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GRONSTEDT GROUP

Reimagining
a VR-Driven Post-Pandemic Learning Future

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1. A historical moment for VR

Summary

- Half of all large companies were already harnessing the superpowers of virtual reality (VR), including experiential and embodied learning, state-dependent retention, deliberate practice, visualization, and analytics, even before COVID-19.
- The pandemic has necessitated an even greater focus on digital work and learning – just as new-gen mobile VR is making immersive learning available at enterprise scale.
- Now is a critical time to reimagine learning for a post-pandemic future.

Acceleration of change in work and learning

"There are decades where nothing happens, and there are weeks where decades happen."

You've probably had some of those weeks recently when decades happen. What better time to start a learning revolution?

COVID marks a digital transformation tipping point that was first envisioned in the 1990s. Online learning would be individualized and on-demand. But decades went by where … nothing happened.

The best that can be said about most eLearning today is that it gives you the sensation of a coma without the worry and inconvenience. Most companies doubled down on classroom training and anesthesia-inducing eLearning courses in the last three decades and have little to show for it. Only 8% of the $170 billion spent on corporate training in the U.S. delivers meaningful results according to one study. That's a staggering amount of waste, but too many learning leaders weren't going to change until an external shock forced them.

And then decades happened in a few weeks of 2020, as the shelter-in-place order became an inflection point for the learning industry. Remote working and learning went from marginal to mandatory.

The moment of VR

A breakthrough new generation of mobile VR headsets hit the shelves in the very shadow of coronavirus and they didn't stay in stock long. Oculus Quest has been sold out every week since it launched in 2019 and a new Oculus Quest 2 (with even greater horsepower) launched in 2020. Students can now roam freely in virtual training simulations using only a standalone headset – there are no computers to bump into and no cords to trip over. The magic of virtual reality for critical skills training can finally be deployed affordably to locations that were once remote and inconvenient.

VR is a transformative technology because it fosters the magic of “presence.” The brain treats the VR experience as a real one and takes the user through the frame and into the world. Flat, static Zoom calls and eLearning pages can be replaced by traversable 3-D spaces as hyper-realistic performance environments with positional audio and haptic response effectively “hack our senses.” Learners experience sensory experiences of touch, vision, and sound of such convincing verisimilitude that the brain suspends disbelief and generates a sense of actually being in an actual place. The Holodeck has arrived.

Some of the biggest companies in the world are already using VR: half of IT Decision Makers in a 2019 survey said their companies had started researching, testing, piloting, or deploying VR. Some of them may well be your competitors.

This is a critical time to reimagine your post-pandemic future around an assumption of experiential and visceral learning we once could only dream about. Organizations that wait for the “new normal” to take shape will find themselves 18 months – or more – behind the competition.

VR is *here*. Companies need to make smart investments in emerging low-cost mobile VR technology. This guide will show you how to start your virtual reality journey to a successful new business reality.

VR and learning superpowers

Virtual reality offers low-cost, simulation-based skill training modeled on the flight simulator, which has been the gold standard of procedural training for more than a century. Commercial pilots spend two days in a full-motion simulator every six months practicing emergency procedures; it’s no coincidence we haven’t had a fatal U.S. airline crash in the last 11 years. The "miracle on the Hudson" was no miracle – Captain Sullenberger had spent significant time rehearsing simulated water landings that prepared him to famously glide a powerless jet liner into the Hudson River in New York, saving all 155 lives on board. Conversely, a lack of flight

simulation training on Boeing's 737 Max is largely attributed to the deaths 346 people in recent Ethiopian and Indonesian crashes.

Let's take a look at the why VR learning drives results:

- **Engagement**: VR makes learning fun and memorable, keeping students' attention and motivation. Game elements like mission and storyline, hint-system and feedback, level progression and freedom to fail keep learners engaged. In a world of distractions, VR offers the ultimate to a captive audience.
- **Experiential learning:** VR is modeled on what cognitive science teaches us about how we really learn: experientially. Educational theorists as far back as Aristotle have pointed out that we cannot learn what we have not experienced. VR offers safe, hands-on practice where you can learn-by-doing and fail safely.
- **Embodied Cognition:** As neurologist John Medina reminds us, our brains were designed to solve problems related to survival in an unstable outdoor environment, in constant motion, walking 12 miles a day. If you wanted to create an education environment that was directly opposed to what the brain was good at doing, you probably would design something like a classroom or an eLearning course. If you wanted to create an education environment to grow our caveman brains, you would have to start over with a learning environment that stimulates multiple senses and our entire body. VR offers such "embodied cognition." Walking around and manipulating objects with hands in VR while we while we see, hear, and touch help commit skills to memory and aid in retention and application. It builds "muscle memory," preparing us to perform tasks skillfully without even thinking about them.
- **State-dependent retention:** You've probably walked into a room to pick something up, only to forget what it was. When you walk back to the first room, it will come right back to you. That's an example of learning and retrieval taking place under the same conditions. If you learn something underwater, you'll remember it better next time you're underwater. If you learn something when drunk, you will remember it better next time you're drunk. Similarly, VR harnesses the power of "state-dependent memory" to improve performance. Experience the adrenaline rush of exiting a burning building in VR and you'll better remember how to do it if you find yourself in a real fiery building.
- **Deliberate practice:** Not all practice makes perfect. Multiplying "reps and sets" in the gym doesn't necessarily make you stronger. Achieving top performance requires 10,000 hours of "deliberate practice." Dr. Anders Ericsson argues that such practice "occurs at the edge of one's comfort zone" in small, achievable, well-defined steps with immediate feedback. VR is uniquely suited to providing intense deliberate practice and feedback loops to hone skills. Cutting out the need for a live coach can multiply practice time and

reduce cost. Different variations of a concept can be developed cost-effectively in VR, which will teach the underlying structure. Mastery can be achieved through VR in a lot less than 10,000 hours.

- **Visualization:** VR can make concepts more understandable by visualizing the invisible and playing with scale and perspective. You can travel magic-school-bus-style through the ventricle of a giant heart and appreciate the anatomy in a completely novel way, or walk like a giant on top of our Walmart store to understand supply chain concepts.
- **Storytelling:** The human memory is story-based. We learn through stories and VR takes narratives to new levels. You're not just watching a story unfold from a third-person perspective, you're the protagonist of an immersive, multi-sensory and interactive first-person tale.
- **Empathy:** The visceral sense of embodying another person is why virtual reality has been hailed as "the ultimate empathy machine." Study upon study has validated the "Proteus effect," in which an individual's behavior in a virtual world is changed by the appearance of their avatar. It takes about four minutes in front of a virtual mirror where learners watch themselves, perhaps as a person of different gender, age, and ethnicity and look down at their own hands to experience the "body transfer illusion" of stepping into another body. By mapping their brains to virtual bodies, we can better convey how a customer, coachee, or minority colleague experiences the world.
- **Analytics and AI machine learning:** VR systems can track where learners walk and look, move their hands and bodies, and what they say. Some VR headsets even measure heart rates, pupil size, and brain wave patterns. Machine learning can use this physiological response data to measure the "cognitive load," how much brain power students exert on a task. If the load surges, the simulation can back up and try something simpler.

The question isn't if you should reimagine learning with VR, but *how* is the best way to get started? We've compiled a process to get maximum value from VR learning in minimum amount of time.

2. Experience VR

Summary

The journey to reimagined learning starts with buying your own VR headset and passing it around to colleagues.

Newest VR tech is amazing

VR has to be experienced. No 2D videos or whitepapers do it justice. The best place to start is by getting your own headset. If you don't already own a VR headset, you're already behind. Buy a consumer version of Oculus Quest 2 for $299 at your nearest Walmart and pass it around to your colleagues. Experiencing is believing.

Try these consumer apps

Below are a few consumer apps we suggest you try to inform your understanding of the possibilities with VR:

First steps (preloaded on Oculus)
This is a great model of an effective tutorial to the VR system and a good introduction to the power of VR.

Job Simulator (Oculus Store, $20)
This whimsical VR experience is a great introduction to the ease of using your hands to pick up and manipulate objects, pour fluids and pull levers. Start with the "Gourmet Chef" or "Office Worker" jobs.

Documentary storytelling:

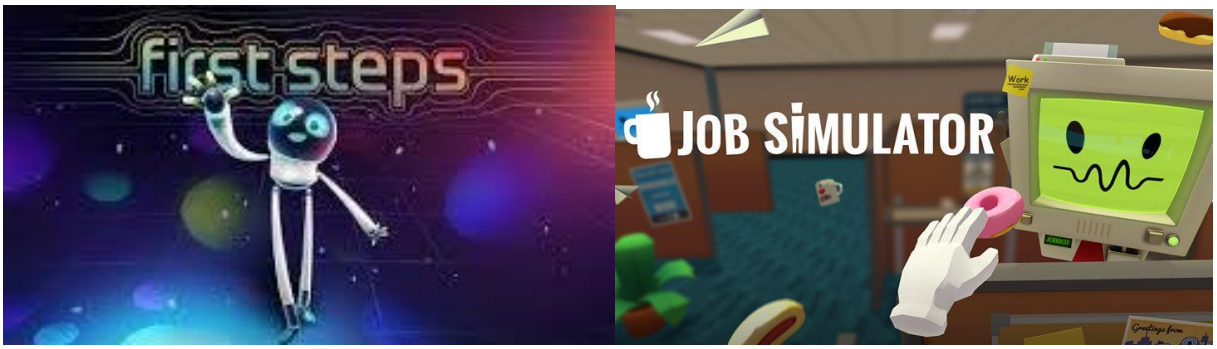
Rebuilding Notre Dame (Oculus TV, free)
Step inside the cathedral before and after the fire in this 360-video documentary.

Storytelling:

Henry (Oculus Store, free) Discover the power of storytelling in VR with this heart-warming tale.

Multi-user and desktop sharing:

Bigscreen VR (Oculus Store, free) Experience being in the presence of other real people in VR.



3. Assemble a VR launch team

Summary

A high-caliber launch team needs to drive your VR transformation. It should include business, learning, and IT leaders along with a VR game development partner.

Team roles

VR is a team sport. It has to be driven by a launch-team staffed with the right combination of talent:

- **Business or learning leader** *with authority to secure funding and support from organizational leadership*.
- **Learning Designer** from the internal learning organization, ideally with a 3D learning design background.
- **IT representative** who can integrate the solution with legacy systems and manage hardware and software acquisition.
- **VR and game development partner** with a proven track record of VR development.

4. Define a pilot

Summary

- Identify a pilot to show case “the art of the possible” of immersive learning. Select a training challenge with measurable outcome that plays to the unique capabilities of VR.
- Identify skill sets and staffing requirements to execute the pilot.

Ideate training challenges

The first order of business for the launch team is to identify a pilot show case that will demonstrate “the art of the possible” of immersive learning. Start by ideating a shortlist of training challenges to be reimagined with VR. The technology’s sweet spot is spatial training involving hands and body for tasks that are too dangerous, expensive, inconvenient, or simply impossible to practice in real life. Examples include training on operating expensive equipment that can’t be taken offline or responding to life-threatening emergencies. Below are a few examples drawn from Gronstedt Group clients:

Novartis lab training
Pharma leader Novartis had to quickly train hundreds of people on best practice production and aseptic procedures for a new childhood leukemia treatment. It had limited physical training labs and SMEs to train people. Gronstedt Group partnered with Novartis to develop a “flight simulator” for skills where mistakes have life and death consequences. It will be described in more detail later in this whitepaper.

AAA driving safety sim
In partnership with eLearning Brothers, Gronstedt Group developed a VR driver safety simulation for the American Automobile Association. Young drivers get behind the virtual wheel of a car and immerse themselves in a driving experience, complete with the three-dimensional sights and sounds of a busy city street. They learn to identify risks by looking at areas of danger. Every subtle movement of the head is tracked in real time, including how frequently and for how long they look in the rear-view mirror.

Remote coaching
A leading pharma company turned to Gronstedt Group to develop a multiplayer VR environment for remote coaching. Instructors can strap on a headset or simply open their laptops to enter a virtual lab with students who practice compounding drugs for clinical trials. They can watch over the shoulders of students, correcting, demonstrating, and debriefing. This form of remote coaching inside the performance environment is a killer app for VR.

Soft is hard

We suggest starting with the low-hanging fruit of procedural training and working your way up to those higher branches. The empathy power of VR can certainly be leveraged to drive organizational change. Onboarding, sales, service, leadership, management, public speaking, diversity and inclusion, sexual harassment, coaching, and other difficult conversations can be elevated to new levels with VR. However, big challenges persist. Conversational AI and sentiment analysis still have a long way to go. Most VR conversations are eLearning-style branch structured trees, which take the user out of the magic of presence. Creating soft skill training in VR is still hard, so beginning with what it's good at now and allowing soft capabilities to evolve while you establish and build physical and cultural infrastructure is the best approach.

Select a pilot

Pick a pilot from the list of candidates by asking yourself:

A. Which training challenge could be most effectively reimagined with VR *to replace* current approaches?
B. Which of those training challenges could achieve breakthroughs by using VR to *augment* current training?

Be selective. VR isn't an all-purpose training device that should be used gratuitously or wasted on mundane training tasks. It's intense for the learner, expensive to develop, and cumbersome to deploy. Save VR for your high-value challenges.

Select a pilot project with maximum business impact to leverage the unique affordances of VR. Consider how well it can be scaled across the enterprise as well. The training team of an industrial company we work with partnered with its marketing department. They're developing a VR training sim on how to service one of their products. Marketing will fund the development and use it to showcase the product at exhibits. Sales might even hold virtual client-meetings in the same VR environment. R&D can use it to test new features.

Your virtual products and facilities are malleable assets that are scalable and infinitely extensible. They can be used with multiple audiences and deployed on multiple platforms. The same VR sim can overlay the real world in Augmented Reality (AR) or be featured in "pancake mode" on mobile and PC screens. Unlike video that needs to be reshot every time and requires an update plus live, non-scalable instructor-led training, your 3D simulation investment can be amortized over many years and numerous applications.

Identify skill sets and staffing requirements

Once you've picked a pilot project, it's time to identify skill sets and staffing requirements. These include:

Project champion connected with senior management who will provide resources and remove barriers for the team.
Project manager with experience wrangling complex digital media projects, ideally including 3D media projects.
Instructional/learning designer with experience managing complex digital media projects, ideally including VR projects.
Game development team of 3D graphics artists, animators and programmers with Unity and/or Unreal authoring skills.
Quality assurance testers validate that all sim requirements function appropriately.
IT for deployment and support.

5. Select tech requirements

Summary

Key tech choices for your VR pilot include:
Hardware: The latest generation mobile VR (like Oculus Quest) will be the VR headset of choice for most learning organizations. Some edge cases still need PC-tethered VR.
Software: Most VR programs are developed in one of two real-time game engines: Unity or Unreal. Spherical 360-video doesn't offer complete presence, but can be useful for some cases.

Mobile VR

There are several technology choices facing your VR team. The first is the VR headset and enterprise device management platform. The launch of the new generation mobile Oculus Quest VR headset in 2019 made that choice easy for most companies. Paired with Oculus for Business, a cloud-based device management suite, the device is catapulting enterprise VR adoption. (The older Oculus Go and Rift are discontinued.)

There is no viable competition to the Oculus Quest 2 in mobile VR yet. A couple of smaller Asian players, Pico Neo 2 and HTC VIVE Focus Plus, are the only other headsets in the category and they don't begin to rival Oculus. No competitor has yet to dedicate the billions of dollars in investment and engineering talent that Facebook is throwing at the market, and CEO Mark Zuckerberg is personally driving the effort.

PC-tethered VR

While mobile VR will cover most needs, some projects require PC-powered VR. The graphic power of the PC is always going to be several steps ahead of mobile VR and better suited for large, high-fidelity experiences. There are several VR headset options for PC-powered VR:

- Oculus Quest ($300 consumer/$800 business) can double as a PC tethered headset, but a compressed video stream makes it slightly inferior to PC-only devices.

- HP Reverb G2 ($600) includes eye tracking, face tracking, and a heart rate sensor. Face and eye tracking can give your avatar real-time facial animation that can convey subtle hints like rolling of the eyes.
- Valve Index ($1,000) offers wider fields of view and hand controllers that are strapped around your hands and respond to the force with which you grasp and squeeze objects.
-

- **Varjo** ($7,000) allows for mixed-reality simulations where you can sit in a physical cockpit simulator and view your actual hands touching the instrument panels through a pass-through camera while virtual content appears in the windshields.

These headsets all require a high-end gaming PC.

Beyond hand controllers: future options for gesture and voice input

Most of the interaction in VR is done with hand controllers that act as both your hands and as gamepads with buttons and thumb sticks. Several more naturalistic approaches are in development, however, but most aren't ready for prime time yet. They include:

- Voice: Integrated with head and eye tracking, the user can look at virtual characters and just talk to them. However, conversational AI isn't yet advanced and economical enough for most learning programs. They have to resort to more primitive forms of voice recognition for the time being, such as reading voice prompts out loud.
- Hand tracking: Slip on the Oculus Quest and look at your hands and you will find all ten fingers moving in the virtual world. However, the hand controller still holds several advantages over hand tracking. Grabbing an object is performed more accurately by

squeezing the trigger on a hand controller. Also, it isn't as easy to move yourself around in the virtual world ("locomoting") without the thumb stick on the hand controller. In addition, the vibrating haptic feedback of the hand controller is a surprisingly effective sensory input when grabbing an object.

- Haptic gloves: Grab a wrench in VR as you squeeze your hand and your fingers stop in midair as if you're actually holding it. That's the promise of haptic gloves. But at $9,000+ they're not a viable option for most learning organizations yet.

Voice input, hand tracking, and gloves will get better, and coming behind them are non-invasive brain-computer interfaces that will allow users to make things happen as you think them.

Physical peripherals

Yet another input option is external peripherals, like a steering wheel or joystick for vehicle training or a scalpel for surgeries. Grab a physical forklift joystick and you'll see it modelled in the virtual world when you look at your hands. Learners can even walk on an omni-directional treadmill or sit in a motion systems chair that moves their body, mimicking environmental motion. These devices have a place for certain high-budget learning challenges, but you have to ask yourself how much this level of "physical fidelity" will really add to the learning process. Realism isn't the goal itself – improved performance is. Students don't necessarily need to feel the haptic sensation of cutting into tissue, muscle and bone or the recoil of a gun, or resistance in a steering wheel to learn effectively. The human body learns quickly how things feel. What they need more of is cognitive repetition.

Another reason better physical peripherals produce diminishing returns is the dominance of visual processing. A case in point of how the vision overrides other sensory experiences is our Novartis lab sim. You can stretch the plastic tubes in such realistic ways that the brain tricks you into feeling the resistance in your hands even though you're just holding two VR hand controllers. It's proof that we don't feel with our hands, we feel with our brains. The visual stimuli create a hallucination of resistance in our hands that we associate with stretching a flexible material. Forget the hoax that we are born with different "learning styles." We are all primarily visual learners and vision takes up half our brain's resources. The hands feel what the eyes see. This is why RAND Army research found that high-physical fidelity simulators aren't cost effective for most team training skills.

Peripherals have a place for some learning challenges, particularly vehicle control. But a VR headset, hand controllers, and a team of kick-ass developers will suffice for 95 percent of the learning challenges most learning organizations will face.

VR authoring: Real-time game engines

Another important technology decision is the VR authoring system. A new generation of real-time game engines help manage logic, rules, physics, real-time visuals, sound, artificial intelligence and more. These engines allow developers to focus on the creative aspect of development. Two market-leading game engines power most entertainment and learning games and simulations: Unreal and Unity. They're both license-free for educational purposes. Best of all, the same simulations can be deployed from Unity or Unreal to a vast array of platforms, from phones and iPads to VR and AR headsets. Build once, deploy anywhere. Gronstedt Group developed a customer service game for healthcare giant DaVita in Unity that can be engaged on both a phone and a VR headset, for instance. Practically speaking, virtually showing a 70,000-member team how the world looks through the customer's eyes is a challenge that benefits from a multi-platform approach.

[insert DaVita VR and mobile images]

Which game engine is best for you?

- Unity was long the favorite for learning organizations. It sports the largest developer community with some seven million developers.
- Unreal just recently became free for educators and is owned by Epic Games, maker of the *Fortnite* behemoth. Fueled by *those consumer* billions, it might be pulling ahead. It also offers Epic Online multiplayer services and Unreal 5 has superior real-time "ray tracing" renderings that will look completely photorealistic.

Talk to your developer partner about the best game engine option.

360-video vs. CGI

Some companies start their immersive journeys with 360-video or photography. They usually do it for all the wrong reasons because it's cheaper and easier to produce with in-house resources (or it's the only thing the vendor knows how to do). However, 360-video is not necessarily less expensive in the long run. As soon as you need to make a change to the video it must be re-shot.

The more serious drawback with 360-video and pictures is the lack of presence and skill practice. Users are stuck in the camera position, unable to move around or use their hands to interact. All they can do is watch and point and click on hot spots. The result is frequently like

strapping a basic eLearning program to your face. Real VR requires computer-generated imagery (CGI) where users are embodied in the world with agency to move inside the scene.

That said, there are a few good use cases for 360-video, including:

- onboarding to a company facility where you want to faithfully represent environments with people working;
- interviews with company leaders, customers and others; and
- some soft skill training where you need to demonstrate nuanced face and body language by professional actors.

The production processes for 360, or "spherical" video, are similar to traditional photography and video. The main challenge is that the camera captures everything in its view. The camera crew and equipment, lights, microphones, etc. have to either blend in or hide.

Once the spherical video or pictures are shot, the learning program can be developed in a number of do-it-yourself authoring tools (see a directory here).

Augmented reality

While VR immerses the user in a virtual world through a headset that largely shuts out the real world, Augmented Reality (AR) inserts virtual objects and information into the real world. These technologies are closely related, but the applications are usually different. VR is about immersion. AR is a utility. Think flight training: VR is the "flight simulator" on the ground. AR is the "heads up display" that guides the pilot through the actual flight. Together, they will revolutionize learning and performance support as we know it.

The real promise of AR won't be realized for several years, when mass market headsets arrive. Lightweight glasses that will leave the hands free to perform tasks is the future of AR. The AR revolution will happen – and it will be amazing – but not until later in the decade.

	What is it	**Learning and performance support**	**Maturity**
VR	Immersion: Can put you anywhere	Skill training simulator, complete sense of presence, being inside the performance environment.	Technology is here and mature.
AR	Utility: Can bring anything to you	Performance support in the real world.	Will take several years to reach the mass market.

6. Build the Business Case

Summary

Demonstrate the value of VR to the enterprise by reducing training costs, improving job performance, or boosting engagement.

Reducing training cost

With meta analyses showing that 90% of training programs are ineffective, VR can make an immediate impact on the bottom line by reducing training time, being universally available, and reducing cost of trainers, facilities and travel time.

Faster training time
VR doesn't just collapse space; it collapses time as well. A well-designed VR simulation can reduce training time by five or ten times what it takes in a physical simulation. How is that possible? For starters, the VR simulation will automatically reset every time you fail. Also, every student can do it at the same time – there's no need to wait your turn. It progresses at the pace of the student's performance. And every hour of saved training time is an hour of additional employee productivity.

Access any time and place
VR training is available just-in-time and just in-place, allowing organizations to train people at every point of need. There's no need to wait for the next training class before someone can operate a new piece of equipment or start a new job position.

Lower instructor, facility, and travel costs
VR reduces the need to fly instructors and students around the world and tie up capital in training facilities and equipment.

Less operational disruption
Plants frequently have to close down production to conduct training simulations and fire drills will interrupt office workers. Such operational disruptions can be minimized with VR exercises.

Improved job performance and operations

Align your pilot with business strategy and identify specific business metrics that can be improved with VR training. Key Performance Indicators that can be impacted include efficiency, quality/value, and safety rate.

Better efficiency, quality, and value
Most of the returns of VR simulations will come from quantifying the impact of efficiency, quality, and value of higher performing people. Use the data to make the business case.

Lower accident rate
Accidents are a human and business cost that can be drastically reduced with VR. The two recent 737 Max crashes are estimated to have cost Boeing $23 billion. The company did not want to spend the money on additional training simulator time for the new plane model, but sending all pilots a VR headset with a simulation exercise would have cost a fraction of that.

Higher engagement

Gallup reports that disengaged workers cost U.S. business more than $400 billion a year (including absenteeism, retention cost, and low productivity). A single disengaged employee can cost $16,000 per year. Training is an important driver of employee engagement because it builds self-confidence and improves motivation. VR training can improve employee-based ROI in multiple ways. Reduced turnover and improved talent acquisitions are good places to start.

Reduce turnover
Hiring and training a new associate at Walmart costs an estimated $3,000. In other industries, the total costs of replacement can reach 200% of an employee's annual salary. An IBM study finds that new employees are 42% more likely to stay when receiving the training they need to do their job properly. VR training can have a dramatic impact on turnover cost.

Improve talent acquisition
VR can attract a new generation of recruits reared on video games, broaden the pool of diverse, non-traditional candidates, and can even be used as a selection tool. The car racing industry recruits drivers with VR simulation already. Nissan organizes the annual *Gran Turismo* driving simulation contest to recruit new real-world race car talents. *America's Army* is another case in point. The game has been hailed by an MIT article as the most successful recruitment tool in the history of the military, as more than 13 million registered players have logged over 260 million hours of playing time. While there is no VR version of *America's Army* yet, the data suggests how immersive games can improve talent acquisition.

7. Develop and deploy the pilot

Summary

- Assemble a team to develop the pilot.

- Design the learning thoughtfully, with tutorials, guided deliberate practice, feedback, engagement, and real-life scenarios.
- Prototype early and iterate fast.
- Key success factors for deployment are onboarding to the VR system and health and safety.

Assemble the team

When the pilot is greenlit, it's time to assemble the team to develop it. Identify the specific internal team members who can fill the roles described earlier and partner with a proven instructional VR development company.

Learning design

The project team will identify performance objectives, map out processes that need to be trained (along with common mistakes) determine KPIs to measure success (e.g., accelerate time to proficiency or reduced error rate), script feedback, and identify the data that needs to be captured. Asking the following questions will help focus this learning design process.

Pilot Planning Checklist Questions:

1. WHY do you need this training solution?
2. WHAT problems will it solve?
3. WHO is it for, specifically?
4. Have you tried to solve this problem BEFORE? If so, what did you try? What results did you get? What worked, what did not?
5. What does the staff need to DO differently?
6. How do the best performers do this?
7. What will happen if you DON'T DO this VR program?
8. How will you know you have been SUCCESSFUL?

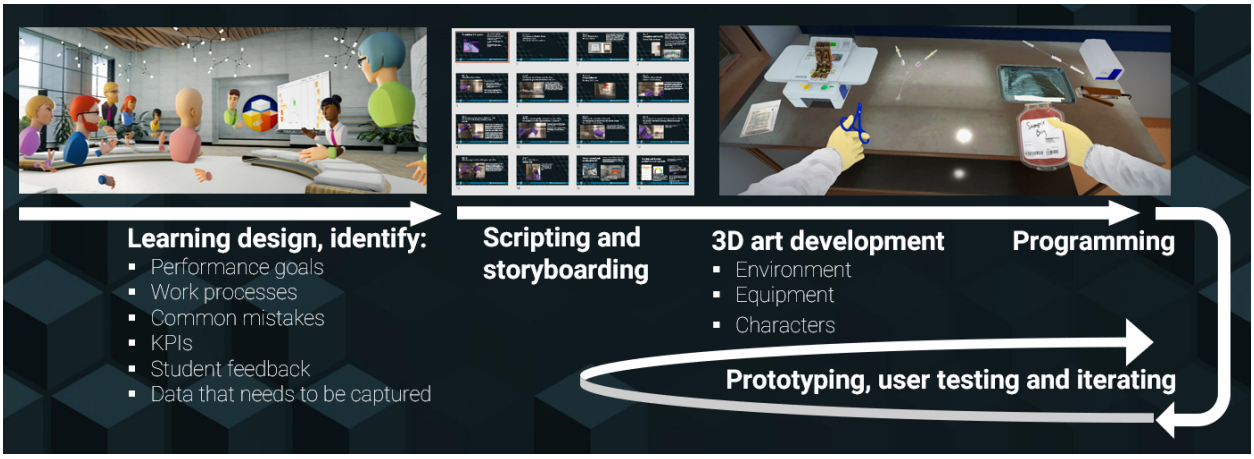
Scripting and storyboarding the flow of the VR experience isn't all that different from planning a traditional learning program. However, unlocking the potential of VR requires an action-based learning design approach rather than conventional didactic learning. Instead of presenting facts,

the learning will emerge from the experience as an active process of discovery through guided practice. Effective VR simulations promote learning in the context where the skills will be applied. They're a virtual rehearsal studio that challenges players with increasingly complex real-world tasks, where they get feedback and recognition along the way.

[Show sample script and storyboard]

Prototype and iterate

Once you've developed the learning design, it's time to prototype early and iterate fast. Artists will model the 3D environments and equipment. They typically use pictures, blueprints and existing 3D assets for reference. Character developers and animators generate non-player characters, a process that frequently involves motion capturing. Programmers will code the interactivity. The client will test design iterations on a weekly basis and involve end-users in playtesting. This testing process is surprisingly easy to do remotely; with a click of a button, clients will have a new version of the simulation loaded on their WiFi-connected VR headsets for review.



Deployment: tutorials and screen casting

A key success criterion when deploying the pilot is to include a tutorial to onboard new users. Oculus' "*First Step*" tutorial app is a good model for a tutorial. In it, a 3D model of the hand controller appears in the palm of the user's hand and the buttons are illuminated as a prompt to press them. Such a tutorial can be custom-developed in the actual environment where the rest of the simulation takes place.

There are a couple of options to let instructors or other students in the same physical space see what's going on in the student's VR headset. The best option is to hook the headset to a PC (using the Link cable for the Oculus Quest). This requires a gaming computer with a high-end graphic card and a PC version of the simulation. Screen casting directly from the Oculus Quest to a second screen is another option, but we discourage this because it introduces lag for the student in the VR headset.

Deploy safely

VR training poses several health and safety challenges that need to be addressed during deployment:

Sanitizing shared VR headsets was critical even before the pandemic. Now it's paramount. Wipe down the headset and hand controllers with alcohol-free antibacterial wipes and let them air dry for 10 minutes. VR headset makers tell you to not to use alcohol wipes on the VR lenses. Our experience suggests they won't actually damage lenses, though. Another cleaning approach is a UVC light box, which cleans headsets in one minute. (This is the same technology used by hospitals to disinfect equipment.) Regardless of cleaning approach, disposable masks are a good complement.

Bumping into physical obstacles is addressed with a clever translucent "Guardian" boundary system that displays in VR as soon as you walk near a chair or wall. A pro tip to keep the user centered in the physical room: have them stand on a floor mat with some texture, such a padded anti-fatigue mat.

Eye strain can occur after 30-60 minute of VR activity. Adjust interpupillary distance (IPD) on the headset for each user and take breaks every 30-60 minutes.

Fortunately, VR motion sickness was solved years ago with improved refresh rates and VR design. Our clients have not heard complaints about nausea in years. Anyone with such complaints has probably used an older VR headset and/or not tried a well-designed learning simulation.

Developing the Novartis sim

The Gronstedt Group kicked off the Novartis pilot development by travelling to its lab facility in Morris Plains, New Jersey. We took pictures and video for reference while our subject matter expert walked us through the work processes. Novartis sent us home with blood bags, PPEs and other equipment used in the simulation. During the next couple of weeks, we distilled and synthesized the information and ideated a simulation design in collaboration with the client subject matter experts. We estimated the time of development and agreed on a fixed budget with the client.

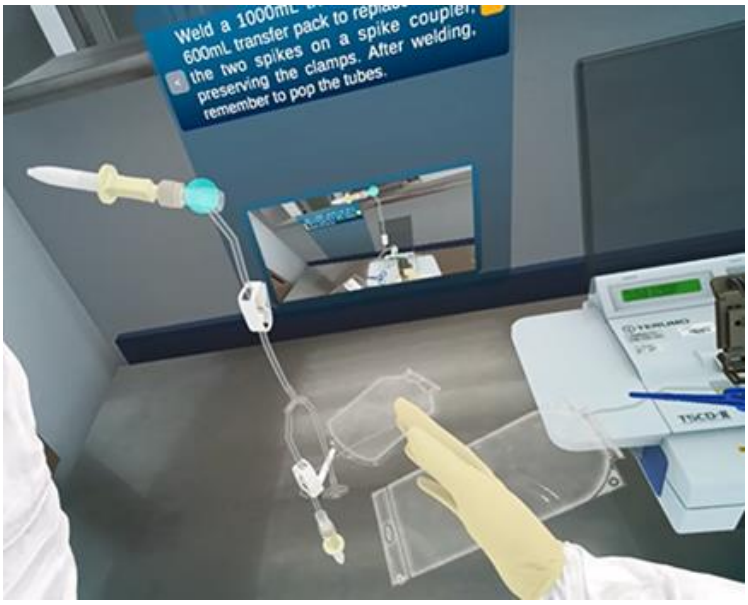
Design for visual realism

Next, our artists began modelling the lab and the equipment based on reference photos. They designed in Autodesk Maya, a 3D modelling tool, and imported the models into the

Unity Game Engine. The client received weekly versions straight to their VR headsets. They could walk around in the virtual lab to review and provide feedback. The result was a virtual reality lab where learners can weld tubes, remove bag caps, label bags, sanitize their hands, and practice surgical skills in a safe non-threatening environment.

Design for audio and haptic realism
Sound effects and haptic feedback completed the sense of "presence." Novartis made audio recordings of everything from dropped scissors to clamping a tube. When learners spray their hands with an antiseptic cleaner, both hands feel a slight vibration through the hand controller as you hear the spray bottle from the source. When enough visual, hearing, and feeling senses tell the brain that you're spraying the hands, you feel an overwhelming sense of actually spraying your hands.

Designing for learning: tutorial
Once we created the virtual sandbox, it was time to design a tutorial system that guides the learner through each step of the simulation, from welding tubes to operating the DynaMag magnet. The tutorial is displayed on a flat screen inside the VR lab, always visible within the work area. Text instructions appear at the top of the screen. A video demonstrating the proper execution of the step displays on the lower half of the screen. The system detects the correct completion of a step and automatically forwards the tutorial screen to the next step.



Feedback
In collaboration with Novartis' subject matter experts, we mapped key error condition types and built them into the simulation logic. If a learner makes a mistake, the system will immediately display a feedback message on the tutorial screen. It's like having an instructor watching over your shoulder.

Do-overs
The learner's error automatically triggers the simulation to reset back to the step that was performed incorrectly. It immediately provides feedback and starts over if learners drop blood bags on the floor, cross their hands or angle them the wrong way under the biosafety cabinet, forget to clean their hands, don't wait an appropriate amount of time after spraying hands with antiseptic, etc. As part of our learning design discussion we determine "retake" requirements if a learner makes errors during their simulation session; for example, are students required to redo the entire simulation or just the subsection in which the errors were made?

Visualizing the invisible
The simulation also helps demonstrate the invisible. For instance, it's important for lab technicians to minimize disruption of air flow in the biological safety cabinet. The VR sim demonstrates how to do this by moving hands slowly and holding bags vertically, while not covering the air grille (which sounds simpler than it is). In VR, learners can see the air flow as they move their hands. They can rehearse techniques over and over in preparation for real-life performance, building "muscle memory."

Novartis has now been using the simulation for a couple of years to onboard new technicians and the feedback has been extremely positive.

8. Evaluate, improve, evangelize

Summary

- Measure and improve the value of the pilot in terms of student engagement, learner actions in the sim, and business impact.
- Evangelize across the organization by demoing the VR sim and communicating the value.

Launch, evaluate and improve

Once launched, the impact of the pilot should be evaluated at all four Kirkpatrick levels (Reaction, Learning, Behavior, and Results). Below are examples of how they can be applied to VR.

Engagement with Net Promoter Score (NPR)
Asking students “how likely are you to recommend playing the sim to a colleague?" is a valuable measure of engagement and word-of-mouth popularity of the game.

In-VR telemetry
Every digital footprint can be measured in the game – where users looked, how they walked, where they moved their hands, etc. A dashboard of telemetry data can provide actionable insights to improve the simulation experience. Heatmaps visualize analytics events spatially in 3D. Because of the data requirements, heatmaps are usually used for playtesting rather than deployment. A/B testing or split testing is an effective way to evaluate different versions of the sim with different learners and compare which one is most effective. Physiological response data such as heart rates, pupil reaction, and brain waves can also be measured.

Business impact with Randomized Controlled Trial (RCT)
The gold standard of measuring actual business impact compared to other forms of training is a randomized controlled trial. Compare on-the-job performance of employees who were randomly assigned to either VR training or control groups of eLearning, classroom, or other training modalities. For instance, Imperial College London reported that no fewer than **83 percent of surgeons who completed surgical training via virtual reality were later successful in a physical lab, while zero percent of those trained via traditional methods were successful**.

Spread the word

Make sure the pilot project creates excitement and word-of-mouth in the organization. Invite decision makers across the organization to try out the VR experience for themselves. Seeing is believing. Once they have experienced the VR sim and learned about the value it created they will become evangelists.

Novartis leaders visit the company's Innovation Lab in Basel where Hugo Avila, Global Head of Digital Experience, and his team provide demos. Other leaders of the company try it out at the training site in New Jersey. Novartis' Head of Learning, Steve Sitek, shares success stories across the far-flung company, which has triggered a few other VR project ideas.

9. Scale your way out of pilot purgatory

Summary

- Escaping "pilot purgatory" requires planning a full rollout from the start of the project.
- Develop a roadmap with additional use cases that can deliver quick returns and become self-funded, supercharging the transformation to enterprise scale.
- Acquire headsets and an enterprise platform with integration to legacy systems, including LMS and LRS through xAPI.

Enterprise deployment

Many companies are stuck in VR "pilot purgatory" for years. Escaping this predicament requires planning with a full rollout in mind from the outset. As soon as the pilot has launched successfully, it's time to identify additional use cases and develop a roadmap to scale VR across the enterprise.

Consider adjacent processes with interconnections to the pilot first – this allows you to reuse assets from the VR program. Next, set bold goals for other performance tasks that can be improved with VR training. Sequencing new projects that can deliver quick returns is key to building scale quickly. As new VR projects capture more value and become self-funded, they will garner support and build momentum.

VR headsets need to be acquired and managed by an enterprise platform. Most organizations share VR headsets among multiple learners and the software must identify, authenticate, and grant access to different users. Oculus for Business offers secure account management and access control. Administrators have access to the status of each headset. It also integrates with leading Mobile Device Managements like MobileIron. These cloud-based device management tools enable VR programs to be deployed safely and integrated with legacy systems.

Integrating reporting from our Oculus Quest VR sim to Novartis' Cornerstone Learning Management system was a challenge because Cornerstone's implementation of xAPI doesn't support external standalone applications posting statements. As a workaround, we built an xAPI Gateway server as a middleman to report student results to the LRS.

10. Plan for the future of social presence

Summary

The future vision of VR is social presence, a shared virtual 3D space where students and instructors can interact with each other seamlessly in the performance environment.

Social presence

As “Zoom-fatigue” sets in, VR can create a social presence and shared spatial awareness, a “metaverse” for learning, meetings, and social interactions.

The cultural moment of Travis Scott’s concert in *Fortnite* with 28 million people offers a vision of social presence. *Fortnite’s* “Party Royale” is the next step in this evolution, where its 350 million users are partying instead of fighting. In the world of VR, apps like *AltspaceVR*, *VRChat*, *Bigscreen VR*, and *Rec Room* are growing in popularity. A sprawling Burning Man VR reconstruction in *AltspaceVR* offered 100 interconnected worlds of art and activities. Facebook is developing its own OASIS-style social VR platform called *Horizon*. Open-source platform *Mozilla Hubs* offers another compelling social VR option. Users can meet up on any device, from the browser of your phone to a VR headset. Just share a link and play it in the browser. *Mozilla Hubs* is removing the friction of apps, which is what made Zoom successful. This social VR trend will have dramatic implications for workplace collaboration and learning.

Future “Learning Royale” venues will bring employees together in real time. They will be accessible across platforms, from phones to VR headsets. Small groups can meet and walk around in a virtual store, plant, or lab. The virtual space offers venues for all-hands meetings by the hundreds or thousands or one-on-one mentoring meetings.

The 3D models can not only represent the *appearance* of the physical stores and manufacturing plants, but the real-world *state* of them. By feeding real-time data from the physical store, products, hospitals and manufacturing plants, the models become “digital twins” of their physical counterparts. Imagine the applications. Predictive and condition-based analytics can identify maintenance and repair needs, that can be practiced on the virtual twin before they’re practiced in real life.

Augmented reality (AR) headsets will make the real world the canvas of such interactions in the next few years. Apple and Facebook are locked in a race to release a mass market AR headset in 2023.

The future of immersive learning is social presence, lifelike interactions between people in a virtual setting. When “going to class” means putting on a headset and interacting with people in the context of the learning application, the real learning transformation will ensue.

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GRONSTEDT GROUP

About Gronstedt Group

Gronstedt Group is a digital training company innovating the future at the intersection of gaming, virtual reality, and corporate learning. Our team of top-tier simulation designers has years of experience developing both enterprise learning solutions and AAA-video games. We create state-of-the-art enterprise VR, PC, and mobile training solutions. Our Walmart Sims-style mobile management game has half-a-million downloads on the app stores. "*Spark City*" is revolutionizing the way the world's largest employer, attracts and develops a new generation of managers who have spent more time playing games than they have in the classroom. Gronstedt Group helps pharma leaders Pfizer and Novartis learn life-saving lab skills with high-fidelity, multiplayer virtual reality "flight simulators," where students can interact with instructors and practice with unlimited do-overs.

We are an Oculus Independent Software Vendor and earned Gold in Chief Learning Officer's 2020 Excellence In Technology Innovation Award. As thought and practice leaders in the learning industry for 23 years, our team has developed 3D immersive training solutions for over a decade. We help clients boost performance and drive business results through digital transformation of the learning function for a post-pandemic era.

Contact us

Contact us for a demo and conversation about how we can partner to accelerate the digital transformation of your learning mission: anders@gronstedtgroup.com

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