Ready Trainer Too: The Trials, Tribulations, and Technical Troubles of Bringing the Classroom and Immersive Training to the Metaverse

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ABSTRACT

"Death by PowerPoint" is a phrase used to describe a lack of proficiency in the use of the software, but also infers a lack of learning from the observer. "Class via Zoom" may as well be synonymous, and as we delve further into using the MR/AR/VR as learning tools, "Immersed in the Metaverse" could join the crowd. Worse yet, immersive content is not easily created, leaving instructional designers dependent on the expertise of specialized artists/programmers to develop, which once made is not easily modified without those same creators. One option is to create a virtual environment where learners and trainers can immerse themselves. One where the trainer can work to develop meaningful trainer-led events, while learners can explore and work with each other and the instructor to grasp concepts that would require varying logistical issues, that could instead be reduced or replicated via simulacrum created by the specialty art and programming team. This paper intends to utilize information gathered from conferences, the development tools of serious/non-serious games, and the development process of a solution to the said option, in order to discuss how current technology both is and isn't ready, as well as how the industry itself must work together to define acceptable standards that must be met to create the remote virtual classroom that works with both the private, public, and government sector in a way as seamless as creating a PowerPoint presentation with the immersion of a fully equipped training center.

ABOUT THE AUTHOR

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BACKGROUND

Nobody wants to sit through another PowerPoint, but if they had a choice, they would rather do that than read this paper (Tufte, 2006). Everyone wants to use the latest technology to advance training, but in the end, most still return to presentation software instead of the various technical solutions provided. This must mean that software like PowerPoint is the perfect solution for everyone's training needs. No reference is needed to determine that this is false. But, why do educational institutions rely so heavily on this tool and similar software solutions instead of focusing on new mediums to enrich their students? This paper will attempt to illuminate what makes PowerPoint, the de facto leader in presentation software and as such our chosen software for comparison purposes (Keller, 2003), still, the go-to option for trainers as compared to the latest in training technology software and hardware used to immerse trainees into the 'Metaverse', a termed coined by the novel Snow Crash, but most recently co-opted as a term that refers to a "new" type of internet where people can navigate 3D virtual worlds from the comfort of their own home and virtual reality, or VR, devices (Ball, 2022). Furthermore, this paper will present how VR, as well as Augmented Reality(AR) and Mixed Reality(MR), can be used to overcome the gripes learners have with PowerPoint-based learning, known colloquially as 'Death by PowerPoint', and the sudden rise in remote based learning, administered by software such as Zoom and Microsoft Teams, caused by the Covid-19 Pandemic (Abott, 2020), and how a VR/AR/MR based solution not only solves issues that arose from the sudden need for remote learning but also how it can make remote learning a viable and potentially permanent solution which would solve several financial and logistics issues presented by various government leaders in conferences held 'post'-pandemic.

A Solution Requested

The theme of most conference talks from the voices of those representing the United States government and armed forces has been that VR/MR/AR is the desired and requested future, but also that training solutions need to be a unique version of good, fast, and cheap that has been tailored for the needs of the scale of bureaucracy as well as the preparing the best means of improving a newly enlisted warfighter. Below will look at talks and themes presented at the 4th Military Virtual Training & Simulation Summit as well as the 2021 Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) as observed by Emerging Technology Support, LLC employees in attendance.

Other than the unique challenges presented by a military and government solution, talks from the 4th Military and Virtual & Training Summit focused on accessible, durable, readily available, cheap, exceeds the limitations of reality, and scalable joint-operation solutions, that can be done hidden from the ever watching eyes of adversaries. Themes of the government looking for a return on its investment, and how to best leverage what it received with that funding, echoed across several talks. Open-source, or at least shared-source solutions, to eliminate proprietary products that prevent industry collaboration with the government and each other. These were common requests among the government representatives. Still, speaker Carolina Cruz-Niera, Agere Chair, and Professor for the College of Engineering and Computer Science at the University of Central Florida, and a major contributor to the history of VR, made other suggestions (Cruz-Neira et al., 1992). VR does not necessarily equal headsets but is any technology that takes you there. Also, there needs to be a re-education on VR not being a new solution, and the trainer must be able to create VR training events. She further suggests that non-government VR solutions such as those for Arts and Humanities be used as testbeds for new projects, thus expanding the audience and exposing VR to even more potential users and creators.

I/ITSEC 2021's opening ceremony focused on Virtual Training as more than just a training solution to solve problems revealed by the Covid-19 pandemic, but also as something needed to enhance all training beyond what could be done

physically. People are first when it comes to training efforts, followed sequentially by ideas and finally things. The Department of Defense is no longer interested in closed-system solutions, solutions must be joint-operative and integrated, and solutions not meeting these goals will be sunset in favor of requested solutions. The solutions presented in the exhibit hall overwhelmingly did not show much progress toward these requests, however, tools were presented that could be harnessed to create such solutions.

Problem Statement

This brings us to the issue at hand. Nobody wants to use PowerPoint, but there is a lack of resources that a trainer can rely on to move away from the presentation software and we've become so reliant that PowerPoint seems almost sacred as a tool that any negativity towards the product can result in extreme actions ("The PowerPoint rant", 2010). The best method of reducing costs while ensuring the content is designed to benefit the learner by following syllabi and directives, which is also using the newest and most immersive technologies, requires the trainer to be the main facilitator of the content deployed to the learner. The trainer is generally the subject matter expert and the best source of information for the learner. Still, the trainer's best solution for deploying their knowledge and skillsets, via a means that they can develop themselves, is through lecture accompanied by PowerPoint or demonstration, also potentially accompanied by PowerPoint, not the development of immersive and/or live virtual training. This leaves two options for a school: train their trainers on developing VR/MR/AR-based training, which increases costs, or invest in product development from a separate internal or third-party team. Both cost time and effort beyond what the trainer is already tasked with. The trainer must either take their own time to study the toolsets needed or be trained at the cost of the school, which reduces the number of trainers available to deliver training. Using an option external to the trainer requires trainer input, and then rehearsal so that the trainer is also not seeing content for the first time, or even so the trainer can perform the tasks required of the developed training solution. All the while, the higher echelon is requiring that training be more immersive and real-world, while also being deliverable cheaply and remotely at a moment's notice, and if the trainer fails to develop such a solution, then they are at fault, not the requirements. Maybe it is more than just ironic that the first VR Head Mounted Display was called 'The Sword of Damocles' (Sutherland, 1968).

ORIGINS - POWERPOINT AND VIRTUAL REALITY

To start, it is important to know both software solutions' origins and how they've shaped the training landscape. Instead of proceeding chronologically, we'll start with PowerPoint, then follow up with Virtual Reality. As the proposed solution for the stated problem does not utilize Augmented or Mixed Reality as generally defined, their origins outside of their inherent relationships to PowerPoint and Virtual Reality will not be discussed.

History of PowerPoint

PowerPoint wasn't the first presentation software, but its prevalence has rendered it the de facto term as 'X-Acto' is to hobby knives, and 'Kleenex' is to tissue. 1987, 5 years after nearly a half-dozen other similar software releases and 3 years after beginning development, PowerPoint, known simply as 'Presenter' during development, was released, created by developers Robert Gaskins and Dennis Austin for Forethought, Inc (Gaskins, 2012). While early development favored a release for Windows 1.0, further designs also showed the software in an Apple environment. Apple, believing that presentation software has a bright future, chose PowerPoint to be its first investment of its Apple Strategic Investment Group, and as such PowerPoint 1.0 was released first for Macintosh PCs (Gaskins, 2012). PowerPoint's unique offers, and success with its initial Macintosh release, prompted Microsoft to move to acquire Forethought, Inc, one month after the initial release ("Microsoft Buys Software Unit", 1987).

Initially, PowerPoint was a traditional presentation software. Traditional in the sense that it was used to create presentation mediums used for overhead projection and 35mm projectors, but with PowerPoint 3.0, live video was added for projectors and monitors so that the software itself could be the presentation medium (Gaskins, 2007). Thus began the move away from traditional mediums, to what is commonly used today. Initially, Microsoft sold its various Office suite of software in packaged bundles as a marketing ploy to sell more products, as each piece of software was a separate entity within the package, before eventually bundling all products together into the current Microsoft Office product. With PowerPoint 4.0, the Office suite began to integrate, and further versions began to share similar user interfacing to make the use of each software appear seamless.

Currently, PowerPoint and its presenter software are available on Macintosh, Windows, iOS (iOS and iPadOS), Android, and the Cloud. Ignoring Linux, which could use the cloud versions, Microsoft has ensured that PowerPoint can be used to create, share, and project from nearly all platforms used for the creation of training content, and with Microsoft Word being the backbone of almost all word processing in white- and blue-collar industries, the integration of PowerPoint into the same suite as Word makes it an obvious choice for anyone looking to create a presentation. Students are even generally introduced to the software in grade school and college from both a viewer and learner standpoint, but also as a presenter when asked to create media-enriched reports during their education. Through various strategic investments and business decisions Microsoft cemented PowerPoint as the almost sole choice when it comes to developing a presentation that anyone can make, view, and share at the click of a mouse or tap of the screen.

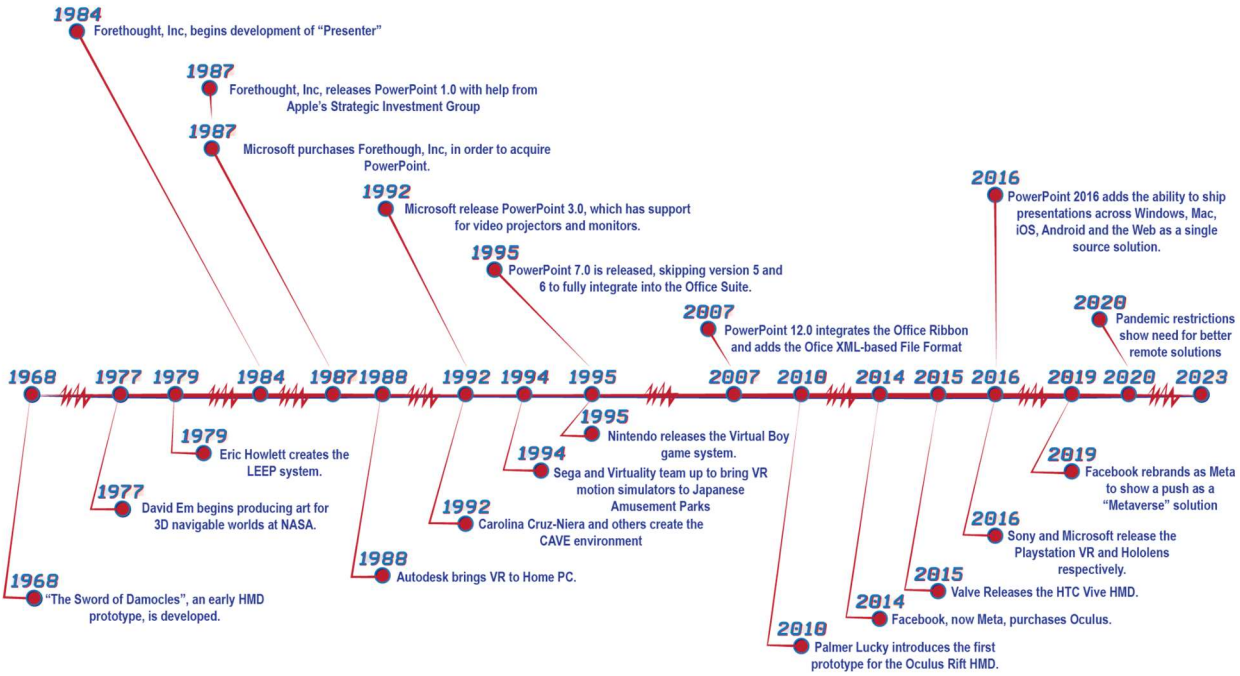

Figure 1. Timeline of PowerPoint and VR Milestones

History of Virtual Reality

From the 1987 release of PowerPoint, to nearly two decades earlier, in 1968. Although concepts existed before Ivan Sutherlands' 'The Sword of Damocles', an early HMD so named due to it being a massive and heavy device mounted to the ceiling above the wearer, this device is given the distinct title of being the first VR headset. The 'Sword' featured an optical pass-through and created wireframe rooms for its virtual environments (Sutherland, 1968). The idea of VR no longer being purely in the realm of science fiction led to its use in high-end training and manufacturing, reserved in areas where either cost wasn't an issue or the cost of VR was cheaper or more ethical than a live training event.

For the next two decades, development focused further on the informative and immersive use of VR technology. NASA's Jet Propulsion Laboratory harnessed David Em's art to produce 3D navigable worlds in 1977. In 1979, Eric Howlett created the Large Expanse, Extra Perspective, or LEEP system, which increased the field of view to reflect the user's real perception, a feature improved upon in further iterations and a driving feature of modern VR (Thomas, 2005). Hand and Body based interactive devices began to become more commonplace in the early to mid-1980s and by the end of that decade the term 'Virtual Reality,' made popular by Jaron Lanier, became the common term for all of these technologies, and Autodesk brought VR to the home computer in 1988, a year after the release of PowerPoint (Barlow, 1990).

The 1990s were the first entertainment renaissance of the VR industry. While Atari and Nintendo had been relatively unsuccessful in their VR ventures in the 1980s, Sega and Virtuality jumped in to bring VR to the arcades and expand VR into the realm of entertainment. Although Sega's Sega VR never made it to market, Virtuality's success with their pod-based VR systems caused Sega to form a partnership with Virtuality and create a VR motion simulator ride

dubbed VR-1 in 1994 to be installed in Joyopolis, a group of Tokyo-based indoor amusement parks, bringing what was originally only seen in flight training simulators to the general consumer ("*Sega Teams Up",* 1993). Additionally, the Star Trek 'holodeck' concept, a generated virtual environment that could be explored and interacted with physically and dynamically by users, was brought to life through the cave automatic virtual environment, or CAVE, created by Carolina Cruz-Neira and others at the University of Illinois in 1992 (Cruz-Neira et al., 1992). Virtual 'worlds' dominated the entertainment landscape with experiences such as Second Life and various MMOs such as EverQuest and World of Warcraft in the early 2000s. Software companies such as Apple and Google began introducing 3D immersive content into their products.

The 2010s have brought us to the current renaissance, and the beginning of VR as a viable education and entertainment solution. Palmer Lucky introduced the prototype for the Oculus Rift in 2010, and in 2014 Meta, then Facebook purchased Oculus VR outright (Metz, 2014). Valve introduced its consumer headset the HTC Vive in 2015, and Sony introduced the PlayStation VR to the market in 2016. Various other devices have been introduced during the last decade as well, and VR has gone from requiring external sensors placed in various places around the room, to inside-out tracking where all that is needed is open space to utilize the headsets and controllers effectively. Meta has even introduced its own VR version of 'Second Life' called Horizons and has invested heavily in VR, even rebranding to Meta from Facebook taking the prefix "Metaverse" as their name ("*Introducing Meta",* 2021). Microsoft also has delved into VR with the HoloLens headsets and mixed-reality integration present in the current and previous Windows OS by default.

Historical Analysis

VR, as we know it today, appears to be twenty years older than PowerPoint, yet it has only become prevalent over the last decade outside of military and industrial training, as well as high-end entertainment ventures. In general, newer technologies tend to phase out older outdated technologies, so it's not odd that PowerPoint would be 'in the lead' when it comes to training systems. However, VR has begun to have a resurgence due to certain limitations that have hindered mass consumption of the technology. But even with these new cheaper and portable solutions, PowerPoint remains the training aid of choice. It is, therefore, necessary to evaluate the present for possible reasons for VR's lack of mass acceptance.

MAKING A POWERPOINT VS VR SOLUTION

Comparison of Development Costs and Time

The costs of PowerPoint, VR, and Live Training development and execution balloon exponentially as we move sequentially through each. PowerPoint development is measured in hundreds to thousands of dollars. VR development is measured in the thousands to tens of thousands of dollars, and Live Training is measured in tens of thousands to hundreds of millions of dollars. While the cost of equipment and software (see Table 1) is a major factor when determining the overall cost of a training event, PowerPoint and Virtual Reality could be considered to have similar software costs, the key factor is personnel with certain expertise required to develop and implement a training solution. PowerPoint requires the fewest developers as the Instructional Designer or Instructor can be the one-stop solution for a finished product, as all the tools to create a basic product exists within the software. Virtual-Reality requires that same person, as well as at least a graphic artist, 3D artist, and programmer, and as such increases cost by over three times (See Table 2). Live Training requires the full personnel needed to complete the training event, and the cost increase could be quantified, but it is determined by the nature of the event and as such cannot be properly defined.

Table 1. Software Costs

	Software Required (Cost in Dollars per year per seat from product websites)				
	Microsoft Office	**Adobe Creative Cloud (Graphic Arts)**	**Autodesk Maya (3D Modeling)**	**Other**	**Total**
PowerPoint	$264	-	-	-	$264
Virtual	$264	$1,019.88	$1,785	-	$3,068.88
Live	$264	*~$1,019.88*	*~$1,785*	**~∞**	**~∞**

Table 2. Personnel Costs

	Personnel Required (Cost in Dollars per year, estimates from Glassdoor.com)					
	Instructional Designer	**Graphic Artist**	**3D Artist**	**Programmer**	**Other**	**Total**
PowerPoint	$78,097	-	-	-	--	$78,097
Virtual	$78,097	$45,556	$58,483	$85,962	--	$268,098
Live	$78,097	*~$45,556*	*~$58,483*	*~$85,962*	**~∞**	**~∞**

PowerPoint, by comparison, is also the least time restrictive of the training mediums, except in instances of Live Training that require minimal setup to deploy. VR and large-scale or obtuse Live Training events require months or even years to properly develop for deployment to the trainer, compared to the days to weeks a PowerPoint would take to create.

Comparison of Development Hurdles

Like the costs of each training product, the development of each of the previously mentioned methods comes with its own unique set of hurdles. Starting with PowerPoint, the major hurdle is the ability to use the software. Points could be made that an understanding of operating a personal computer could be included, but if we afford that most users in a position of training development would meet such a requirement, we can ascertain that the only hurdle between them and a realized presentation solution is the ability to harness the software itself. Nearly every tool, outside of custom video, audio, and graphics, for the development of a PowerPoint, is included in the software itself (Microsoft, 2023). Furthermore, one operator can develop a fully realized presentation from concept to completion with very minimal outside help if none. Live Training comes with another variety of logistical hurdles, but these are too varied and nuanced to spend a paragraph describing, so we will instead explore the unique development hurdles associated with VR that are not present in PowerPoint due to Microsoft providing a solution, or they were inherently never present.

VR suffers from what would be called 'moving goalposts,' a metaphor from sports that infers that rules were changed to the detriment of the players after the rules had been initially established. As discussed, while VR isn't new compared to classical classroom training, it's older than PowerPoint. However, the process and tools for development have been constantly shifting, and recently they have shifted at a rate where a company could have to change course during development and even after to maintain a deployable piece of software. PowerPoint doesn't have this problem, instead with each new technology and graphic medium, Microsoft instead made its best effort to ensure backward compatibility to ensure that old graphics and video technologies could be shared alongside newer technologies (Microsoft, 2022). However, game engines such as Unity and Unreal Engine, have begun to avoid using proprietary mediums and move towards more open solutions. This results in a better pipeline for VR development that requires a lower burden on current and future developers as there is less repeat work as game engines iterate themselves, but that doesn't mean that VR development is safe from the next hurdle, deprecation.

All three mediums suffer from deprecation. Whether through the deprecation of software or hardware, or even deprecation of the training method itself, there will come a point when some aspect of a previously developed solution will need to be readdressed to ensure proper deployment methods and training standards are met. PowerPoint is the least affected as they generally only suffer from changes to content, and while there have been subtle changes to each iteration of the development software itself, source files of presentations created in older formats can be opened and edited in the new software. VR however doesn't have this luxury as a feature. While Unity and Unreal Engine, game engines used for game and simulation development, have attempted to ensure that newer versions of their software can easily migrate to older projects, this does not mean that all aspects of the source project will transfer. This means that a whole new product would need to be developed as technology advances, resulting in entire solutions being deprecated to meet new standards of both learning and deployment, including the multi-player system used originally for the development of the RE∀LMS product to be discussed further on in this paper (Meta, 2022). Live training suffers primarily from the deprecation of the training medium itself but can be adapted to by the trainer or training environment without the necessary need to deprecate the training wholly. A deprecation of a Live Training event

rarely results in the same loss of investment, concerning training medium, as VR would lose if deprecated in the current training methodologies, as the venue itself would generally be able to sustain the new training.

Comparison of Deployment

Without question, Live Training is the most difficult to deploy as it is reliant on many factors beyond just hardware and software, but when it comes to PowerPoint versus VR, PowerPoint once again outpaces VR in matters of deployment ability. In general, if it has a screen, it can display a PowerPoint, and even better PowerPoints can be printed so they don't rely entirely on digital as a means of deployment (Microsoft, 2022).

The lack of ability to deploy without additional funding outside of the development also puts a hamper on VR's use in the classroom. VR requires specialty devices not readily available in most training installations. If the training installation was specifically built with VR training in mind, this may not be the case, but in general, a basic classroom is not currently equipped with even the rudimentary hardware required to deploy a VR training event. Most trainers themselves have probably heard of VR training, but they may not even have first-hand experience with a VR Head Mounted Display (HMD) themselves outside of seeing commercials and advertisements for them. This is also assuming that the training event itself can be supported solely with an HMD and 'controllers', be they hands-free or hand-held and that it does not require any other immersive technologies, e.g., a motion simulator. Where PowerPoint can use what is already present, VR would require a possible complete reworking of the layout of a classroom, the hardware present, and even the number of students that the classroom could reasonably accommodate. Also, HMDs and the technology within them change at a much more rapid pace than video devices. Video standards outside of resolution tend to be a constant that is overseen by the industry to keep consumers, developers, and competitors on the same page for the good of the public and profit. Except for the 3D television and Monitor experiment of the early 2000s, technology in TVs and Monitors has focused on resolution, framerate, and color depth. Where while the same can be true of HMDs, concepts such as external and internal tracking, eye tracking, peripherals, and connectivity don't stay consistent from brand to brand resulting in custom solutions tailored to the deployment device instead of device agnostic training solutions.

Comparison of Educational Value versus Live Training

No one will undercut the value of Live Training. There is no equal. However, not all things can be trained without some sort of simulated aspect. Not all aspects of a manned mission to Mars can be trained 'live', and while we could present the gravitational difference between Earth, open space, and Mars as an equation and table via PowerPoint, most would hope that there was some method to immerse a future Martian in such an environment before landing on the red soil. VR helps fill the gaps where Live Training is impossible, unreasonable, or impractical for reasons such as time, location, or physical limitation, and results in almost identical results to the real thing (Staff Sgt. Lyndall III, 2020). PowerPoint results in the same knowledge of the subject, but not necessarily the same physical and mental retention of performing the act live or simulated.

IN SUMMARY

The reason for a lack of VR use in the classroom isn't necessarily only due to logistical issues, but more often the inability of the trainer to develop or facilitate the content at a rapid rate justified by ever-changing learning standards. The trainer is the driving force behind how a student interacts with the subject matter at hand, and PowerPoints are the easiest method to develop for that does not suffer from a lack of material understanding. This does not mean that trainers are abandoning VR as a solution out of inability, but a high barrier of entry coupled with an inability to learn all that is required to be a solo dev with even the same level of content delivery of a PowerPoint renders the thought in many a mind pointless. Until VR's development and deployment reach a near similar solution to the ease of use and development present in PowerPoint, VR will be reserved for entertainment and large corporate solutions instead of entering the common learning center as a realized and immersive solution desired by many.

The problems found in our conclusion are best summarized as VR is not used due to its costs, development hurdles, trainer unfamiliarity, and the final hurdle of justifying that it is better than a traditional classroom solution, a sentiment that many use to defend classical rote memorization because that is how they learned it and therefore that is the best method.

A proper solution must therefore provide the following:

- Maintain at a minimum the current level of training offered by presentation software while being a worthwhile solution that increases the level of learning and immersion in the presented content.
- Ease of, or transparent ease of, development and modification of training solutions via the abilities of the trainer or subject matter expert of the training content, while also being easily interacted with by the learner.
- Ease of deployment for both classroom and remote training solutions.
- A cost-effective solution to justify investment and replacement of older solutions.
- Be invisible to prying eyes.

Ready Player One: As a Model

In the world of fiction, this solution was provided by the OASIS (Ontologically Anthropocentric Sensory Immersive Simulation), a massively multiplayer online simulation game, created as an entertainment platform in an alternative timeline of present-day Earth in Ernest Cline's *Ready Player One* (Cline, 2011). Within this system was a "Planet" or level called "Ludus," which was created as a means of providing public education virtually within the OASIS. Campuses littered the planet, and because the world was not real but virtual, they could be as large and ornate as desired by their creators, as well as they did not need to follow the same laws of time and physics that limit us within the real world. Students could be taken from a lecture to an immersive field trip within an instant, and a lecture on ancient Egypt could happen in a facsimile of the pyramids of Giza. All without the teacher or students leaving the confines of their own homes or any other safe location they desired.

The purpose of bringing up *Ready Player One* isn't to say that the solution to VR as a training medium is to create a dystopian world fueled by the desires of humans to escape from the ordinary, mundane, and worries of reality, but instead to look at the solution as a model for what we could create now. Two decades ago, the hot-button simulation book was *Ender's Game,* and now we as a community have moved on to *Ready Player One*, both of which are known by the decision-makers at the higher echelons. They've asked for *Ender's Game* and now they'll ask for *Ready Player One*, and as always, the response will be from developers that such a solution is impractical, uncostly, and impossible for current platforms. For *Ender's Game*, that is more than likely still the case, but "Ludus" is something that could be made with today's technology.

The Industry Toolsets

Game engines, such as Unity and Unreal, are some of the current toolsets used to develop VR training solutions. We will expand upon Unreal Engine's capabilities and features that show that Epic Games, Unreal Engine's developer, has made strides to create a training solution accessible to as many users as possible, but also where it still falls short of PowerPoint as a go-to solution for trainers. Although Unity and its features won't be mentioned many of the solutions provided by Unreal Engine are shared with its competitor.

Unreal Engine is now on its 5th version. Other than being a real-time 3D game engine, Epic touts many new features in their online documentation where Unreal 5 has advanced from its predecessors (Epic Games, 2023). Lumen, their new global illumination system, and real-time reflections bring realistic lighting to games for the first time, and Nanite, a new geometry algorithm, results in highly detailed 3D models almost beyond what the human eye can see. While neither of these features works natively in mobile VR, advancing technology will result in less tethered or cloud-based solutions. Another impressive feature is the World Partition system, resulting in the ability to create planetary and beyond-scale environments for open exploration. The limitations of previous generation game engines that were non-starters when it came to certain training solutions have begun to be no longer the case as fully immersive visuals and real-world scalability have finally come to fruition.

INTO NEW EXPERIMENTAL RE∀LMS

Here at Emerging Technology Support, LLC, we've been experimenting with a solution we've named RE∀LMS, shortened from Remote Educator Virtual Learning Management System, that provides a solution that meets the above-stated qualities needed in a VR training solution. While it's still a distant means away from being a fully realized and developed product, its true purpose is to reveal that the solution is possible in theoretical and non-theoretical

practice. Foremost, the objective of RE∀LMS is to get a potential solution to the previously stated problems into the hands of those who can help shape the trajectory of VR-based training solutions.

Ready Trainer Too

The most important element of any training is that learning can be trainer led to ensure places where a student loses the thread can be immediately addressed or readily noticed to be gone over in more detail or reserved for a virtual face-to-face between the instructor and learner time during the lecture or after. Using the same methodology of crowd-sourced assets offered by Unreal Engine, trainers will be equipped with the ability to create immersive training classes, courses, and impromptu training moments via an on-demand inventory of environment assets, media, and interactives created by various teams and added to the schoolhouse's stores. Outside of custom textures, materials, sounds, and media required to render to desired audio and visuals requested of a schoolhouse, custom interactions requested by the trainer could be developed and added as required and once developed further shared.

Our current RE∀LM, our name for individually created worlds within the system, consists of a Lobby, Classroom, Dorm, Office, and Training Center. The Lobby serves as a dynamic meeting location for students enrolled in the virtual schoolhouse. Here they can have the same experience they would have walking the hallways of an actual school as well as having access to various amenities that the school has decided to provide for students to inform or entertain themselves with before and after classes. The classroom is structured like a traditional lecture room. Here instructors can give lectures, share media, and perform in-class demonstrations of concepts. The Training Center is the final portion of the schoolhouse itself and can be tailored to the training event required.

The Dorm and Office locations serve as hubs for the learners and trainers. In the Dorm, learners will be able to modify their avatar and check their grades, as well as sign up for new classes or review previous lessons. The Office space will provide similar for the trainer but also serve as a place for trainers to have virtual meetings with other trainers and learners.

In this RE∀LM, the learner is trained in using a detection device to locate wireless emitters. The classroom uses a traditional lecture approach and then immediately transports the learner to the training center once they have familiarized themselves with the subject matter. If a learner struggles in the training center, they will be able to return to the lesson to review, as well as contact their instructor who can join them in their training and provide direct training support within the simulation.

Rapid Development and Deployment

The current target platform of RE∀LMS is Meta Quest 2, an HMD developed by Meta. The choice of hardware was driven by the need for a low-cost immersive solution that could be powered by the 'cloud'. It also has a small form factor as it doesn't require external devices to power the training event itself outside of any servers providing the required connections. A warfighter can be supplied with a device in a protective case that takes up very little room, and commercial solutions are even smaller. The solution is low-weight and requires minimal adapters if there is access to US-style power outlets. The use of inside-out tracking eliminates the need for a special facility and instead requires a certain amount of space, which costs square footage, but not furnishings. A warfighter with the proper venue doesn't even need to deploy to be in class, helping maintain invisibility from enemy forces. The cost of travel is also vastly reduced. Also, all the locations within the demonstration can be furnished and traveled to in the time that it takes to load them, and initial setup for a new class or a repetition of the lesson can be done at the push of a button.

CONCLUSION

A trainer-led VR training solution, be it RE∀LMS or another solution, is necessary for the future of VR-supported training. Without the ability of the trainer to create the training content, and/or the ability to quickly learn and develop it, VR will be solely reserved for single-use high-end training events. This goes against the federal government's desires and seems counter-intuitive to what is needed from the general population. The Technology to develop VR's answer to PowerPoint is currently available and there's no good reason to not develop it.

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