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Virtual Reality

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Virtual Reality

Sabbatical Project Report

Jeffrey Byers

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It is important to keep up with the myriad of technological changes within the game and animation industry. This sabbatical allowed me to take the time to catch up on some new and fast growing technological areas such as Virtual Reality technology and supporting software, techniques and procedures, and incorporating VR into Motion Capture technology for game and animation. In addition, this sabbatical has given me the opportunity to re-charge myself and be able to take a closer look at the advancement in tools available for VR, motion capture data and rigging for motion capture for use in my animation and game classes. I also had the opportunity to take a closer look at the motion capture to animation pipeline that larger animation and game companies are using. The research I have done will help me structure my course work and classrooms, labs and any other collaborative spaces in a manner that is consistent to industry practices.

During my sabbatical I have developed new skills in VR, motion capture and 3D software and game engine technologies. My skills will add another dimension to my teaching and course work potentially giving students an additional advantage in the animation and gaming industry field.

This project consisted of two distinct parts, which I will address separately.

Part one: Research and learn more about VR (Virtual Reality), and to determine a method to bring VR capabilities and new Motion Capture software for the Motion Capture system (hardware) that JCCC currently has dedicated to OCB 110. This new technology could also be brought into the gaming and animation classrooms to engage student activity and learning. I researched new technologies in the VR world, and look into different solutions that could be incorporated and foster cross-curricular activities between Animation and Game Development and beyond. Focusing on the VR headset and software I explored ways to bring the game artist/designer and developer into the virtual world. I have always been interested in VR technology, However; ten or so years ago it was just not practical and very clumsy to operate. In the past few years VR technology has grown into a mature and technical marvel with several practical solutions for us now and will continue to develop in the future. I have always been fascinated with gaming worlds, and how they are constructed. I enjoy playing games not only for the pure enjoyment of it, but

also as a way to learn about the world we live in. Of course like all of you it's also fun to put yourself into a character in a distant world working on objectives or just jumping around and picking up coins, and fighting creatures. There are also other discipline and applications that could incorporate Virtual Reality in the industry, which could play a vital role in training. I have researched and looked into ways in bringing VR into our classrooms and help industry partners who may be unaware of VR capabilities.

Part two: I focused on researching and learning new techniques on how to use the motion capture raw data and effectively drive a rigged character to be used in a student or professional project. At this time you are currently unable to drag and drop or use the raw motion capture data straight from the source. During the sabbatical I explored new software and learned new techniques, and created examples via scene files and video tutorials that will allow students to use raw mo-cap data, manipulate it in a 3D animation program like Maya and Motion Builder so that the data will properly move the character in an appropriate manner. I have investigated, and in some cases developed step-by-step tutorials for students, and faculty.

My primary objectives for this sabbatical were to analyze, develop techniques, write tutorials, record or find video tutorials if appropriate, and create in class examples on how to use raw motion capture data and refine it into a usable resource for animation and game students for future projects and portfolios. To do this I have spent countless hours exploring those specific areas, and have contacted local studios that uses the same VR technology, and software I am considering to use in the motion capture studio. I have worked closely with Russ Hanna the last couple of months, and have had several meetings discussing, testing developing, and implementing VR technology into the Unity Engine and creating a fully working VR game level. I have also reviewed and have article documentation that will allow us to incorporate new technology into the Motion Capture room to help stimulate student interest in VR gaming, Health Care, Vocational Training and beyond.

Virtual Reality in the Classroom

VR in the classroom is the most memorable medium for education because it involves all the senses. Virtual Reality will also be a game changer for its immersive capabilities in learning. Today there are hundreds of VR apps and millions of 360 immersive experiences in every subject area including STEM, history, and geography. These can be enhanced by VR because it allows students to immerse themselves in different worlds such as traveling to ancient Egypt to see how the pyramids were built. The VR apps range in cost from free to a few at the high range costing around \$19 and can be found in the online Steam powered store. The Steam powered store has an educational category that features early learning children's VR books like Henry the Hedgehog as well as upper-level VR apps that focus on biology, anatomy, geology, and Astronomy In other areas of education. VR apps allow students to construct architectural models, re-creations of historic or natural sites

and other spatial renderings. The Steam powered store also provides VR apps to engage students in topics related to literature, history and economics by offering a deeply immersive sense of place and time, whether historic or evolving news stories of the present. In my classroom, I foresee that the biggest hit will be the Tilt Brush app, which paints from a virtual perspective. As students grow up with 3D art tools that unleash their creativity, their room will be their canvas.

For high schools and higher education environments, VR apps promise to deliver the best aspects of both real-world classrooms and online distance learning into a single platform. With tools that provide avatars that represent the educators and the students, voice and video capabilities, PowerPoint and other collaborative whiteboard technologies and group and private messaging chat, educators are finding that the newest generation of virtual worlds can simplify the lecture and presentation process.

The leading Virtual Reality Devices for the Classroom

According to Techradar, the two best VR headset systems on the market right now are the HTC Vive and the Oculus Rift. These two offer unparalleled immersion through superior refresh rates, extremely high resolutions, and both the HTC Vive and Oculus Rift offer room-scale tracking and motion controllers for your hands right out of the box. In my opinion, the HTC Vive has the edge over Oculus because the room scale tracking which allows a student to physically move within the space helps to replicate real-world movement for the user and make the virtual environment seem more real.

In addition to the headset, we will need to think about what the computer specifications should be to run the Virtual Reality headset appropriately. I would highly recommend a VR-ready computer with a high-end graphics capability is necessary to create the best VR experience.

Virtual reality opens the doors for all our students to access the best kind of education by blending together the best of the real world and the best of an immersive, virtual world technology so that the most modern techniques are utilized to obtain that education.

Techradar: Review

<https://www.techradar.com/news/the-best-vr-headset>

Objectives:

Part 1:

- How to setup and use VR in the classroom
- The type of VR that can be used in the classroom
- How to use VR in the animation and or game classrooms
- How to teach effectively with VR
- How to get passed the wow factor
- How VR can engage students to learn
- Is VR an effective way to teach, and how does it change the classroom dynamics

Part 2:

- How to clean up real-time data in Motion (OptiTrack motion capture software)
- Motion capture clean up
- Using motion capture raw data in software packages like Motion Builder, and Maya
- How to use the different types of motion capture raw data files in a game or animation scene.
- How to rig for Motion Capture data
- How to use motion capture after the rigging process
- How to rig for game engines
- How to add the motion capture data to the rig
- How to use the rig in the game engine

Part 1: Virtual Reality Solution for Animation Classrooms

Setting up a VR system in a classroom will be different for everyone. It all depends on the VR system you choose and the computer you will be using it on. Setting up the right VR system can also depend on the curriculum you are teaching, and what area you teach so instead of trying to write out documentation for hundreds of different setup scenarios I will focus on the animation department, and the best setup for our classrooms. After a lot of research on VR systems, and physically trying each one out; I narrowed it down to three main systems; the HTC Vive Pro, Oculus Rift, and the Samsung HMD Odyssey. They are all very capable VR systems, but out of the three I chose the HTC Vive Pro with its superior comfort, expandability, high

quality build, and high-resolution imagery, and it can also accommodate glasses which is a huge plus since 50% of my students wear glasses, and so do I!

The Vive VR system we are interested in is 3D, which is way more immersive, and flexible than 2D. The 3D animation classroom is a very difficult area to expand on since the very nature of 3D is technical and all about technology. Students are creating 3D content in a 3D program day in and day out and seem totally immersed, but I see some room for improvement.

There are times when 3 hours passes by and you look up at the clock and are shocked at how fast time has passed. I think that animation students need stimulation in a different way so I explored a new plug-in called the VR-Plug-in for Maya. Maya is a robust 3D software animation package that can create content for animation, gaming and VFX. The VR-Plug-in for Maya offers a production proved tool-chain for Autodesk Maya artists to work with Virtual Reality.

The VR-Plug-in allows for 360-degrees of freedom and directly see your 3D assets in VR instead of a 2D screen. The stereoscopic view gives you a precise and natural impression of scene scale and proportion. Experience the entire depth of Virtual Reality in the most intuitive way. HMD movement can be recorded as camera animation, hand controllers are recorded as locators. Use your gamepad as fly-cam and explore the surrounding area.

Speed and performance are the great advantages of the Maya Viewport 2.0 Benefit from full DirectX11/OpenGL lighting and shading support with Virtual Reality. The VR-Plugin transforms your workspace to virtual within seconds – no export required.

The best way to teach effectively with VR is to find an interesting topic and then find the best content to immerse the student, and with the VR-Plug-in for Maya you are basically able to work in 3D as it was intended!

How do you get past the wow factor? I think it's OK not to get past it. I have been using the VR-Plug-in for Maya for about a month already and there is still a little excitement when I put the VR headset on, and work in Maya. The wow factor keeps students interested and that's a good thing!

Part 2: Motion Capture

JCCC has its own dedicated Motion Capture system in the Co-Lab (Collaboration Lab) located in room OCB 110, and I recommend that you check it out. The Motion Capture lab has available training through the Co-Lab administrative staff. There is quick-start documentation in the lab for new users, and video tutorials for additional information. I wanted to make sure that I included this information in my sabbatical report for students, and faculty members who are interested in Motion Capture and would like to incorporate motion capture into their projects.

Motion Capture, Performance Capture or Mocap

In its simplest form it is the recording of the motion of an object by a computer using a series of sensors. As a process it is the planning, recording and integration of that data.

In simple terms motion capture systems can capture the motion of anything you can attach a sensor to. Attaching the sensor is the easy part, applying the data to your model convincingly is the tricky part.

All motion capture systems collect some sort of data from the object the sensors are attached to. Optical systems calculate the relative position of each marker. Inertial systems measure the acceleration and rotation of each sensor.

In its raw form motion capture is simply a set of values for each sensor at a specific time, so you need a way to transfer this data on to your object inside a computer. If you think of it like a puppet system, you need the strings to transfer the movements of the performer on to the puppet in the computer.

The actual capturing of the motion or performance is only a part of the process. Before you start capturing you need to decide what you're going to capture and how you're going to capture it. Once the capturing is completed you will need to map the data to your character and integrate it in to your pipeline.

There are several steps and a number of other tasks to consider when jumping into Motion Capture. Listed is a simple MoCap workflow.

- Creating move lists
- Arranging shoots
- Rigging characters
- Capturing the data
- Cleaning up the data
- Mapping the data to your character
- Editing the data

As evidenced, actual capturing of the motion is only a small part of the whole motion capture process. It should feel like the easiest part. To make the whole process as painless as possible, you will need to plan. Think about it this way, If you fail to plan, you plan to fail.

Special lycra suits with markers or sensors are placed in precise locations on the body to capture its movements. The markers need to stay fixed to those locations to accurately record the movement of the performer. If the performer wears loose fitting clothing the markers will move around independently of their body. You

would be capturing the movement of the clothing not the movement of the performer.

The Optitrack system uses motion capture hardware that consists of specialized cameras to track markers that are connected to a small server that sends the data into a real-time capturing software called motive. The performer puts on a suit, and the engineer sets up the markers on the suit. The performer stands in the middle of the room and the software analyzes and calibrates the room and the markers. The engineer can record the performance and then use the data at a later time. Listed below are video tutorial resources that cover all the objectives outlined in my sabbatical proposal.

Adding Virtual Reality to the Motion Capture Lab

One of my sabbatical objectives was to research and try to find a way to utilize the motion capture space during times when the motion capture system is not used. I did some investigation, and I may have found a solution that would help maximize the motion capture between MoCap sessions. My proposal incorporates the use of virtual reality technology and motion capture technology together as one cohesive unit. These two technologies could work together or separately depending on the project or student's needs. The animation and game students would work together creating VR games and animations that would be viewed in real time or it could be used to immerse the user in a new world or be interactively connected using new and exciting tools. The applications are endless. Students could experience new ideas through VR technology and turn those ideas into workable solutions. We already have the Motion Capture Technology so all we need is to add a VR hardware solution to the motion capture technology room. Listed below is additional justification to incorporate VR into the motion capture room.

Active Participation

High-end VIVE VR is a fully immersive experience that engages sight, sound, and touch. You are not just a bystander, watching the world go by. High-end VR transports you from common reality to a chosen reality where you're an active participant.

Room-Scale Tracking

With high-end VIVE VR, you can physically walk around your environment and interact with your surroundings as if you're actually in them. This is achieved with room-scale tracking technology—the defining feature of VIVE and the one that separates us from the competition.

Motion Capture OCB 110 Revitalization Proposal

Adding a Virtual Reality Solution to the Motion Capture Lab

My proposal is to fund two (2) Enterprise - HTC Vive Pro Full Kits that includes:

- Includes VIVE Pro HMD, second-generation controllers & base stations
- Features SteamVR™ Tracking 2.0
- Up to 22'11" x 22'11" room-scale stage
- \$1399.00 each
- Wireless is an additional \$500.00
- Accessories – Link Box for Vive Pro \$50.00
- VR-Plugin for Maya (stand alone product) \$199.00

Proposal Cost: \$4100.00

Adding Reallusion All-In-One Full-Body Mocap Animation Software Solution to the OptiTrack Motion Capture System

This bundle includes:

- iClone 7
- 3DXchange 7 Pipeline
- Motion LIVE Plug-in for iClone
- Perception Neuron Profile for Motion LIVE Plug-in
- Faceware Profile for Motion LIVE Plug-in (includes Faceware Realtime for iClone)

Exclusive Bonus:

- Leap Motion Profile for Motion LIVE Plug-in (Value: \$99)
- Character Creator 3 for iClone
- Daz Genesis Extension comes free with 3DXchange 7
- Perception Neuron Discount Coupon - For either 10% OFF on 32 Neuron V2 or 15% OFF on Neuron PRO

Save USD1,486.00

USD \$3495.00

Additional Justification: Adding the Reallusion All-In-One Full-Body Mocap Animation Solution for the OptiTrack Motion Capture System will give us the ability to create real-time hand and finger movement, and real-time facial capture. This will enhance the motion capture experience and add an incredible amount of flexibility to the system we already have. We also want to maximize the use of the Motion Capture room by adding Virtual Reality technology and updating software. A Virtual Reality solution to the Motion Capture lab would promote active learning between students, and faculty members. Virtual Reality would also open doors for cross-curricular activities and projects. Listed below are additional reasons to incorporate VR into the motion capture room.

OptiTrack /Motion

MoCap Session with the OSU dance Team

<https://www.youtube.com/watch?v=tBAvjU0ScuI>

Optitrack System with Motive (Tracker) : Calibration, Capture

<https://www.youtube.com/watch?v=G1-N9X4pB6Q>

1) Volume setup and Calibration

<https://www.youtube.com/watch?v=cNZaFEghTBU&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=16>

2) Preparing your Performer

https://www.youtube.com/watch?v=PPh_3C8YbWE&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=17

3) Manual Marker Labeling

<https://www.youtube.com/watch?v=iMPh7JhlCqc&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=18>

OptiTrack /Motion

instructional videos

1) Installation and License Tool

<https://www.youtube.com/OKX8Gaqo0&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=1/watch?v=m->

2) 2D and 3D Views

<https://www.youtube.com/watch?v=QH-FzfNEk6Q&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=2>

3) Panes and Layouts

<https://www.youtube.com/watch?v=wBmdeDtOQmU&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=3>

- 4) **Toolbar and Dropdowns**
<https://www.youtube.com/watch?v=H4Z2FJuzARA&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=4>
- 5) **File Management**
<https://www.youtube.com/watch?v=a-tyB9SW-Ik&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=5>
- 6) **Timeline**
<https://www.youtube.com/watch?v=m-S99EDLbL4&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=6>
- 7) **Intro to Rigid Bodies**
<https://www.youtube.com/watch?v=Z9k07jJgCLE&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=7>
- 8) **Markersets**
<https://www.youtube.com/watch?v=Gfd25DdCZ78&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=8>
- 9) **Intro to Skeletons**
<https://www.youtube.com/watch?v=g9b8EAbDPaQ&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=9>
- 10) **Intro to 2D and 3D Data**
<https://www.youtube.com/watch?v=xhbryQ-nyYw&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=10>
- 11) **2D and 3D Data Examples**
<https://www.youtube.com/watch?v=Pq6wG2iEmSg&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=11>
- 12) **Skeletons 1**
<https://www.youtube.com/watch?v=k1NDIBMD3rU&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=12>
- 13) **Checking Marker Labels**
<https://www.youtube.com/watch?v=alsrZSWLoZw&list=PLdKrdVGpQ5OZSIQDCyYFT-iOo1Qmfzl7Z&index=13>

14) Auto Labeling

<https://www.youtube.com/watch?v=KwXiURjDehU&list=PLdKrdVGpQ50ZSIQDCyYFT-iOo1Qmfzl7Z&index=14>

Cleaning Motion Capture Data with OptiTrack Motive

1) Introduction

https://www.youtube.com/watch?v=xhKwCurY_mY&list=PLT5nBVZ529Ixl_xu0KMAxa2P3mnoWsNOp&index=1

2) The Interface

https://www.youtube.com/watch?v=76Dj9bRkDz4&list=PLT5nBVZ529Ixl_xu0KMAxa2P3mnoWsNOp&index=2

3) Data Cleaning

https://www.youtube.com/watch?v=15gKPAqEht0&list=PLT5nBVZ529Ixl_xu0KMAxa2P3mnoWsNOp&index=3

4) Export

https://www.youtube.com/watch?v=QIF0fp70Ilg&list=PLT5nBVZ529Ixl_xu0KMAxa2P3mnoWsNOp&index=4

Using motion capture raw data in Motion Builder

1) Introduction to Motion builder's Interface

<https://www.youtube.com/watch?v=X1xltjBB76c>

2) Importing Motion Capture Data

<https://www.youtube.com/watch?v=dPNJ5qum8SY>

3) Retargeting Motion Capture Data - Part 01

<https://www.youtube.com/watch?v=EzLwd-Kffo>

4) Retargeting Motion Capture Data - Part 02

<https://www.youtube.com/watch?v=cXDv6kPGSno>

5) Control Rigs and Animation Cleanup

<https://www.youtube.com/watch?v=VSJD1biZgvo&t=68s>

6) Animation Cleanup

<https://www.youtube.com/watch?v=qIeRjj8mzv4>

7) Export

<https://www.youtube.com/watch?v=Jc5Dp6eQXN0&t=3s>

Using motion capture raw data in Maya

1) Maya: Mocap Data Transfer

<https://www.youtube.com/watch?v=RPrdDIOXjEg>

2) How to apply mocap to any rig using Human IK in Maya

<https://www.youtube.com/watch?v=eiSHnYYciec>

3) Transfer motion capture data to custom rig

https://www.youtube.com/watch?v=SYv_Z1TdBvU

Applying Motion Capture Data to Custom Rigs in Maya

Motion capture data has become a common way to quickly offer believable animation for projects. With motion capture data sets being available and affordable on a few market places online, motion capture has proliferated to the masses. How do we use Mocap (Motion Capture data) with control rigs, and how do we transpose the motion capture information onto an already rigged character in Maya? **instructional video**

https://www.youtube.com/watch?time_continue=55&v=-co5cyEt5zM

Cleaning Up Motion Capture Data in Maya

https://www.youtube.com/watch?v=_AQzX2Dopnw

How to apply MoCap Animation to your 3D character in Unity

<https://www.youtube.com/watch?v=nGdCPpWyjM8>

How to Import FBX MoCap from Motion Builder to Unity

<https://www.youtube.com/watch?v=aFF-q6P6Wmk>

Unity 4.0-Mecanim Animation Tutorial

<https://www.youtube.com/watch?v=Xx21y9eJq1U>

Unity 3D & Miximo Character Animation with Mecanim

<https://www.youtube.com/watch?v=256-LXzMt0U>

Animating Characters in Unity 2018

<https://www.youtube.com/watch?v=gQ6VBRVNzus>

Virtual Reality In Education

Better sense of place

When students read about something, they often want to experience it. With VR, they are not limited to word descriptions or book illustrations; they can explore the topic and see how things are put together.

Thanks to the feeling of presence VR provides, students can learn about a subject by living it. It is easy to forget that VR experiences are not real, and our bodies actually believe are in a new place. This feeling engages the mind in a more natural way making the experience feel real to the user.

Scale learning experiences

Traditional science labs allow students to understand how things work based on practical experience. But, many experiments are expensive and can be difficult to scale. There are also a limited number of things they can do. VR gives us the power to scale and make learning more dynamic and engaging. A relatively small VR device can even act as a whole science lab. A virtual laboratory can be like a physical one. Students get hands-on experiences in realistic environments and engage in challenging exercises relevant to real-world experiences.

Learn by doing

Many people learn best by doing; however, if you inspect modern education, you'll see how little learning actually happens by doing. Students are focused on reading instructions rather than using them in practice. VR provides an experience anchor to the instruction. With VR, students are inspired to discover for themselves. They have an opportunity to learn by doing things rather by reading a book. A virtual medicine lab where there's no danger of things going wrong.

Emotional reaction

Visceral reactions to what we are experiencing are fundamental to forming memories. VR makes it easy to engage students the whole time, making experiences really memorable. The emotional connections students make with learning experiences in Virtual Reality increase their excitement and helps them remember different details. Image credit: Google for Education

Develop creativity

VR is useful not only for content consumption, it is also great for content creation. By giving students powerful tools such as Adobe's Tilt Brush, you help them boost their creativity. VR allows you to interact with your own imagination. Tilt Brush is a room scale 3D painting VR app developed by Google.

Visual learning

Many people are visual learners and VR is really helpful for this group of learners, as students can actually see the things they're learning about. Being able to visualize complex functions or mechanisms makes them easier to comprehend.

Showing mechanisms in 3D is extremely helpful in understanding how a system functions.

Users are ready to embrace new technology

The first idea that pops into anyone's mind when they think about VR technology is an entertainment experience. Many designers see VR as an extension of the gaming industry. It's true that VR has historically been dedicated to gaming, but things are changing. According to a recent survey conducted by Greenlight VR, desire for education outweighs desire for gaming content — 63.9 percent vs. 61 percent. This means there is potential of increased demand for educational VR experiences. Johnson County Community College investment in VR technology as a primary learning tool will enhance students classroom experience and give JCCC a competitive edge in attracting new students

Virtual Reality is an exciting and real solution that promotes active participation between students and immerses them into new worlds and places that they would have never experienced before. Virtual reality can also be used in classrooms to enhance student learning and engagement. VR can transform the way educational content is delivered; it works on the premise of creating a virtual world, real or imagined, and allows users to interact with it. Being immersed in your learning motivates you to fully understand it. It will also require less cognitive load to process the information.

I would like to thank the Johnson County Community College organization for giving me the opportunity to take a sabbatical leave of absence, and to research technology areas in VR (Virtual Reality), motion capture, and VR in animation and game development. My sabbatical project gave me the opportunity to personally and professionally grow as a JCCC faculty member through the research and development of my project objectives. I would highly recommend any JCCC faculty member who qualifies for sabbatical leave to take the time to apply for the faculty sabbatical application process and proposal evaluation. It is instrumental for all faculty members to take a sabbatical leave from teaching and daily college administrative duties to help combat burnout, and help refresh your outlook and gain new ideas, and practices. It is also a great time to explore personal and professional development.

Research Resources

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Mixing and Extending Reality : Edtech Options in Higher Education

<https://www.thetambellinigroup.com/mixing-and-extending-reality-edtech-options-in-higher-education/>

How to use VR Technology in your classroom

<https://projected.com/blog/2018/3/9/how-to-use-vr-technology-in-your-classroom-in-2018>

Ten Practical Uses for VR in the Classroom

<http://blog.whoosreading.org/practical-uses-vr-classroom/>

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<https://www.vrs.org.uk/virtual-reality-healthcare/>

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<https://visualise.com/virtual-reality/virtual-reality-healthcare>

How Vr IS Changing Healthcare

<https://thedoctorweighsin.com/virtual-reality-improving-healthcare/>

Seven Ways VR is helping Healthcare

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Top Ten Ways to improve Health Care

<https://vrtodaymagazine.com/vr-healthcare/>

The future of VR inHealthcare

<https://www.interbrandhealth.com/views/the-future-of-vr-in-healthcare/>

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OptiTrack

<https://optitrack.com/>

Connect OptiTrack with Motion Live

<https://mocap.reallusion.com/iclone-motion-live-mocap/buy.html>

Autodesk Maya

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<https://www.unrealengine.com/en-US/>

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