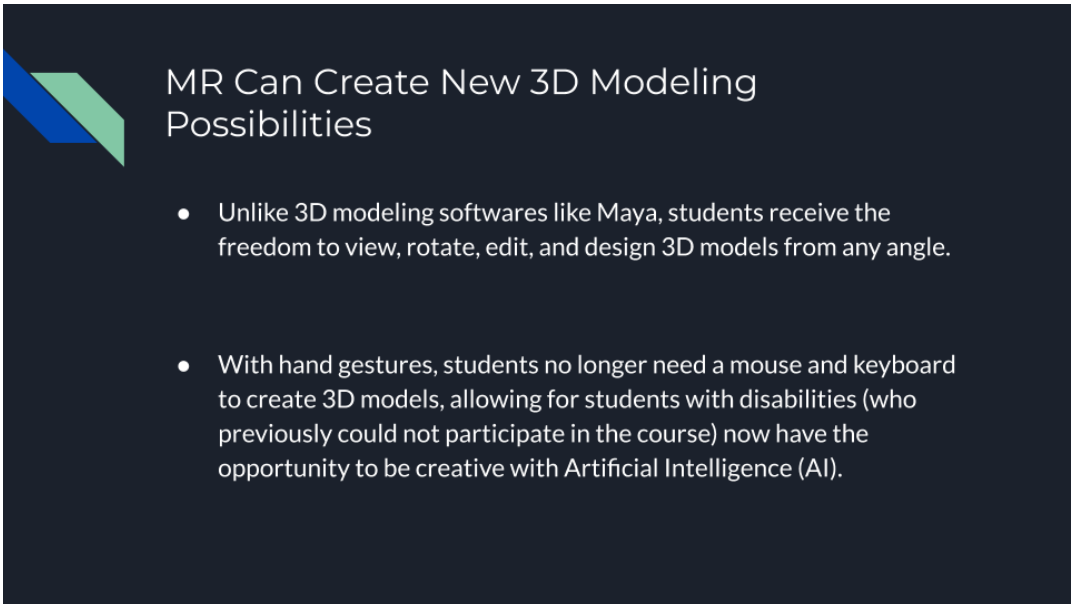
https://www.youtube.com/watch?v=aYdB2xBNFek&t=151s

Content or Settings:

As a digital technology instructor at Union High School, most of my students' ages range between 14 and 17. Students only take 3D modeling courses unless they are interested in the technology or wish to further their education to a possible future career. To achieve permission

on implementing Microsoft's HoloLens within my 3D modeling course, Union High School must agree to this technology's affordance and how it can benefit my students. Although not entirely thorough, I created a few slides that are a glimpse of what the presentation may look like:

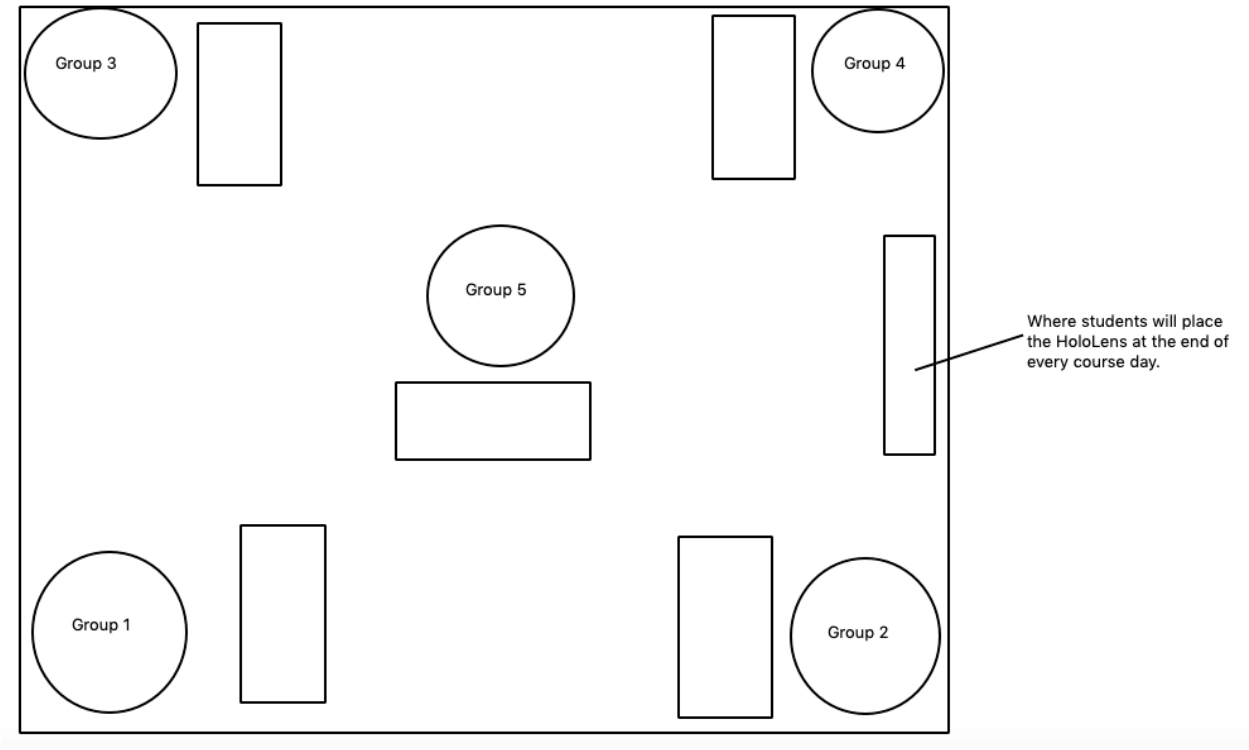




The setting for the HoloLens would be within the classroom, as there is plenty of space with all desks formed into a total of five groups, with four students per group. Each desk group would be away from one another, with five rectangular desks placed near each group. A lockable shelf is found on the right side of the classroom, where students can store the HoloLens at the

end of each day. Computers will be kept on desks for those who do not grow custom to the headsets.

A small diagram was created:



Before planning a physical implementation, I must present the use of Virtual Reality (VR) and Augmented Reality (AR), as Mixed Reality is a combination of the two. Although most of the students have recently taken my Digital Cinema course with 360 videos incorporated into the study, providing both VR and AR before introducing MR would make the transition smoother. Once my students have VR and AR understood, MR will be presented through presentation slides, featuring MR as a whole, Microsoft's HoloLens information, and videos showing what MR can do with 3D modeling software.

Required Resources:

Although the technology is absolutely revolutionary and exceptionally unique, the price of all technology is relatively high. Union High School permitted the opportunity to apply for Microsoft's HoloLens 2 within Microsoft's website. To acquire the headsets, Microsoft requires the purchase to be under an account associated with the company. After doing so, Union High School was able to add the devices within an online shopping cart for $3,500 each. Applying three HoloLens per group, with a total of five groups, equaled $52,500 for the headsets. Microsoft did apply a discount for the amount purchased and due to the purchase providing educational learning. The headsets' total value was $46,500, taking a whole $6,000 off and providing free shipping charges. Microsoft's HoloLens 2 will not be sold within retail stores, making the only way to purchase the headset is Microsoft's online website and arrive at its destination within 3-7 business days. Inside the box consists of the HoloLens 2 device, overhead strap that can be adjusted for the user wearing it, carrying case, microfiber cloth, and USB-C charger cable.

With this being Microsoft’s second mixed reality headset, there are key improvements compared to the original HoloLens. According to an article called “Microsoft launches HoloLens 2 with a Strong Business Bent,” Mark Hachman (2019) states three significant changes. These changes are field of view, which is more than double the first-generation, ten-point touch interaction with holograms, and a new UI model that allows holograms to follow the user (Hachman, 2019). The article also provides all specs the HoloLens 2 has included below:

- **Resolution**: 1440p with light engines in each eye.
- **Processor**: Qualcomm Snapdragon 850.

- **Holographic**: Unit: 2nd-generation.
- **Wireless**: Wi-fi implementation and Bluetooth 5.0
- **Wired**: USB-C
- **Camera**: 8PM stills, 1080p 30fps video.
- **Mic**: 5-channel
- **Speakers**: Built-in, spatial audio.
- **Other features**: Eye tracking, head tracking, Windows Hello authentication.

The previous HoloLens captured and published a low resolution while having difficulty registering more than one finger on the user's hand. The newest headset tracks all ten fingers, allowing more fluent interaction with digital objects (Hachman, 2019).

Microsoft's official HoloLens website mentions that the headset users are self-connected with wi-fi connectivity, having no cords needed (Microsoft, 2020). Microsoft's HoloLens 2 offers innovative security features such as data protection if the item becomes lost or stolen to secure users' information from getting into the wrong hands. According to "Security overview and architecture," Microsoft's website (2020) explains multiple security measurements such as a password-less operating system, called "Windows Hello," which logs students onto the headset based on voice and eye scanning (Microsoft, 2020).

The link below is where Union High School purchased the HoloLens 2:

https://www.microsoft.com/en-us/p/hololens-2/91pnzzznzwcp?activetab=pivot%3aoverviewtab&atc=true

As part of my physical implementation, I will be providing Google Cardboard Virtual Reality headsets and paper printed QR codes. Google Cardboard can be purchased on Amazon

for $16.99 each. With twenty students in the course, $340 will be spent to provide students with Virtual Reality capability before introducing them to mixed reality. QR codes can be found through a simple Google search and printed using 8 X 11-inch paper on Amazon for $8.00.

Students will need to install Google Cardboard's application within the iPhone's application store and Android's Play Store. With QR codes working with any augmented reality application for free.

Link below for Google Cardboard:

https://www.amazon.com/Pro-Google-Compatible-Instructions-Construction/dp/B00Q1FITMO/ref=sr_1_1_sspa?dchild=1&keywords=google+cardboard&qid=1606940638&sr=8-1-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUFZOE1KUjBaME83NVEmZW5jcnlwdGVkSWQ9QTAxNDgzMTJVWlhLMlpSVEJRNyZlbmNyeXB0ZWRBZElkPUEwNDkwNzQ0MVVCUlZRWFhGVlUyQyZ3aWRnZXROYW1lPXNwX2F0ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU=

Verto Studio D's fully capable holographic 3D modeling studio is the first mixed reality 3D tool. According to an article called "3D Modeling Comes to Mixed Reality on the HoloLens with Verto Studio 3D," Jason Odom (2017) explains that in 2017, Mike Farrell announced a partnership with an application called 'Verto Studio 3D.' This application allowed the user wearing the headset to create 3D models without the limitation of a computer screen. According to Verto Studio's official website (2020), the application is free to install on any Microsoft HoloLens. Every editing feature that Verto Studio offers is acceptable anywhere with wi-fi connectivity, allowing users to duplicate, smooth, rotate, scale, and apply textures on any 3D

model, whether built using other 3D modeling software or made entirely from scratch (Verto Studios, 2020).

According to "Ture 3D Modeling on Holographic is Here," by Verto Studio (2020), Verto Studio provides real-world measurements in meters for positioning and scaling holograms. Any 3D file saved onto a PC or tablet can now be edited and viewed instantly as a hologram projection (Verto Studio, 2020). Verto Studio 3D works with the latest firmware update that must be implemented on Microsoft's headset.

Link to download the application below:

https://vertostudio.com/quest.php

With each group only receiving three HoloLens, one student per group is left out from using the headset. Microsoft HoloLens 2 provides a remote assist called "Dynamics 365." The application is similar to a skype call where the user not wearing the headset can see everything the user wearing the HoloLens sees. A small video-chat window appears on the top left corner for the user, allowing for communication. The application comes installed with all HoloLens headsets for a small fee of $50.00 a month for Windows 10 computers and laptops; however, it supports both iPhone and Android smartphones. The price allows multiple devices to use the application as long as they are logged onto the same Microsoft account. Computers and mobile devices must be updated with the current firmware as most applications will not download without continuous updating.

To fully use the implementation, the total of $52,398.00.

Goal Alignment:

The original Microsoft HoloLens was announced in 2015 and released in 2016 with mixed reviews due to the overwhelming price with many people unfamiliar with VR, AR, or MR in the first place. On February 24, 2019, Microsoft HoloLens 2 was announced for pre-order, with a price of $3,500.00, the same price as the original HoloLens. With Microsoft's new hologram technology, the possibilities of 3D modeling have grown stronger. My goal as a 3D modeling instructor is to allow students to use their minds in creative ways. Many students dislike high school due to the mandatory course they must take to graduate. I wish to provide an approach that students find comfort and interest in what they are learning. One of the courses' most significant concerns is preventing those with disabilities from attending. Many digital technology classes heavily rely on computer-based software; however, with AI technology and hand assist, those with a wheelchair, hard of hearing, and a speech impediment can use the HoloLens 2 in multiple ways. Students who have a hard time moving around classrooms can use HoloLens to view computer screens either up close or far away. 3D modeling can be held and shaped with the use of the students' hand or spoken to or provide captions using AI technology.

As technology advances within the next 5-10 years, Microsoft's HoloLens will become commonly purchased, possibly sold in retail stores much like the Oculus and PlayStation VR headsets. I chose this technology to give my students the "leg up" on the competition, as many of my students are interested in pursuing further education in the 3D modeling field. Professors at Washington State University (WSU) will find it quite impressive if most students explain how Union High School students have used mixed reality before higher education, giving them an increased advantage over other students.

Implementing HoloLens 2 within my course will allow students to view models without the limitation of computer screens. HoloLens helps achieve my goals by providing an emerging technology that has not or will be seen within high schools for the next 5-10 years. HoloLens allows my students to create beautiful models and prepare them for future careers that may already have implemented MR into their work field.

Mixed reality falls into emerging technology. According to "Shock of the New," Udell and Woodill (2019) define mixed reality as a merging of elements of both the real and virtual worlds to produce a new environment (Udell & Woodill, 2019). MR continues to be cutting edge as many educators and staff within Union High School still see VR and AR as cutting edge technology with hardly any use of the technology. Attending Washington State University's Digital Technology & Culture program, only the use of VR and AR were implemented in specific courses, with MR remaining in the future.

Physical implementation:

As a digital technology instructor, mixed reality has always been intriguing. MR can benefit those interested in 3D modeling/animation by providing new ways to create 3D designs. To implement this technology to my 3D modeling students, making sure each student understood the basics of Maya (a 3D modeling software for Windows 10 and Apple iMac users). While many students enjoy Maya, a few students wished they could view all their models up close without the border of a computer screen. Maya also prevented students with disabilities from using the technology due to Maya's lack of accessibility and only supporting the use of mouse and keyboard. Knowing that students with disabilities couldn't attend my course wasn't easy. 3D

modeling courses were created in hopes that any student can think outside the box and design with their imagination.

The next day, students will enter their 3D modeling course and receive the opportunity to try out Virtual Reality (VR) and Augmented Reality (AR). "Google Cardboard" (a cheap cardboard headset, providing 360 views) and paper printed QR codes, allowing students to view 3D models with mobile devices, provide students the chance to experience digital spaces while also providing the opportunity to bring digital objects into real-world settings. Providing a Google Cardboard for each student would be easy as the technology is relatively affordable. For a few of my students', this would be their first use of VR as I'm the only educator who incorporates it in the Digital Technology field; however, each student is familiar with AR due to the overwhelmingly popular mobile game "Pokémon Go."

The following day each group of tables will consist of three 'Microsoft HoloLens 2,' the latest mixed reality headset. There will be Windows 10 connected computers within each group. Students wearing the HoloLens 2 can design complete 3D models with the headset without using a computer; however, "Dynamic 365" allows students a chance to view through a HoloLens remote application with only three headsets per group. The desktops enable students who may be prone to seizures or headaches to continue using Maya as a 3D modeling software, with the capability of sending 3D projects to those wearing the headsets. Each rectangular desk per group provides a space for 3D modeling to occur. The first assignment I will assign with the HoloLens 2 is allowing my students to brainstorm with one another on creating a model rocket ship with the animation for taking off. This assignment will enable my students to create 3D models with the capability to view from all angles, similar to building blocks as a child.

Although Union High School is responsible for purchasing the technology, I will take full responsibility as the educator. Every precaution is provided, for example: making sure each student has the opportunity to use the technology, with backup computers for those who are not using the HoloLens due to the headsets currently in use or feel nauseous when using the technology. The HoloLens provide safety measures protecting all data through voice and eye scan recognition with the Microsoft account linked. HoloLens provides big data through the use of Blackboard Learn, allowing educators such as myself to see the progress of the headset's use.

Implementation Assessment:

After a week with the emerging technology, students will present their 3D models to one another in the classroom. With the HoloLens, students can share their holograms with as many users as they wish. After each group has had a chance to present, each student will receive an anonymous questionnaire on whether Microsoft HoloLens 2 proved useful.

The questionnaire will consist of five questions:

1. Did you find the questionnaire effective?
2. What changes could make the emerging technology better?
3. Do you prefer using the 3D modeling software on the HoloLens more than Maya?
4. Did you run into any problems when using the HoloLens?
5. In 1-2 sentences, provide your feedback on the emerging technology.

If most of the students found the emerging technology successful, they would be implemented throughout the remaining semester. Union High School will provide 3D modeling as a course for all students, including those with disabilities.

In conclusion, Microsoft's headset can improve the learning outcomes and transform education with cutting edge technology. The Microsoft HoloLens 2 was designed for projecting images onto the real-world through holograms. Students can digitally create 3D models without using a keyboard and mouse as students look through the headset's lens, moving windows, tools, and objects. Mixed reality is still years away from becoming common within all K-12 schools; however, the emerging technology at Union High School's doorstep will provide the opportunity to enhance our students' learning and prepare them for the rapidly evolving technology of the future. This plan of implementation is not final and can be changed with Union staff; however, providing 3D modeling students the chance to learn first-hand.

References

3D modeling comes to mixed reality on the HoloLens with Verto studio 3D. (0001, January 1). Next Reality. https://hololens.reality.news/news/3d-modeling-comes-mixed-reality-hololens-with-verto-studio-3d-0175785/

BrandonBray. (n.d.). *What is mixed reality?* Developer tools, technical documentation and coding examples | Microsoft Docs. https://docs.microsoft.com/en-us/windows/mixed-reality/discover/mixed-reality

C U., & Woodill, G. (2019). *Shock of the new: The challenge and promise of emerging technologies*. American Society for Training and Development.

Evmill. (n.d.). *HoloLens security architecture*. Developer tools, technical documentation and coding examples | Microsoft Docs. https://docs.microsoft.com/en-us/hololens/security-architecture#:~:text=HoloLens%202%20combines%20hardware%2C%20software,user%20with%20an%20optimal%20experience.&text=Windows%20Holographic%20for%20Business%20eliminates,%E2%84%A2%20and%20FIDO2%20sign%2Din/

Microsoft Hololens explained: MR for business - Visartech blog. (n.d.). Visartech: Custom Software Development Services. https://www.visartech.com/blog/mixed-reality-microsoft-hololens-headset-business/

Microsoft launches HoloLens 2 with a strong business bent. (n.d.). PCWorld. https://www.pcworld.com/article/3342961/microsoft-launches-hololens-2-with-a-strong-business-bent.html

Mixed reality for education. (n.d.). Microsoft. https://www.microsoft.com/en-us/education/mixed-reality#:~:text=Fostering%20social%20and%20emotional%20learning,out%2Dof%2Dreach%20experiences/

Mixed reality for education. (n.d.). Microsoft. https://www.microsoft.com/en-us/education/mixed-reality

VertoStudio.com. (n.d.). VertoStudio.com. https://vertostudio.com/holo.php