

The Future of Skilled Healthcare Education is Immersive Technologies

Unprecedented Global Healthcare Workforce Need

We suddenly have the new world order that the thought leaders have been warning us of (Bush 2005 NIH, Gates Ted talk 2015). The world has instantly been plunged into an unprecedented and desperate position. Many nations concurrently declaring a state of disaster, and now, as never before in history, even every state in the USA declaring a state of emergency. Amongst a number of major challenges, a core issue the world is faced with now is an extraordinary dichotomy – a massive never seen before global surge in need for health care workforce, coupled with a sudden and completely unplanned and almost total shutdown of training education centers producing a full spectrum of skilled healthcare workers -paramedics, nurses, and acute care doctors, both emergency medicine and critical care.

The pandemic healthcare crisis, coupled with societal shutdowns reaching aggressively into the training and educational centers has created a sudden, extreme, and unprecedented skilled health care workforce training need surge. The whole world suddenly and desperately needs more skilled EMS providers, acute care providers and critical care providers. With the centers for training shut-down, how is it best to rapidly ramp up skills and training, when even the trainers are scarce and overwhelmed providing direct patient care? What are the best innovative tools to do this rapidly, scalable, and with cost and resource efficiency? What platforms can do this with immersion, engagement, instant real-time evaluation and minimal pressure on trainers?

The world became a work from home platform overnight. Universities and training centers are shuttered and have transitioned to distance learning or e-Learning, some with remarkable agility – using primarily non immersive, 2-D tools for web conferencing. But, what about skills acquisition and critical thinking assessment? How can the immersive suite, and importantly Virtual Reality (VR) tools, make disruptive or evolutionary change to the current state and this sudden pressing need of healthcare skill education? Why immersive? Immersive education technology can take 2 forms: In VR you become part of the virtual world and can move and do things in it, and in Augmented Reality (AR) the real world has virtual items injected into it (ref: Global Resource Guide to XR Collaboration, April 2020).

Imperative Cultural Evolution in Education

We really need a creative approach now – leveraging and reengineering what is possible is an immediate necessity. When you change the thinking, you can change the rules, or when we change our thinking we can change the solution. The individual and the institution must have an understanding of the confluence point and a view of the future, the drive to make change for the future state, and only then can it become achievable. The challenge is the anchors (the ways we have always have done it, why change if it works now, don't move my cheese) that hold the participants and institutions back. And these traditional tools and ways of thinking - are also expensive, not scalable, not adaptable, usually minimally interactive, and often challenging to equitably evaluate – or to evaluate at scale.

There are research papers (ref. Bracq et al), opinion pieces and a number of great TED talks about this subject of application of new technologies to healthcare education and there are many positive/negative aspects to each perspective.

Education is a confluence between The Student, The Teacher, and The Technology that are core to the success of Learning. We may consider adding a fourth influencing aspect - The Perspective. Perspective can be viewed in many ways – physical environment, mental state, experimentation, or innovative concepts as just a few examples.

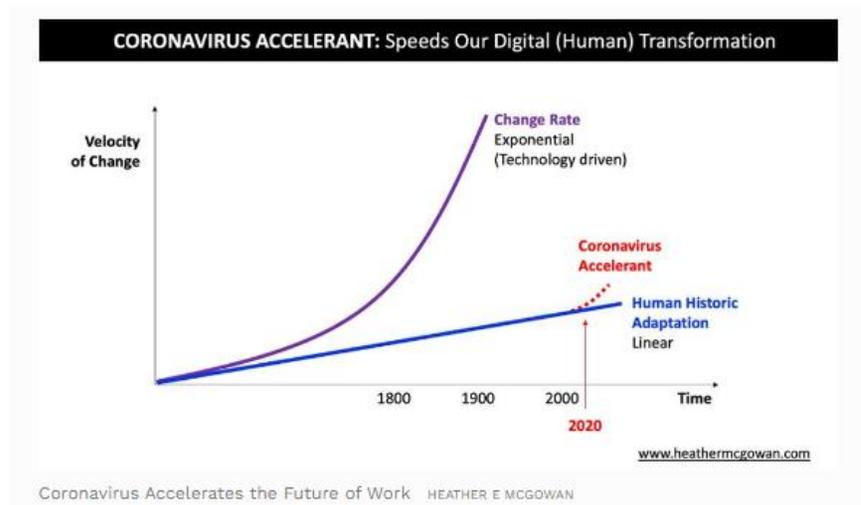


Fig. 1. Human Adaptation Forbes March 2020

The rate of change and half-life of the technologies and interface of daily life in a generation is exponentially developing even though human adaptation is linear, accelerated a little now by the Corona virus, (Fig 1.). You may remember the radio, the 8-track & cassette, the Walkman, the I-pod (introduced on Oct 23, 2001). Today streaming is the means of listening to music and watching movies. The progression is not about the device or technology but the **control** of what the listener wants. The same is true in education and if we ask students today (the Paramedics, Nurses, and Physicians of tomorrow), “How do you want to learn?” Their answer would not involve a book, PowerPoint presentation, or video. Instead it would involve entertainment education through gamified technology. To inspire students today and in the future, we must reach them as never before: by connecting with students the same way they connect with each other and the world around them. The future of that connection is VR/AR/Mixed Reality (MR) or in total Experiential Reality (XR), as outlined by Radianti (ref. Radianti et al) as a promising learning tool. The true irony being that these tools are not primarily in the tool box of the trainer, a generation behind their students, and are largely still peripheral examples of training technologies in healthcare generally, to date considered “too complex” or “too expensive” when in fact they are neither, quite the converse.

The accounting and advisory firm Pricewaterhouse Coopers (PwC), has released a number of studies since 2016 on VR/AR and here are a few of the findings:

- The biggest challenges to the adoption of VR/AR technologies may be cultural. To overcome distrust of new technologies, businesses should therefore support and reassure learners through short and impactful VR/ AR sessions.

- Healthcare and education are industries where the business case for virtual and augmented technologies is clear.
- VR/AR will effectively let employees and students learn and improve their skills in a fast, cost-effective, and safe way. VR/AR offer incredible benefits, but those benefits will not be realized if organizations don't bring their people along with them.

Scalable Tools to Rapidly Skill and Re-skill

The use of VR and AR in training boosts engagement and knowledge retention and enables organizations to apply or enforce consistent, measurable standards at scale. The technology also provides a way to train employees where it is not always practical - or safe - to do so in the real world. Or as we see in this disturbing new world order... even possible – training and education centers are extensively shut down – and the trainers and educators are focused on the overwhelming task of dealing with a major surge in direct patient care. For EMTs & paramedics to simulate emergency situations without the risks on the street environment, for medical students and critical care skills training – simulating an immersive real world setting that is engaging and safe from a real patient situation. Never before in modern medicine times have we had this sudden surge to skill and reskill emergency and acute care health workforce.

- A comprehensive PwC VR Soft Skill Study report, March 2020, (Fig. 2) further finds:
Saving time and building better confidence are life saving objectives in the current surge requirement for skilled health care workers to meet the increasing health care system need. Rarely in a career field does one get to sit on the cusp of time, that they can seize the opportunity to reduce classroom training time by 30-50% while improving confidence by over 300%.

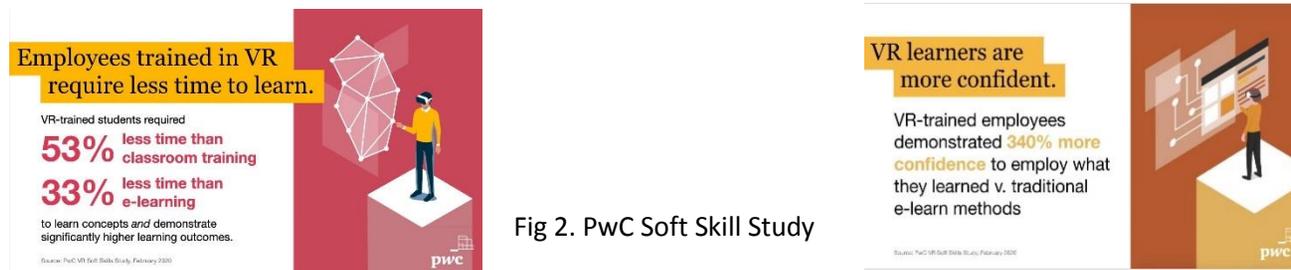


Fig 2. PwC Soft Skill Study

It will take tremendous leadership, and confidence of the implementation directors, to realize the benefits and make it happen. Applying these unique tools to scalably address the healthcare systems current desperate need, is a major gamechanger.

As in many cases it is also about timing – was Google Glass too early or too advanced for acceptance? Over the last 20 years the technology cycles ran 36 months, then 24, then 18, then 12, and today is 9 months or less depending on the device and software category. Technological progress is not the only thing rising at an exponential rate. As we all can see so clearly now, what happens when critical health care needs suddenly escalate at an exponential rate! Likewise, the adoption and acceptance rate of technology by humans is aligned to one's age and opportunities during their primary and adolescent years of growth and development. The rising speed of technological adoption or put simply, the rate at which newly commercialized technologies get

adopted by consumers, is also getting faster. This means that the acceptance and rate of change are exponentially increasing as reflected here by Asymco chart on Adoption Rates of Consumer Technologies in the US:

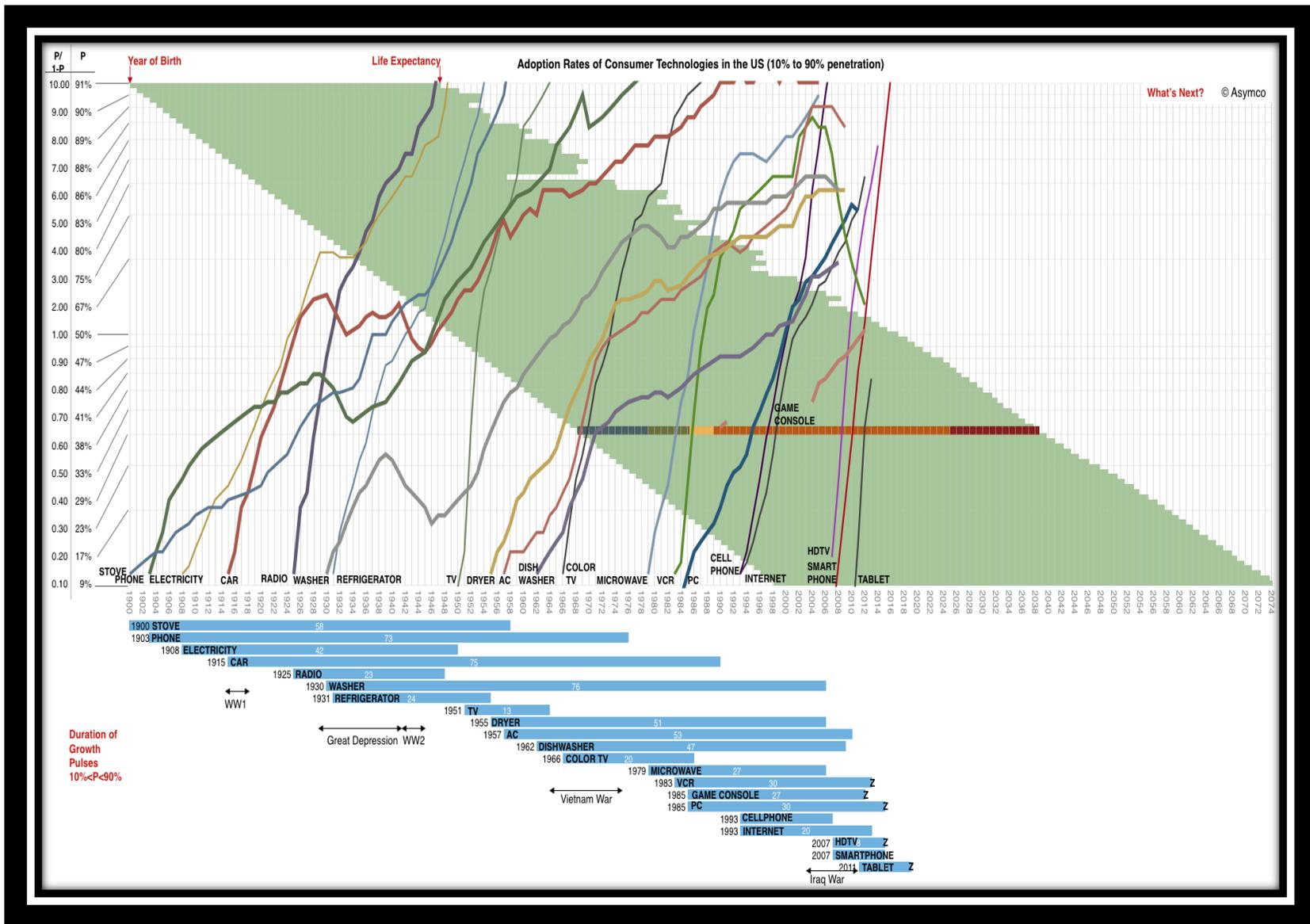


Fig 3. Asymco chart on Adoption Rates of Consumer Technologies in the US

This is the latest data set available for the rising speed of technological adoption and VR/AR/MR/XR technology is not even recognized for consumer introduction. While Game Consoles are recognized, they do not reflect visual immersion of VR as a singular component of the category.

Moving past the delivery platform and general category of VR technology, let's look at the application for immersive learning – the practice of medical care training. Today simulation training is very limited in what it provides for a complete “real world” environment. Yes students can do the haptics and people can judge and review the students on how well their skills are developing, but that is not the real world. These types of environments are also extremely expensive in resources and infrastructure, and not at all easily scalable. After the classroom and haptic SIM labs, students/practioners have exercises internally or externally, and then on job training (OJT), but these are expensive and very time consuming.

While VR technology can address some of the training requirements, other skills will still require manniquins for haptic resolution (MR). In addition to rapid scalability, what VR will allow for are a number of simulations that we don't currently train for, except by the passage of time and experiences during on job training. In other words, while we can train for physiological patient engagement, we also need to train for the psychological patient engagement, situational analysis, and critical decision making for the complete environment. The psychological engagement may not only be with our patient, it should include family members, bystander engagement, maybe our co-worker, our employer, the other emergency responders, or even the media/regulatory/legal interview. Being trained on how to identify, process, and respond to the numerous situations that a first responder or acute healthcare provider may encounter daily, will aid in reducing the psychological impact of their jobs and on their homelife, while managing or reducing the impact of PTSD and depression symptoms.

Emergency Medical response and acute healthcare events have a frequency just like other sciences and should replicate the 80/20 rule – where 80% of the scenarios have the same 20% of similar issues. They are the “frequent fliers” or “bread and butter” of EMS and emergency medicine which may have similar attributes, conditions, and treatments. While VR/XR can create a higher degree of flexibility and reality to the frequent flier experience, there is even greater value produced by also skilling the workforce with the 80% of medical conditions that rarely occur.

Through XR technologies we can experience Life's Realities in emergency response and acute care medicine that are:

- *Rare* (transitory, remote, High Acuity Low Occurrence),
- *Impractical* (dangerous, or expensive to create),
- *Impossible* (reconstruct a past event or create a potential future state),
- Enable people to *experience* things (emotion and empathy) from a different *perspective* (identity or hierarchy structure)
- Create Standardized and Objective and real-time assessment

The ability to create order out of chaos while providing a means to adapt to on-going changes, and to experience it from multiple perspectives, brings a heightened ability for educators/trainers and leadership to better equip trainees of the ever increasing rate of learning or skill requirements.

Simply put:

Induce Stress Inoculation → Improve Stress Resilience → Develop Emotional Self-Regulation = Create Mindfulness Practices

Next product generation – freedom to easily build immersive scenarios yourself

Having the proper tool for any task enhances the quality of the education and provides an exponentially easier path to accomplish it. Being able to build such educational material simply and easily – and untethered from the complex and expensive process of ongoing reliance on technology developers – is now possible.

Early stage VR remains dependant upon recurrent technogists involvement and interventation for design and deployment. However build it yourself clinical training and education scenarios are now able to be in your hands, simple, as easy to use as PowerPoint and highly configurable. (ref. VRpatients.com)

In the usual world order, as in most things, it all comes down to financial considerations. Making it or saving it, money and the value added by efficiency in time or utilization, heavily impacts the adoption and penetration rate of VR use in medical education. However, now there are powerful new drivers; a sudden and massive need to rapidly skill and reskill key segments of the healthcare workforce, almost completely absent in the training and education fabric and infrascture we have known and relied on historically, and without question.

Dr. Daniel Katz, MD, Vice Chair of Education for Mount Sinai Department of Anesthesiology and Director of Operations for the Mount Sinai HELPS Center conducted a research study published September 2019 utilizing Health Scholars' ACLS virtual reality application. He demonstrated effectiveness of up to 83% and major cost savings.

The study showed that VR is highly cost-effective in terms of staff involvement, time, and cost:

- Required Staff - High-Fidelity Mannequin-based Simulation: 20 physician training proctors versus VR: 5 (not required to be a physician resource)
- Average Time - High-Fidelity Mannequin-based Simulation: 45 minutes versus VR: 25 minutes
- Cost per Learner - High-Fidelity Mannequin-based Simulation: \$193 versus VR: \$89

The Mount Sinai study also demonstrated that VR is significantly less taxing on facilitators. Using the [NASA TASLI](#) mental demand model, Dr. Katz found that VR required far less mental, physical, and temporal demand on proctors. It also required less effort and resulted in less frustration. This is important because the operational workflows must be tenable in order to sustainably implement training or competency validation pathways in healthcare.

Juxtapose this with now, that in just those few short years since 2015, that the VR industry is exponentially larger, more mature, and even more clearly poised as a new medium with massive potential (Ref. Ben Lang 2020).

In summary what this means to you now:

The opportunity is here – the time to rethink the health care education culture imperatively is now.

At one time or another we have all used the Microsoft suite of tools – Outlook, Excel, Word, and PowerPoint. The generation before us used the calendar, calculator, typewriter, and overheads. Today our students seek to learn on spatial gaming computers and in immersive reality. As organizations, educators and decision makers, we suddenly need to aggressively search out and apply these new technologies to rapidly solve the sudden and dramatic challenges to the fabric of healthcare education. With results indicating VR’s effectiveness and cost savings up to 83%, VR is on its way to becoming a viable alternative to train and assess competencies at scale and a legitimate solution to preventing skills decay that contribute to poor survival outcomes.

These tools are easy to deploy, decentralized, and independent of any physical or human infrastructure. Not only can you provide instructors with rapid and scalable training tools in clinical decision making, skills, procedures and treatment – you can also easily build your own medical cases, independent of any engineering or technical skill. We are on the frontier of XR and VR development tools, with the ease of use now just like making a PowerPoint presentation, that provides flexibility in design of medical cases for teaching, training and testing. We have an imperative need to embrace and engage the utility of these immersive tools of XR/ VR to enhance and scalably address our pressing and unprecedented training and education needs in skilling and reskilling our emergency and acute care healthcare workforce. Though VR educates and trains one experience at a time (Ref. Maddox 2019), its deployment is a quantum leap for healthcare training and education

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