# OREGON STORY BOARD

# Exploring the Integration of HoloLens Technology within Academia for Trade-Based Education

## Providing a framework for HoloLens-enabled educational experiences

Researched and prepared by:
Anthony Pires, Technical Curriculum Design Specialist
Shelley Midthun, Executive Director, Oregon Story Board

In partnership with:

## Clackamas
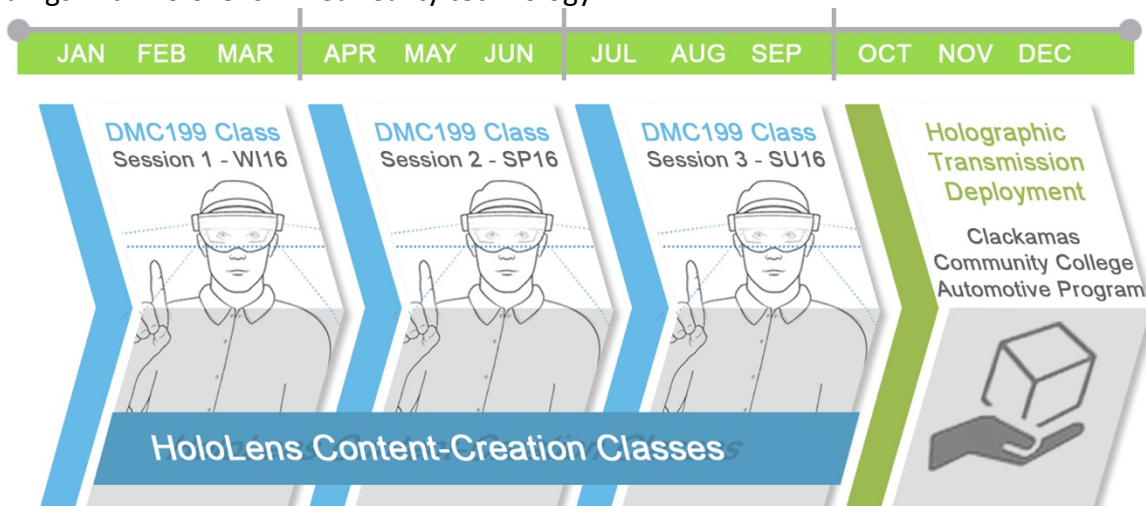Community College

# Overview



In the spring of 2016, Microsoft released the HoloLens, a mixed-reality headset that revolutionized the computing experience. Prior to this initial public release, Microsoft made HoloLens Developer Kits available to early adopters and industry pioneers. Oregon Story Board (OSB), Clackamas Community College (CCC), and Intel partnered to create educational opportunity for developers and storytellers for the HoloLens and the broader Augmented, Mixed and Virtual Reality fields.

In October 2015, Clackamas Community College and four other universities (Carnegie Mellon, Dartmouth, Virginia Tech, and UC Berkeley) were chosen as recipients of Microsoft's Academic Research grant.  Microsoft established this grant to better understand the role and possible applications for holographic computing. Additional goals were to stimulate and advance academic research in mixed reality and encourage applications of holograms for new and unique purposes. This opportunity allowed for early access to an emerging technology and early exploration of its potential within a learning environment.

As part of our proposal to augment trade-based education, Oregon Story Board opened its doors to interested students and working professionals excited to take part in this emerging technology. Part one of the CCC/OSB grant application proposed that we create "project-centered, studio classes," which would allow students from various Portland-area schools to work with industry professionals in cross-disciplinary teams to develop content for HoloLens. The final HoloLens project created by the class would then be used as a supplemental teaching tool within the Automotive Services Training program at CCC.

The second part of the research grant featured a content-creation component to augment learning in the community college classroom.  The grant team would supplement existing curriculum for CCC's Automotive Services Training program with HoloLens technology. To achieve this, the grant team engaged students and professionals with a full range of skills; Unity and C# were a priority, as were digital design skills such as modeling and

texturing.  This whitepaper has been produced to showcase our exploration and share our findings with HoloLens mixed reality technology.



## Assessing Curriculum for Emerging Technologies

A main objective of this grant was to imbed the Microsoft HoloLens technology within an academically structured, competency-based, exploratory environment. Many academic institutions express enthusiastic interest in bringing emerging technologies to their institutions, however an early champion's initial intent is often derailed due to lack of support, technical understanding, obtaining clear student learning outcomes, and/or the ability to demonstrate a clear value in the initial investment.

In their whitepaper, "The Digital Promise: Transforming Learning with Innovative Uses of Technology," Dr. Michael Levine, founding director of the Joan Ganz Center, and colleague, Jeanne Wellings (2009) say that students need preparation through advanced technologies: "Schools need to function in a 21st century work environment where employees are expected to collaborate on projects, incorporate feedback from a work group and a supervisor, and make connections between new and existing knowledge." The collaborative and exploratory classroom environment for the CCC DMC199 classes touched on exactly these principles. The DMC199 classes were run through Clackamas Community College, but held at the Oregon Story Board facilities in downtown Portland.
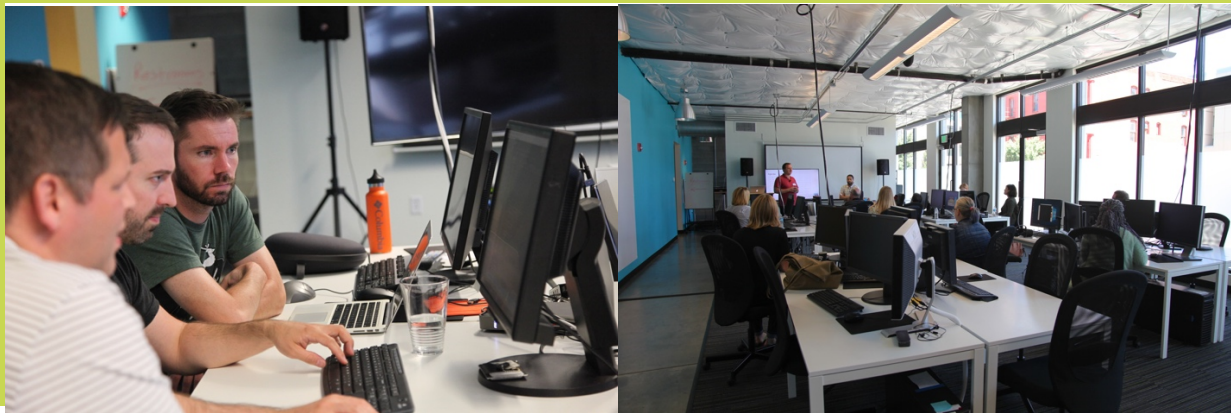
The DMC199 series engaged participants and students in a nine-month journey to understand the HoloLens, develop content for it, and apply those development practices towards created holographic content for trade-based education. Centered on student testimonials and qualitative interviews, the following categories were areas with positive student feedback:

- **Professional/Industry Partnerships**: The DMC199 series included various participants with a range of professional backgrounds: guest speakers with a focus in Virtual Reality

(VR) and Augmented or Mixed Reality (AR/MR) business models, instructors with skillsets that aligned with VR/AR/MR content creation, enthusiasts and early adopters of the technology, and college students enrolled in visual media programs. This diversity in perspective added value throughout the classroom environment and positively influenced problem-solving and necessary skillsets required for content creation.

- **Learn by Doing w/ HoloLens Training**: Participant feedback indicated high satisfaction with learning how to develop content for the HoloLens. Through hands on engagement with the technology, as well as trouble-shooting through development challenges, students valued the competencies gained throughout the DMC199 courses.

- **Exploratory Classroom Environment**: The DMC199 series ran in conjunction with the pre-release of the HoloLens technology. The hardware, software, and development processes were in a stage of exploration.  In turn, the students' educational experience was also partially exploratory in nature. Students had to work together to problem solve, apply personal strengths to the project, and build upon preexisting knowledge.

Wellings and Levine (2009) noted that researchers across many prestigious universities, industry leaders, and philanthropies, have concluded that "...the key to engage the 21st century digital generation involves harnessing its passion for media and technology and incorporating it into rigorous, more participatory learning experiences."



## The Evolution of Exploratory Pathways

The DMC199 classes were laid out to achieve the following student learning outcomes:

| 1 | Demonstrate fundamental knowledge of  3D Modeling Software & Unity 3D |
|---|---|
| 2 | Implement 3D Mapping and introduce assets into AR environment |

| | |
|---|---|
| **3** | **Understand AR Interactions with HoloLens headsets** |
| **4** | **Demonstrate the ability to produce an augmented reality project** |
| **5** | **Implement an educational module driven by AR mechanics** |
| **6** | **Integrate and record best practices and procedures for AR platform and tool creation** |

During the assessment of student learning outcomes for DMC199, the curriculum specialists discovered that the development process for creating HoloLens content includes specific learning pathways. These pathways evolved when students utilized their initial skillsets to build upon the project-based outcomes. These exploratory pathways were categorized into three main groups: Developers, 3D Modelers, and Experience Designers (Instructional and User Experience).

While the participants gravitated to their respective development roles holistically, participant feedback indicated that they would have derived greater benefit from a more concentrated track in which they could expand upon their existing knowledge of programming, 3D modeling, or user experience design.

> *"I would suggest a more prescriptive approach in methodology. If instructors knew multiple skill sets were coming in, there should've been thought behind how the class could benefit from each development skill."*
>
> - *Student Testimonial of DMC199 series*

Integration of emerging technologies faced hurdles in the classroom, primarily with achieving the originally desired student learning outcomes. Multiple skillsets were required for development with the Microsoft HoloLens, so students would benefit from training within key areas of the development process prior to product development as a team. With student learning outcomes focused in areas of user-experience design, 3D development, and programming for HoloLens development, competencies should align to enhance team collaboration and generate a stronger team project outcome.

## Challenges with Emerging Technology in the Classroom

Many institutions view their technology department as a "support" resource for their campus. Dr. Willard R. Daggett, author of *Preparing Students for Their Technological Future*, stated that

as educators, "…we are unwittingly failing to prepare our students for a technology-driven world that is nothing like the place that many of us graduated into." To positively impact DMC199 classroom instruction, OSB and CCC had to embrace and embed new technology resources. During the initial phase of setup for OSB's grant collaboration with Microsoft and CCC, OSB's instructors and technology support staff had to build a fully equipped computer lab and IT infrastructure from the ground up. Emerging technology requires adaptation in an ever changing environment.
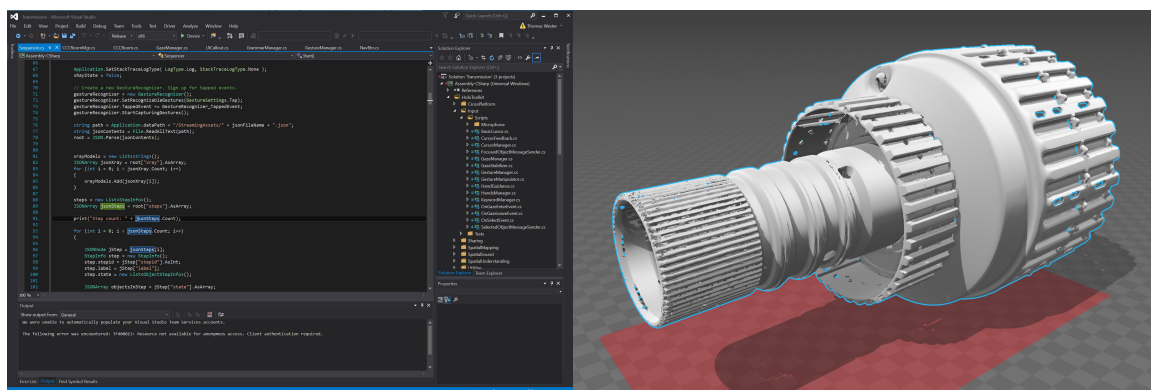


The integration of emerging technologies embedded within classroom instruction is much more complex than delivering information about an already established topic. Some of the main challenges that this grant project encountered resonate with the complexities of teaching new technology and their processes. The following were the top challenges gathered from participant interviews:

- **Lacking Defined Assessment Methods**: The DMC199 series was built as an exploratory class with less focus on grading and more on experimentation with HoloLens technology. While exploration with emerging technology has benefits, it left some participants with an unclear assessment of how they were progressing in the class.
- **Software/Hardware Challenges**: One of the biggest challenges was the variety of collective software used in the pipeline of HoloLens production. HoloLens development required different types of software that needed to be integrated to work as a whole system. Some of the software suites were Unity, Visual Studio, and Windows 10. The software often updated at randomized intervals, which impacted the production pipeline workflow and halted project productivity if updates were not addressed consistently. These pauses in productivity during instruction meant making unplanned modifications to original lesson plans, which affected classroom workflow and frustrated instructors and students.

- **Oversaturated Communication Methods**: The DMC199 classes intended to integrate real-world production processes within their structure, using project management and communication methods to interact and to organize processes with participants. The software used to communicate with the participants included Basecamp, Slack, Google Docs, GitHub, personal and CCC email accounts. The variety of communication methods confused some participants at times. This confusion led to project development setbacks and feelings of frustration.
- **Class Structure Inconsistencies**: During the nine (9) month period of the DMC199 series, new instructors were assigned every three months to teach competencies for specific areas of HoloLens development. Each instructor had different teaching methodologies and classroom management approaches. These transitions created an additional learning curve for participants. Another inconsistent element was the hand off of the holographic transmission progress. Each instructor had a different approach to creating transmission content and translating instructional design elements and process.

These challenges can be addressed when setting up a learning environment and prepping classroom instructors and technical support. The challenges above reflected a negative impact in student satisfaction but, if taken into consideration during curriculum development and classroom planning, they can be improved upon in future iterations.



## What is the Educational Value of HoloLens Content in the Classroom?

Early adopters of the Microsoft HoloLens will most likely convey that first-time users need to experience the device to understand its full potential. This perspective can be attributed to both the development of holographic content, as well as use during experiential learning in the classroom. In his research study on experiential learning, John Richardson noted that our educational program delivery systems should include delivery methods that provide opportunities for clientele to gain sensory, exploratory experience with the information being presented (Richardson, 1994).

The holographic transmission was deployed using three (3) primary methods:

1. Faculty lecture using the HoloLens
2. Individual review during lab with HoloLens
3. Faculty led, group review using the HoloLens

Our goals were to build an experience that:

- Helps students better understand and imagine the inner workings of a car
- Helps instructors explain the front-wheel transmission without creating new curriculum
- Increase comprehension without the need for more instruction hours



**Trade-Based Classroom Study**

Instructors from the DMC199 series and an automotive instructor from CCC collaborated with a curriculum specialist to develop and integrate the holographic transmission into the appropriate automotive lesson plan. The students in the CCC automotive class were learning about the front wheel transmission assembly, which was comprised of an eight (8) gear system. The holographic transmission built for HoloLens contained the first gear components, animated the assembly process, and included an "x-ray" command function to view the internal workings of the transmission assembly parts.

The holographic transmission was labeled and color-coded to match the automotive manual that faculty and students used in the classroom. A Likert-Scale questionnaire was then used to evaluate the experience of students in the CCC automotive classroom while they used the holographic transmission produced within the DMC199 class as a learning tool. The sample size of automotive classroom participants was nine (9) in total.



**Findings**

The demographic analysis indicated that most respondents were adults from 19 to 23 years old. All of the participants were enrolled at Clackamas Community College. About two-thirds were full-time students, 13% were part-time auto repair technicians, and the remainder indicated their primary occupation was outside of the automotive field. Overall, 75.7% of participants strongly agreed that the HoloLens and the Holographic Transmission, had a positive impact on learning about trade-based automotive content.

**Student Learning Perspective**

To determine the effectiveness of the holographic transmission, students were given a survey to evaluate their time spent with the HoloLens and their understanding of content associated with the holographic transmission. The Likert-Scale ranged from one (1) through seven (7); with one (1) being "Strongly Disagree" and seven (7) being "Strongly Agree." Data indicated an overwhelming degree of positive satisfaction from participants as shown in the Tables below.

**Table 1: Participant responses about use with the Microsoft HoloLens and holographic transmission**

Statement: Being able to see a holographic animated transmission increased my knowledge and understanding of the content.

| | n (%) | avg.(%) |
|---|---|---|
| Strongly disagree | 0 (0.0) | |
| Disagree | 1 (11.0) | |
| Neutral | 3 (33.3) | 5.3 (75.7%) |
| Agree | 0 (0.0) | |
| Strongly agree | 5 (55.5) | |

**Table 2: Participant responses about use with the Microsoft HoloLens and holographic transmission**

Statement: The X-Ray feature in the HoloLens transmission project enhanced my ability to comprehend moving transmission components and their interactions with each other.

| | n (%) | avg.(%) |
|---|---|---|
| Strongly disagree | 0 (0.0) | |
| Disagree | 0 (0.0) | |
| Neutral | 1 (11.1) | 6.3 (90.0%) |
| Agree | 0 (0.0) | |
| Strongly agree | 8 (88.8) | |

Participants were asked if the features within the holographic transmission, particularly the "x-ray" mode, increased comprehension and understanding of the content. In their responses, an average of 75.7% of participants agreed that the holographic transmission increased knowledge and understanding of the content. These findings, shown in Table 2, also indicated that an average of 90% of participants thought that the x-ray mode enhanced their ability to comprehend moving transmission components and their interactions with each other.

**Table 3: Participant responses about use with the Microsoft HoloLens and holographic transmission**

Statement: As a student, having access to the HoloLens in the classroom improves my technical awareness and increases potential job opportunities.

| | n (%) | avg.(%) |
|---|---|---|
| Strongly disagree | 0 (0.0) | |
| Disagree | 0 (0.0) | |
| Neutral | 2 (22.2) | 5.6 (80.0%) |
| Agree | 3 (33.3) | |
| Strongly agree | 4 (44.4) | |

**Table 4: Participant responses about use with the Microsoft HoloLens and holographic transmission**

Statement: I would like to see HoloLens technology used more frequently in my classes.

| | n (%) | avg.(%) |
|---|---|---|
| Strongly disagree | 0 (0.0) | |
| Disagree | 0 (0.0) | |
| Neutral | 1 (11.1) | 6.1 (87.1%) |
| Agree | 1 (11.1) | |
| Strongly agree | 7 (77.8) | |

With respect to hardware accessibility and gainful employment, Table 3 indicated that an average of 80.0% of participants strongly agreed that access to the HoloLens in the classroom improved their technical awareness and potential job opportunities. Table 4 showcased that an average of 87.1% of participants would like to see HoloLens technology used more frequently in their classes. This data provided insight into the students' demand for emerging technologies, particularly with interests toward potential job prospects.

| Table 5: Participant responses about use with the Microsoft HoloLens and holographic transmission | | |
|---|---|---|
| **Statement:** The Holographic Transmission matched my transmission instruction manual (GM Powertrain – 4T60E). | | |
| | n (%) | avg.(%) |
| Strongly disagree | 0 (0.0) | |
| Disagree | 0 (0.0) | |
| Neutral | 0 (0.0) | **6.6 (94.3%)** |
| Agree | 1 (11.1) | |
| Strongly agree | 8 (88.9) | |

| Table 6: Participant responses about use with the Microsoft HoloLens and holographic transmission | | |
|---|---|---|
| **Statement:** My instructor used the HoloLens effectively for in-class lecture. | | |
| | n (%) | avg.(%) |
| Strongly disagree | 0 (0.0) | |
| Disagree | 0 (0.0) | |
| Neutral | 0 (0.0) | **6.1 (87.1%)** |
| Agree | 1 (11.1) | |
| Strongly agree | 8 (88.9) | |

Findings indicated that students who used the HoloLens content gained a stronger understanding of the concept than learning through the traditional training medium of text and lecture. An average of 94.3% of participants indicated that they strongly agreed that the HoloLens transmission matched their existing instructional manual. The instructor also emphasized the correlation between the manual and holographic transmission during his HoloLens-assisted lecture. The instructor was involved in the DMC199 holographic transmission development process and thus was familiar with how to use the hardware and associated content. Based on participant response, an average of 87.1% of students strongly agreed that the instructor used the HoloLens effectively for in-class lecture.

# Summary

## HoloLens Curriculum (DMC199)

The results of participant interviews indicated primarily positive views towards the DMC199 series. Participant feedback indicated high satisfaction with learning how to develop content for the HoloLens. Through hands on engagement with the technology, as well as trouble-shooting through augmented reality development challenges, students valued competencies learned throughout the DMC199 courses.

Participant feedback expressed desire to expand upon student learning outcomes in areas of user-experience design, 3D asset development, and programming for HoloLens applications. Expanding upon these student learning outcomes during curriculum design will enhance team collaboration, as well as generate stronger project-based outcomes.

## HoloLens Holographic Transmission Learning Content

The results of these studies indicated that integrating HoloLens technology within academic, trade-based education has a strong degree of acceptance from its participants. The learning

process was enhanced by providing opportunities for students to see, interact, and discuss the information while in their traditional classroom setting. Thus, development and implementation of a comprehensive program that included these components will be most effective for all participants involved in both delivering and receiving the HoloLens curriculum and content.

Evidence indicated that students had an enhanced learning experience with the HoloLens technology during the holographic transmission pilot project. Upon completion of the automotive class at Clackamas Community College, instructor Rick Lockwood gave this statement about his experience with the HoloLens and its effect on student learning:

> *"Traditionally, in my class, [auto transmission] powerflow was taught through power point presentation and hands on with actual transmission components. Powerflow has always been a huge obstacle for students to overcome. The average student would spend a minimum of three weeks mastering this concept and some as much as five weeks. I often found myself demonstrating powerflow to the students more times then I care to count. After the introduction of HoloLens, most all of my students were able to demonstrate first gear powerflow in the first week. In my opinion, HoloLens made a significant difference in the student's ability to learn powerflow."*

> - *Rick Lockwood*
> *Clackamas Community College*
> *Automotive Service Technology*

*A Special Thanks to:*

*Tawny Schlieski, Thomas Wester, Nick Lambert, Ben Fischler, Nikki Dunsire, J Bills, Rick Lockwood, Philip Modin, Jennifer Harjer, Sonya Neunzert and Greg Hyatt.*

**References**

## References

Daggett, Willard R. "Preparing Students for Their Technological Future." 2010.

"HoloLens OSB." *Oregon Story Board*. N.p., 2016. Web. 19 Dec. 2016.

Jeanne Wellings, and Michael H. Levine. "White Paper: The Digital Promise: Transforming Learning with Innovative Uses of Technology." *Joan Ganz Cooney Center*. Apple Inc., 2009. Web. 19 Dec. 2016.

Richardson, John G. "Learning Best Through Experience." *Learning Best Through Experience*. Extension Journal, Aug. 1994. Web. 19 Dec. 2016.

**About the Authors**

*Anthony Pires is a technology curriculum specialist, with a background in software development and curriculum development within academia. In the past ten years, he has worked on the development of simulated training applications within government, academic, and corporate entities. Using his knowledge of curriculum development within academia, and bridging it with his experience in software development, he has been able to provide pathways into bringing emerging technology to colleges and corporations.*

*Shelley Midthun is the Executive Director of Oregon Story Board. Prior to taking the lead at OSB, she spent more than a decade working in animation, film, commercial production and economic development.  Shelley worked in production management at LAIKA animation studio and then ran the Portland Film Office at the Portland Development Commission.  She currently sits on the Board of Directors for the Oregon Media Production Association, the Broadcast and Social Media Advisory Team for Clackamas County C-TEC, and the 5 to 50 Program: Empowering Women Creative Directors.*
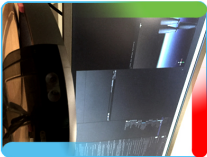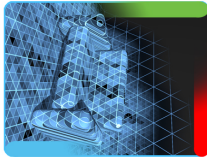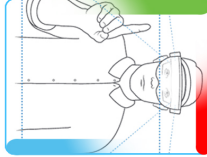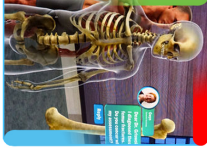
**About Oregon Story Board**

Founded in 2013 as the brainchild of Vince Porter, Tawny Schlieski and Rick Turoczy, Oregon Story Board is a 501(c)(3) nonprofit dedicated to creating and incubating educational opportunity and workforce development pathways in the emerging VR industry ecosystem. OSB's Board of Directors represents public and private initiatives across technology, film, entrepreneurship, economic development, gaming, education and animation. This group is committed to supporting the emerging VR industry and its potential for job growth and economic vitality.

*For more information, visit http://www.oregonstoryboard.org/*

# Appendix

## Oregon Story Board - Augmented Reality Classes
### Student Learning Outcomes & Exploration Pathways



| Demonstrate fundamental knowledge of 3D Modeling Software & Unity 3D | Implement 3D Mapping and introduce assets into AR enviorment | Understand AR Interactions with HoloLens headsets | Demonstrate the ability to produce an augmented reality project | Implement an educational module driven by AR mechanics | Integrate and record best practices and procedures for AR platform and tool creation |
|---|---|---|---|---|---|

**Exploration Pathways**

**Development (DEV)**
**Design (DES)**
**CG (3D)**

Due to cross-functional skillsets within the development process, Learning Outcomes will have "Exploration Pathways" embedded within 3 categories. The pathways consist of a focus in Development, Design, and CG. Development consists of programming& interaction outcomes, Design consists of content development (Instructional & UI/UX dynamics), CG consists of 3D modeling and asset development. Regardless of explored pathway, each student should still walk away with the 6 key learning outcomes.

# Oregon Story Board - Augmented Reality Classes

Student Learning Outcomes through Competency Building

| LEARNING OUTCOMES | | Course 1 ( 10 Weeks) | Course 2 ( 10 Weeks) | Course 3 ( 10 Weeks) |
|---|---|:---:|:---:|:---:|
| 1 | Demonstrate fundamental knowledge of 3D Modeling Software & Unity 3D | + | + | + |
| 2 | Implement 3D Mapping and introduce assests into AR enviornment | + | + | + |
| 3 | Understand AR Interactions with Hololens headsets | | + | + |
| 4 | Demonstrate the ability to produce an augmented reality project | | + | + |
| 5 | Implement an educational module driven by AR mechanics | | | + |
| 6 | Integrate and record best practices and procedures for AR platform and tool creation | | | + |

**Clackamas Community College - Holographic Transmission Project Deployment**
Date: November 1st, 2016
Collected By: Anthony Pires

Likert Scale Assessment - Range: 1-7 (1 = Strongly Disagree / 7 = Strongly Agree)

| Statement | Student 1 | Student 2 | Student 3 | Student 4 | Student 5 | Student 6 |
|---|---|---|---|---|---|---|
| Overall, the HoloLens was easy to use. | 7 | 5 | 7 | 6 | 5 | 5 |
| The Holographic Transmission helped me understand the the front wheel drive transmission. | 7 | 6 | 7 | 5 | 5 | 4 |
| The HoloLens headset was comfortable to wear. | 5 | 7 | 7 | 6 | 5 | 5 |
| My instructor used the HoloLens effectively for in-class lecture. | 6 | 7 | 7 | 6 | 6 | 5 |
| I felt comfortable navigating through the Holographic Transmission. | 7 | 7 | 7 | 6 | 6 | 5 |
| Having the front wheel drive transmission (1st Gear) developed as a hologram was a better experience than traditional lecture and demonstration. | 7 | 7 | 7 | 4 | 6 | 2 |
| The voice command features (Next Step, Previous Step, X-Ray, etc.) was an effective way to navigate through the Holographic Transmission. | 7 | 6 | 7 | 5 | 7 | 7 |
| I would like to see HoloLens technology used more frequently in my classes. | 7 | 7 | 7 | 7 | 6 | 6 |
| The Holographic Transmission matched my transmission instruction manual (GM Powertrain – 4T60E). | 7 | 7 | 7 | 7 | 7 | 7 |
| Using the HoloLens during lab time allowed me to gain a better understanding of the front wheel transmission. | 7 | 7 | 7 | 5 | 5 | 2 |
| Learning about the transmission has been difficult for me. | 7 | 4 | 5 | 5 | 7 | 7 |
| I felt I needed additional technical support to help me understand how to use the Holographic Transmission. | 1 | 5 | 3 | 5 | 5 | 2 |
| The X-Ray feature in the HoloLens transmission project enhanced my ability to comprehend moving transmission components and their interactions with each other. | | | | | | |
| I would prefer the standard front wheel transmission lecture without the use of the HoloLens. | 7 | 7 | 7 | 6 | 7 | 4 |
| I do NOT feel that the HoloLens helped me understand the front wheel transmission. | 1 | 3 | 1 | 2 | 3 | 4 |
| I felt that the Holographic Transmission complicated my understanding of the front wheel transmission. | 1 | 1 | 1 | 3 | 3 | 5 |
| As a student, having access to the HoloLens in the classroom improves my technical awareness and increases potential job opportunities. | 7 | 7 | 7 | 5 | 4 | 4 |
| My instructor felt confident using the HoloLens during lecture. | 7 | 7 | 7 | 6 | 5 | 5 |
| I look forward to using the HoloLens for additional automotive education. | 7 | 7 | 7 | 7 | 6 | 5 |
| I felt that using the HoloLens was more effective for understanding the transmission content during my lab time. | 7 | 7 | 7 | 5 | 5 | 3 |
| I felt that using the HoloLens was more effective for understanding the transmission content during the instructor lecture. | 7 | 6 | 7 | 5 | 5 | 3 |
| The Holographic Transmission increased my comprehension of Gear 1 in comparison to the other gears with standard lecture and demonstration. | 7 | 7 | 7 | 5 | 5 | 2 |
| The Oregon Story Board team was helpful getting me acquainted with the HoloLens. | 7 | 7 | 7 | 7 | 7 | 7 |
| I would encourage my college to use HoloLens technology in other programs outside of my own. | 7 | 7 | 7 | 7 | 7 | 5 |
| The layout and design of the Holographic Transmission was aesthetically pleasing. | 7 | 7 | 7 | 6 | 5 | 5 |
| The functionality of the Holographic Transmission worked correctly. | 7 | 6 | 7 | 3 | 6 | 5 |
| I was able to comprehend the front wheel transmission easier than usual because of the HoloLens technology. | 7 | 7 | 7 | 4 | 6 | 2 |
| Being able to see a holographic animated transmission increased my knowledge and understanding of the content. | 7 | 7 | 7 | 6 | 6 | 2 |
| The Holographic Transmission gave me new insights into the front wheel drive transmission. | 7 | 7 | 7 | 5 | 6 | 2 |
| It was helpful to collaborate with fellow classmates while having our instructor run through the Holographic Transmission. | 5 | 7 | 7 | 6 | 6 | 1 |
| It was helpful to look at the Holographic Transmission in a group setting with my instructor. | 5 | 7 | 7 | 6 | 6 | 1 |
| Wearing the HoloLens doesn't interfere with my lab time assembly. | 7 | 7 | 7 | 6 | 6 | 7 |