Measuring the Success of VR

Beyond the art of the possible

By Make Real Ltd

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A collation of outcomes of studies, looking at metrics highlighting the benefits and advantages of incorporating Virtual Reality into your learning & development solutions

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1. Introduction

Since the launch of the 4th wave of Virtual Reality (VR) in 2013, many experts have spoken of the benefits of using the technology for learning & development, training and simulation.

However many of these benefits have been little more than vague statements without any substantiated proof or empirical evidence.

The purpose of this report is to present the deeper-dives, research and studies carried out over the past few years, into the measurable effectiveness of using VR by learners and organisations.

Where possible, publicly-available sources will be linked and referenced for auditing accountability and validation of data.

The term XR is used to refer to VR and AR devices

2. Stated Benefits of Using VR

Across a range of sectors, from AEC to retail to automotive, there have been many statements around the benefits of using VR.

The most common of these have been compiled below as a primer of where VR has a role to play.

- **Learner "superpowers"** - Gives learners enhanced capabilities, tools and confidence
- **Reduced time to train** - Learning objectives can be delivered in shorter sessions anywhere
- **Reduced costs to train** - Learners do not need access to real world assets or travel for training

- **Reduced risks of training** - Virtual scenarios allow safe fail states without real world repercussion

- **Improved training scenarios** - Edge cases and greater depth of interaction and involvement

- **Greater knowledge retention** - Learn by doing, building up muscle memory

- **Deeper formed memories** - Greater number of senses involved with learning

- **Greater memory recall** - Greater knowledge retention and deeper memories to draw upon later

- **Repeatable** - Virtual simulations can be easily replayed and repeated or customised

3. VR TRAINING METRICS

Below you will find a series of metrics related to a specific known benefit of using VR, focusing upon the statistical data associated with that point, without any further detail into the use case scenario, research study or outcome.

The statistics shown are taken directly from the specific study, which where possible is linked from the footer to provide further detail where available, into how the research was carried out, metrics achieved and the use case scenario associated with the incorporation of VR.

KNOWLEDGE RETENTION

6 weeks later, VR learners retested would have passed at **80%**

70% VR simulation group able to carry out correct sequence of steps compared to 20% using non-VR

Median test score increase from **5.5 > 9.0** / 10

Better technical performance upon re-assessment **6** months later*

130% increased scores in medical training knowledge retention**

6 weeks later, VR learners retested **80%** had higher score***

Training Industry - https://trainingindustry.com
https://www.docwirenews.com/
VR Infographic - https://wearesponge.com/vr
Fire Safety - https://link.springer.com/article/10.1007/s00464-018-6063-x
**Data from Oculus for Business ISV Partnership.
***Data provided to Make Real by Severn Trent client

COST REDUCTION

Mortenson 'Stonebridge Marriott'

Saved **$45,000** by creating VR version instead of a traditional physical mock-up

Mortenson 'Bucknell University'

Saved **$500,000** by creating VR pre-vis reviews

Lloyds Banking Group*

£175,000 expected savings in training costs for x1 course delivered over 2 yrs

Purina**

$100,000 per year saved on travel & lost productivity costs by training 10 salespeople per month in VR

Unity AEC Case Study - https://create.unity3d.com/
*Data provided to Make Real by Lloyds Banking Group client.
**Data from Oculus for Business ISV Partnership

TRAINING TIME REDUCTION

Nationwide Insurance

3hrs training to 25-minutes > **86%** reduction

United Rentals **40%** reduction training time

OssoVR*

- VR trained participants completed procedure average **20%** faster than traditionally trained group
- Completed **38%** more steps correctly in procedure-specific checklist

Hilton Hotels**

Training time reduced from 4 hours to **20** minutes

Strivr - https://www.strivr.com/blog/why-companies-vr-engage-train-employees-faster/
*Data from Oculus Connect 6 'Oculus for Business : Scalable, Professional, Reliable' talk
**Data from Oculus for Business ISV Partnership.

TRAINING TIME REDUCTION

KFC The Hard Way

5-step cooking process reduced to **10** minutes, compared to 25 minutes with current training

55% faster training completion*

VR-trained students required:

- **53%** less time than classroom training
- **33%** less time than elearning

to learn concepts AND demonstrate significantly higher learning outcomes

PwC VR Soft Skills Study, February 2020
Eater - https://www.eater.com/2017/8/23/16192508/kfc-virtual-reality-training-oculus-rift
*Cambridge University, Cyber-Human Lab

EMPLOYEE PERCEPTION

Jaguar Land Rover 2018 VR Feedback

50% felt it was exciting and fun

42% saw it as innovative

33% saw it as informative, engaging and intriguing

83% more educated about the cars afterwards

41% comfortable with VR

58% VR added value to the sales process

50% appreciated benefit of VR

33% saw as good value for money

Dell Making VR Real - https://blog.dellemc.com/

EMPLOYEE PERCEPTION

Bodyswaps User Survey

78% of learners reported a “good” or “great” understanding of safeguarding best practices

77% of learners reported an improvement in their confidence to handle someone disclosing an incident

89% of learners reported looking to apply what they learned in the simulation to their work

93% of learners reported being likely to recommend the training to their colleagues

86% of Learning Managers reported looking to roll the training further into their organisation

Learners Perceive VR as better training; More immersive / intuitive / interactive / easy-to-use
https://www.sciencedirect.com/science/article/pii/S2095268617303439
Greater perceived value of training
https://www.sciencedirect.com/science/article/pii/S074756321400555X
Bodyswaps - Safeguarding VR
https://bodyswaps.co/project/safeguarding-vr/

LEARNER BEHAVIOUR

"One study used VR to replicate the Milgram shock experiment—a famous psychology experiment in which a subject is asked to press a button to electrically shock a stranger in another room. There are no actual shocks delivered with the button, but during the experiment, the stranger cries out in pain and the subject hears those cries. In the original Milgram experiment the test subjects thought they were administering real electric shocks to real people.[31] Not so in this experiment. In spite of the fact that all participants in the VR study knew that neither the stranger nor the shocks were real, the "participants tended to respond to the situation at the subjective, behavioural and physiological levels [as measured by skin conductance and heart rate] as if it were real."[32] Those subjects who interacted with the stranger via text screen did not produce comparable levels.[33] Many people cannot separate their intellectual understanding of what is happening from the very different signals their body is sending them. And even for those who can, the body will not be ignored. It releases chemicals in response to perceived threats, pleasures, or opportunities whether or not the brain knows those things aren't real. People in VR environments physiologically respond to actions done to them in VR.[34] Subjects who see themselves getting slapped in VR respond with skin conductance and heart rate levels as if they were actually getting slapped. The results are replicable even when the subject is male and their VR "body" is female."

31 Benedict Carey, Decades Later, Still Asking: Would I Pull That Switch?, N.Y.TIMES, July 1, 2008. **32** Mel Slater et al., A virtual reprise of the Stanley Milgram obedience experiments, 1PLOSONEe39(2006); Marcus Cheetham et al., Virtual Milgram: empathic concern or personal distress? Evidence from functional MRI and dispositional measures, 3 FRONTIERS HUMAN NEUROSCIENCE 29 (2009). **33** Slater, supranote32. **34** Mel Slater et al.,First person experience of body transfer in virtual reality, 5 PLOSONE e10564 (2010). Participant Concerns for the Learner in a Virtual Reality replication of the Milgram obedience study - https://dx.plos.org/10.1371/journal.pone.0209704

4. Findings

We have spent a considerable amount of time researching data for this report, either online, in journals, published materials and through our own connections to the wider immersive learning experience for enterprise development sector and our own clients.

The main findings have been that there are few publicly available studies available that contain validated measurements of the effectiveness and impact of Virtual Reality-based training experiences, and those that are available were carried out with a small sample set of data (participants).

However there appears to be a number of case studies as listed above, where there are clear advantages to incorporating Virtual Reality into a training programme.

The other types of research and studies into Virtual Reality training are typically academic and inaccessible behind a paywall and statistic models incompatible with enterprise C-Suite executive levels of understanding. The data needs to easy to understand and easily quotable with clear benefits rather than being hidden within complex data models and evaluations.

Some outcomes in the academic space (that we could access) actually find or conclude that Virtual Reality training does not create learners who complete tasks faster, or with fewer errors, or achieve greater understanding of a specific purpose or action, but similarly, many of these studies also conclude that a small sample size was used and that the nature of the study and/or control groups and design of the tasks were not in-depth enough to provide valid conclusions without further investigation.

It should also be noted that many of the studies were completed using academic settings or task design that often not do represent real world understanding or representative usage by learners or employees, and of course can not factor elements in such as cost savings without access to empirical data from enterprise organisations.

5. Conclusion

Whilst there are fewer discoverable studies than hoped, there are some clear measurable benefits to incorporating Virtual Reality into training scenarios, as shown by the results in the following areas:

- Reduction in training time
- Increased knowledge and memory retention
- Reduction in training costs
- Increased learner perception of the training quality
- Increased realism of training scenarios and outcomes

A number of the studies highlighted the benefits of incorporating VR into soft skills training, an area typically associated with subjective assessment and inconsistent provision.

From onboarding of new employees (Hilton Hotels) to preparing for high street sales days (Walmart) or even armed robbery (Verizon), there are clear benefits to using VR at scale for training to reduce costs (Lloyds Banking Group).

360º video viewed through VR headsets can provide improved training outcomes to who undertake the sessions, as well as improve organisation representation within the eyes of their future workforces.

Other forms of training where VR brings benefits as shown above are within the "learn by doing" hands-on task training, however many of these metrics are qualitative rather than quantitive since direct impact is often hard to measure or correlate directly, such as improved health, safety and well-being, although of course overall reduced incidents at work or improved employee mental health are clear positive outcomes of any training undertaken.

One are where many studies focus is within the medical training area and this is where most statistics are available. This is logical since carrying out operations and procedures on humans requires lengthy training and there is very little room for error, therefore any new training tools or methods have to be scrutinised deeply to ensure effectiveness without adding risk to patients.

What some of the academic studies show however is that VR is not a magic bullet and will not solve all training problems or benefit every scenario.

Similarly focusing on using technology to impress future employees as a gimmick is a short-term benefit if the subsequent training does not match.

This is reflects our approach to incorporating Virtual Reality into training solutions, in that the learning objectives and outcomes should be the key driver, not the use of a particular technology, with measurable outcomes determined early on.

This approach helps to ensure that benefits are measurable and apparent at time of deployment and that KPIs can be met with ROI obvious to all stakeholders.

We advise achieving this through starting small and iterating; targeting a proof-of-concept demonstrator that tests and verifies one or two key learning outcomes first, built with an internal champion, before building up the scope and breadth of stakeholder engagement and scale of deployment.

This can be achieved by defining clear use cases to ensure outcomes can be met and measured against. We have included our project framework template as the last page of this report to help you ask the right questions to determine the validity of the use case for Virtual Reality within your training needs.

Finally, VR should be treated as an additional tool within an existing training toolbox, rather than a complete replacement of existing methods and materials, to instead enhance and compliment.

APPENDIX I - CURRENT INDUSTRY STATUS

To help provide some context to how enterprise is already using or looking at using immersive technologies such as AR and VR within their organisations

93% of enterprise using XR have seen positive impact

46% seeing strong growth in enterprise app dev

66% enterprises would invest in XR over next 3 years

46% said price still barrier to success

58% lack of understanding of benefits

54% lack of business case / ROI proof needed

54% mostly built content in-house

VRX 19/20 Industry Report - https://www.vr-intelligence.com/xr-industry-report-2019-free-download

APPENDIX I - CURRENT INDUSTRY STATUS

Statistics around current impact, trends and future predictions for the value of immersive training.

- Development & Training industry predicted to be worth **£16.3Bn** in 2020, globally

- **400,000** UK jobs to be XR enhanced by 2030

- **52%** developers designing specifically for XR

Content Deployment Logistics

Average Session Length: 19 mins

Average VR Space Size: $4m_2$ - 60%

Average VR Space Utilisation: $1m_2$

PwC Seeing Is Believing Report - https://www.pwc.com/seeingisbelieving
XRDC19 AR VR Report - http://reg.xrdconf.com/AR-VR-Innovation-Report-2019?=ARVRPR
Observer Analytics Report Q2'19-Q3'19 - https://observeranalytics.com/reports/q219-q319

APPENDIX II - MAKE REAL PROJECT FRAMEWORK TEMPLATE

Immersive Learning Framework

Client and Date

The Big Picture

Value Proposition, who, what, why?
What makes Immersive tech valuable for this?

Budget

What budget (or range) are you considering?

Learning Objectives

What is the learning need?
What learning gains are expected?
Is it guided or assessment?

End Users

Who are they? e.g. Solo learners, class of 30?
What's the learning environment? E.g. 1-2-1, remote etc.

Measuring Success

What metrics do we use to measure success?
Where will impact be visible?

Learning Obstacles

Are there significant obstacles to implementation?
E.g. demographics, location etc

Scale

How many end users?
Are users expected to be simultaneous?
How is the content promoted?,

Delivery

How will content be delivered & how does it influence tech choices?
Are multiple delivery mechanisms required? e.g. High-end, standalone VR and SCORM?

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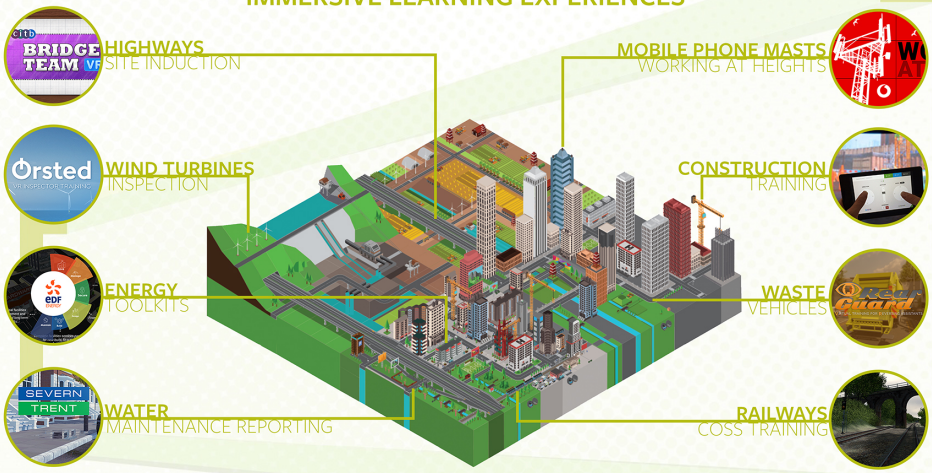
BUILD ENVIRONMENT
IMMERSIVE LEARNING EXPERIENCES



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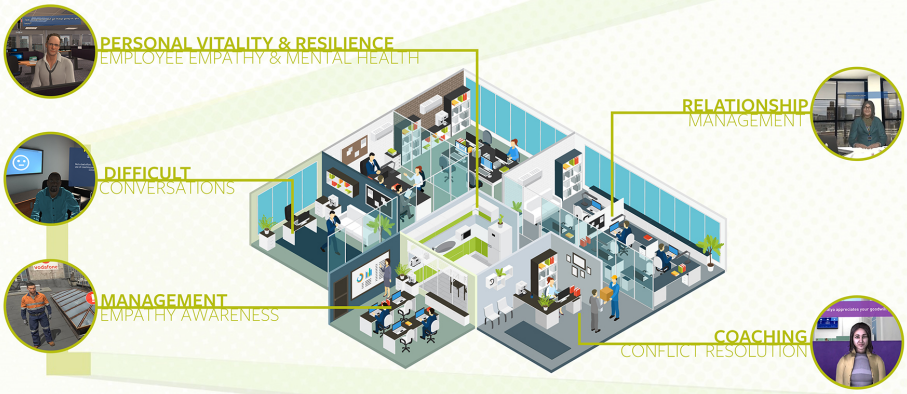
SOFT-SKILLS
IMMERSIVE LEARNING EXPERIENCES



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