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Technologies With Potential to Transform Business and Business Education: Virtual and Augmented Reality

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In February 2018, AACSB International's Innovation Committee convened to discuss emerging opportunities being created by virtual and augmented reality technologies and their applications in business, society, and higher education. This overview provides a glimpse into some of the major characteristics and developments along the reality-virtuality technology continuum, as well as some general frameworks to inspire new ideas and discussion on how this growing technology segment impacts business education and its stakeholders.

This document is intended as an introductory primer on a complex and ever-evolving topic and is not a scientific analysis of the phenomenon. A listing of references and resources is included to help guide further research and understanding on the topic. For questions or suggestions, please contact the AACSB Business Education Intelligence team at research@aacsb.edu.

What's Inside

Special thanks to Anders Gronstedt, president of the Gronstedt Group, for his participation at AACSB's February 2018 Innovation Committee meeting, demonstration on virtual and augmented reality for training purposes, and contribution of insights on emerging practices.

How Are Virtual and Augmented Reality Distinguished?

While "virtual reality" is the most frequently used term in common parlance, a full spectrum of related technology concepts exists, ranging from those that apply virtual content to those that create full virtual worlds, and each with important distinguishing features and uses.

The technical foundation of virtual reality (VR) is said to be traced back to the early 1950s, although it had been discussed in theory for some time before then. One definition of virtual reality is that it is a "three-dimensional, computer generated environment which can be explored and interacted with by a person," who is then able to manipulate objects or perform actions within that virtual environment.[1] VR is implemented through the use of specific computer technology, most often headsets that create the illusion of reality.[2] Virtual reality uses a coding language known as VRML (Virtual Reality Modeling Language) that creates three-dimensional images and the possible user interactions that go with them.[3] According to Recode's Eric Johnson, VR differs from similar technologies in that it allows users to be more deeply immersed in a specific experience: "[W]hen VR users look around—or, in more advanced headsets, walk around—their view of that world adjusts the same way it would if they were looking or moving in *real* reality."[4]

[1] Virtual Reality Society. What is Virtual Reality? https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html

[2] Ibid.

[3] Virtual Reality vs. Augmented Reality. (2017, March 6). *Augment Blog*. http://www.augment.com/blog/virtual-reality-vs-augmented-reality/

[4] Johnson, E. (2015, July 27). What are the differences among virtual, augmented and mixed reality? *Recode*. https://www.recode.net/2015/7/27/11615046/whats-the-difference-between-virtual-augmented-and-mixed-reality

Some credit Palmer Luckey to having kicked off the current age of VR in 2010, when he created the first prototype of a VR headset, which later became known as Oculus Rift. A few years later, Facebook CEO, Mark Zuckerberg, bought the company for 2 billion USD. More and more competitors are filling this market, including HTC Vive, Sony PlayStation VR, Samsung Gear VR, Google Cardboard, and Microsoft HoloLens. Some of these fall under what is considered to be augmented reality (AR) or even mixed reality (MR), which will be discussed later.[5]

Augmented reality is another concept, having originated in 1990 by Tom Caudell, that is often discussed in conjunction with VR.[6] While VR immerses the user in an entirely virtual world that is most often viewed through a screen in a headset, AR adds to, or *augments,* reality. AR enhances real-world experiences by adding virtual, computer-generated components, such as digital images, data, or sensations as a complementary new layer to create enhanced interactions.[7] In contrast, VR creates its own reality that is completely computer generated and driven. As mentioned earlier, VR usually requires users to use a head-mounted or hand-held controller that connects them to the virtual reality and controls and navigates actions. AR may also be delivered through a wearable device but most often uses apps for mobile devices that allow digital images to interact with the real world, while still remaining distinct from one another.[8]

Milgram and Kishino (1994) are often cited for their development of a Virtuality Continuum that ranges from completely real environments to completely virtual ones. Along the middle of the two ends of the continuum is mixed reality (MR), which is defined as "the joint presentation of objects of the real world and objects of the virtual one."[9] MR combines aspects of both AR and VR in that it allows the user to see the real world while also seeing virtual objects that are anchored within a real space and can be treated as "real."[10]

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[5] Dredge, S. (2016, November 10). The complete guide to virtual reality—everything you need to get started. *The Guardian*. https://www.theguardian.com/technology/2016/nov/10/virtual-reality-guide-headsets-apps-games-vr

[6] Lee, Kangdon (2012). Augmented Reality in Education and Training. *TechTrends* 56 (2), 13–21.

[7] Virtual Reality vs. Augmented Reality. (2017, March 6). *Augment Blog*. http://www.augment.com/blog/virtual-reality--vs-augmented-reality/

[8] Ibid.

[9] Castellanos, A., & Perez, C. (2017). New Challenge in Education: Enhancing Student's Knowledge through Augmented Reality. *Augmented Reality: Reflections on Its Contribution to Knowledge Formation*, ed. Ariso,J. Walter. Berlin, Boston: de Gruyter GmbH & Co KG.

[10] Johnson, E. (2015, July 27). What are the differences among virtual, augmented and mixed reality? *Recode*. https://www.recode.net/2015/7/27/11615046/whats-the-difference-between-virtual-augmented-and-mixed-reality

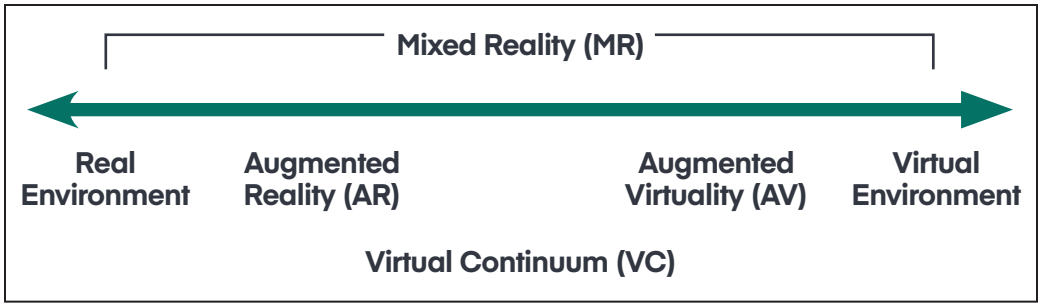

Figure 1. Reality-Virtuality Continuum by Paul Milgram (1994) [11]

MR is often confused with AR, given similarities in the types of technology used and their applications; however, an important distinction is that MR overlays digital information on the user's own reality and integrates it into the environment, while AR simply overlays the information. For example, Google Glass is an AR device that projects information in the periphery of the visual field, whereas with MR the images would be "tethered to the first-person viewpoint and moved with the wearer."[12] Snapchat's world lenses are an example of MR, allowing the user to interact with virtual objects as the camera is moved around. Microsoft's HoloLens is another example of MR technology that allows users to scan their environment and place 3D objects in the room that are viewable from different angles. Below are some of the defining characteristics of VR, AR, and MR.

Table 1. Virtual Reality vs. Augmented Reality vs. Mixed Reality[13]

Characteristics	Virtual Reality	Augmented Reality	Mixed Reality
User is aware of the real world	No	Yes	Yes
User can interact with the real and virtual worlds in real time	No	Yes	Yes
Real and virtual contents interact with each other in real time	No	No	Yes

[11] Milgram, P. and Kishino, F. (1994, August 25). A Taxonomy of Mixed Reality Visual Displays. *IEICE Transactions on Information Systems*, vol E77-D, no.12, p.3.

[12] Hoberman, D. (2017, April 26). What's The Difference Between VR, AR and MR? *Key Lime™ Interactive Blog*. http://blog.keylimeinteractive.com/whats-the-difference-between-vr-ar-and-mr

[13] Kumar, S. (2018, January 6). 7 Signs Mixed Reality is a Secret Game Changer Technology for Tech Startups: Augrealitypedia. *AugRealityPedia*. https://www.augrealitypedia.com/mixed-reality-game-changing-technology/

There is growing interest among certain industries in applying MR technology, especially as it continues to advance in its ability to display more information and provide a greater sense of immersion. For example, educators may look to incorporate MR-enabled classrooms that enhance the learning experience by immersing students in a course or project that encourage more "learn-by-doing" experiences. Architects or designers may use the technology to work on and manipulate scaled-down versions of buildings or projects instead of relying on two-dimensional drawings or hypotheticals.[14] Other examples of uses across various industry sectors will be shared later.

Confusion remains in the marketplace around the appropriate terminology between VR, AR, and MR. Some technologies that are commercially labeled as AR may in actuality be something else. For example, although some can make a case that Pokémon GO is AR, Ken Perlin of NYU Media Research Lab considers it to be an example of an even different term, "location-based entertainment," since the digital characters are not integrated into a player's surroundings in such a way that it alters their reality.[15] For the sake of consistency, the remainder of the overview will refer to the collection of these technologies as "digital reality" (DR), as Adam Draper of Boost VC has used for the collective VR/AR/MR space.[16]

[14] Rivera, A. (2017, October 9). Virtual Reality vs. Augmented Reality vs. Mixed Reality. *Business.com*. https://www.business.com/articles/virtual-vs-augmented-vs-mixed-reality/

[15] Greenemeier, L. (2016, July 13). Is Pokémon GO Really Augmented Reality? *Scientific American*. https://www.scientificamerican.com/article/is-pokemon-go-really-augmented-reality/

[16] Hoberman, D. (2017, April 26). What's The Difference Between VR, AR and MR? *Key Lime™ Interactive Blog*. http://blog.keylimeinteractive.com/whats-the-difference-between-vr-ar-and-mr

Where Have We Seen Digital Reality Most in Society?

Digital reality (DR) is predicted to make significant impacts across various aspects of human life, from healthcare, sports, tourism, training, and entertainment to, of course, education. Experts also discuss the impact that DR may have from a humanistic perspective, more specifically in building empathy and awareness of other perspectives by immersing individuals into the realities of others. For example, BeAnotherLab is an "interdisciplinary, multinational group dedicated to understanding, communicating and expanding subjective experience" and focuses on understanding "the relationship between identity and empathy from an embodied perspective."[17] The group has developed The Machine to Be Another, which is a virtual reality system that allows a user to experience the world from the perspective of another person with the goal of promoting prosocial behavior.

Entertainment and gaming often appear as the most visible and accessible ways that humans can experience DR, particularly with the increasing consumer technologies coming to market in this space; however, there are several ways that other industries are employing DR. Below are some of the major ones.

Medicine and Therapy

In certain medical treatments, DR technology has been increasingly used as a mechanism for alleviating pain through distraction. For example, patients with post-traumatic stress disorder can relive negative experiences in ways that help them overcome fears and trauma.[18] Similarly, the Childhood Anxiety Reduction Through Innovation and Technology (CHARIOT) program at Stanford uses digitally immersive technology to relieve anxiety or stress associated with medical treatments in children.[19] Los Angeles Cedars-Sinai Medical Center is exploring the therapeutic value of VR by helping patients

[17] BeAnotherLab. http://beanotherlab.org/

[18] Cowen, T. (2017, December 19). Virtual Reality Will Make Lives Better ... Mostly. *Bloomberg*. https://www.bloomberg.com/view/articles/2017-12-19/virtual-reality-will-make-lives-better-mostly

[19] Stanford Chariot Program: Childhood Anxiety Reduction Through Innovation and Technology. http://web.stanford.edu/group/chariot/cgi-bin/wordpress/

relax through immersive experiences with animals and nature, which would be impossible to replicate in real life,[20] while MindMaze[21] is making VR software that aims to help rehabilitate stroke, spinal-cord injury, and amputee patients.[22] Others, like Frank Kolkman, are addressing "death anxiety" through a VR-enabled death simulation machine that helps prepare terminally ill hospital patients for their passing.[23]

DR also plays an increasing role in the training of medical students, specifically through simulations for experiencing actual surgeries, or through an augmented approach where instructions or guidance overlays the surgery.[24] Medical Realities is a company using VR, AR, and games to train medical students by enabling them to experience operations from the surgeon's perspective.[25] Some believe that, as technology continues to become more reliable and accessible, using VR in medical training is a more cost-effective option compared to the expenses associated with face-to-face training, such as travel and individual instruction. DR technology can also be a helpful preparation tool for surgeons by allowing them to visualize the procedure and results of an operation, as well as be a helpful tool in communicating procedures to patients through visualization and setting their expectations.

Tourism

A major draw for VR technology is its ability to bring people to places they are unlikely to visit in person, whether due to expense, safety, accessibility, health, or other circumstances. Technology already exists that allows its users to climb Mount Everest (through Iceland-based Sólfar Studios)[26] or explore the Grand Canyon (through Immersive Entertainment), for example.[27] Mars

[20] Cedars-Sinai. (2016, February 15). Virtual Reality | Cedars-Sinai. *YouTube*. https://www.youtube.com/watch?v=z-pcNhnU-Aaw

[21] MindMaze. https://www.mindmaze.com/

[22] Dredge, S. (2016, November 10). The complete guide to virtual reality—everything you need to get started. *The Guardian*. https://www.theguardian.com/technology/2016/nov/10/virtual-reality-guide-headsets-apps-games-vr

[23] Carter, T. (2017, November 22). Frank Kolkman creates death simulation machine using virtual reality. Dezeen. https://www.dezeen.com/2017/11/23/frank-kolkman-outrospectre-near-death-experience-virtual-reality-technology-robots-health/

[24] Cardinal, D. (2018, April 6). VR and Now AR Medical Solutions Are Gaining Ground in Hospitals. Extreme Tech. https://www.extremetech.com/extreme/267078-vr-and-now-ar-medical-solutions-are-gaining-ground-in-hospitals

[25] Medical Realities. https://www.medicalrealities.com/

[26] Sólfar. EVEREST VR. http://www.solfar.com/everest-vr/

[27] mmersive Entertainment. The Grand Canyon VR Experience. https://www.immersiveentertainment.com/the-grand-canyon-vr-experience/

2030, a VR venture developed in partnership with NASA and Fusion Media Group, allows users to wander around the surface of Mars.[28] Google Earth had been recently revamped to include VR experiences through HTC Vive and Oculus Rift, including guided tours of major world destinations.[29] Recent VR ventures like these are a powerful planning tool for travelers considering a particular destination and familiarizing themselves with a location to plan out an itinerary prior to arriving, as well as adding a new layer of entertainment and immersion when visiting a destination virtually.[30] Although some may argue that a real-life travel experience trumps a virtual one, virtual options create valuable opportunities for more people to experience travel and the benefits associated with it, regardless of their personal circumstances. This applies not only to tourism as a form of entertainment but also to higher education, or in some cases professional development, where exposure to different cultures is considered necessary in the learning and development process.

Media

A growing number of journalists, filmmakers, and media professionals are using 360-degree cameras to create new experiences for their viewers. Filmmaker and WITHIN founder, Chris Milk, has made a name for himself through his work in using VR for storytelling. Milk describes his interest in the "foundations for a medium that could be more powerful than cinema, than theatre, than literature, than any other medium we've had before to connect one human being to another."[31] Returning to the point raised earlier, VR's ability to create stronger empathy in human beings, innovative filmmakers like Milk see this as one of the biggest opportunities for VR in film. In a 2015 TED Talk, Milk describes a VR film he created by shooting a 12-year-old girl's story of living in a refugee camp in Jordan with her family. He tells the audience:

[28] Mars 2030. http://mars2030-vr.com/

[29] Google Earth VR. https://vr.google.com/earth/

[30] Modak, S. (2017, April 18). The New Google Earth Has 3D Views and Guided Tours. *Condé Nast Traveler*. https://www.cntraveler.com/story/the-new-google-earth-has-3d-views-and-guided-tours

[31] Dredge, S. (2015, January 29). Virtual reality documentaries 'take the middle man out of journalism.' *The Guardian*. https://www.theguardian.com/technology/2015/jan/29/virtual-reality-documentary-middle-man-journalism-chris-milk-film

> "You'll notice you see full 360 degrees, in all directions. And when you're sitting there in her room, watching her, you're not watching it through a television screen, you're not watching it through a window, you're sitting there with her. When you look down, you're sitting on the same ground that she's sitting on. And because of that, you feel her humanity in a deeper way. You empathize with her in a deeper way."[32]

Traditional media companies are also experimenting with how VR can amplify their journalism, such as the *Guardian*'s 6x9 Project, which explores solitary confinement by allowing viewers to experience the psychological impacts of being inside a U.S. solitary confinement prison cell,[33] or the *New York Times*, which distributed more than one million Google Cardboard headsets to its print subscribers and created a VR-specific mobile application for viewing *New York Times*-created VR experiences.[34] Since launching NYT VR in 2015, the *New York Times* has used VR technology, such as VR cameras like Z Cam S1 in their immersive journalism features.[35] Examples include The Daily 360, in which journalists from around the world share a 360-degree video every day around a particular topic or story,[36] or in stories where the location or place are the main focus, such as the Antarctica Series.[37] Costs associated with shooting and editing VR footage are steep but are likely to decrease with time and lead to more media companies recognizing VR's potential for enhancing media and entertainment offerings. Some are hopeful that more user-friendly VR-enabled wearable technology will be developed, for example, in the form of glasses, that will allow for mainstream use and viewer experience.[38]

Although VR's ability to bring audiences closer to real-life experiences seems to align with the goals of journalism, Jeremy Bailenson, founding director of the Virtual Human Interaction Lab, raises potential drawbacks of its use, particularly in objective journalism whose industry is rapidly changing. First, VR may instill too much emotion in viewers in that it prevents rational thinking and decision-making—a technique used throughout history particularly with propaganda campaigns. Second, because of its digital nature VR can be altered and, as a result, misinform or emotionally manipulate viewers.[39] Although a viewer may be convinced

[32] Milk, C. (2015, March). How virtual reality can create the ultimate empathy machine. *TED Talks*. https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine

[33] 6x9: A virtual experience of solitary confinement. *The Guardian*. https://www.theguardian.com/world/ng-interactive/2016/apr/27/6x9-a-virtual-experience-of-solitary-confinement

[34] Bailenson, J. (2018, January 15). How virtual reality could change the journalism industry. *PBS News Hour*. https://www.pbs.org/newshour/economy/making-sense/how-virtual-reality-could-change-the-journalism-industry

[35] Hopkins, M. (2017, October 18). Pioneering Virtual Reality and New Video Technologies in Journalism. *The New York Times*. https://www.nytimes.com/2017/10/18/technology/personaltech/virtual-reality-video.html

[36] The Daily 360. https://www.nytimes.com/video/the-daily-360

[37] The Antarctica Series. *NYT VR*. https://www.nytimes.com/interactive/2017/climate/antarctica-virtual-reality.html

[38] Hopkins, M. (2017, October 18). Pioneering Virtual Reality and New Video Technologies in Journalism. *The New York Times*. https://www.nytimes.com/2017/10/18/technology/personaltech/virtual-reality-video.html

[39] Bailenson, J. (2018, January 15). How virtual reality could change the journalism industry. *PBS News Hour*. https://www.pbs.org/newshour/economy/making-sense/how-virtual-reality-could-change-the-journalism-industry

they know the reality given their VR experience, there are certain things that cannot be fully understood unless experienced in real life.

The ability to create stronger emotional connection is seen as an advantage among advertising and marketing companies, who see the potential of prospective customers becoming so emotionally invested that they make a purchase, or creating unique experiences around particular products or brands. Additionally, being able to virtually try on or "test-drive" certain products presents a way for marketers to reach more potential buyers and eliminates the need for physically visiting a store.[40]

Training

VR has been used for training in hazardous occupations, like in aviation, the military, or fire rescue; however, more companies are looking at the advantages of VR for training across various sectors, occupations, and experience levels. Anders Gronstedt, president of the digital training agency Gronstedt Group, believes that as VR technology evolves and becomes more common in everyday life, companies will increasingly be looking to it for more strategic employee development.[41] For instance, Walmart partnered with VR startup STRIVR to create a technology that allows employees to experience real-world scenarios through the use of an Oculus headset, with the goal of preparing employees for certain situations they are likely to encounter, such as holiday rush crowds or cleaning up messes in aisles.[42] The headsets link to a video screen that displays to the classroom what the trainee is seeing, allowing the instructor and other students to experience and provide feedback. Nearly 200 Walmart employee training centers use STRIVR for employee training, including customer service, operations, and emergency preparation.[43] More recently, Walmart has partnered with the Gronstedt Group to develop The Game, "a mobile simulation that leads associates through

[40] Tokareva, J. (2017, December 6). How virtual reality is changing the world of advertising. *Forbes*. https://www.*Forbes*.com/sites/quora/2017/12/06/how-virtual-reality-is-changing-the-world-of-advertising/#2cd6fdbd68d5

[41] Rio, A. (2018, March 8). Brining the future forward. *Chief Learning Officer*. http://www.clomedia.com/2018/03/08/virtual-reality-bringing-future-forward/

[42] Feloni, R. (2017, June 1). Walmart is using virtual reality to train its employees. *Business Insider*. http://www.businessinsider.com/walmart-using-virtual-reality-employee-training-2017-6

[43] Metz, R. (2017, 22 November). Finally, a Useful Application for VR: Training Employees. *MIT Technology Review*. https://www.technologyreview.com/s/609473/finally-a-useful-application-for-vr-training-employees/

an array of important customer service tasks."[44] Other companies, as well as sports teams, have also used STRIVR to help improve staff or athlete performance. For example, equipment rental company United Rentals engaged with STRIVR to use VR to immerse employees into construction sites and recreate the "five phases of construction," in turn reducing training time by 40 percent.[45]

General Motors has used Google Glass to train factory workers in real time and provide immediate feedback by allowing users to view the correct techniques in their Google device as they perform tasks.[46] One major benefit of AR technology in training is its ability for customization, for example, creating training experiences tailored to an individual employee's experience level or susceptibility to a specific set of errors.[47] Deutsche Bahn AG uses VR technology in its recruitment efforts, particularly in a competitive market, by providing prospective employees the chance to experience the job before committing. The company also believes VR may help better prepare older employees to new workplace challenges by proving a glimpse into what they can expect to see and experience.[48] Similarly, AGL Energy has used VR technology during the onboarding of new employees to give them a "taste of life at AGL and the types of 'in situ' experiences they are likely to encounter," allowing new hires to more quickly acclimate to the AGL environment.[49,50]

Although educational classrooms have used AR and VR technologies, adoption has not been as fast or as well embraced compared to industry and business training. As will be discussed later, many of the challenges to adopting within higher education revolve around integrating technology with traditional learning methods, associated costs, and resistance (by faculty and users). However, with the more recent improvements in computer and information technology, some experts believe that the use of AR in education and training can become more streamlined and include a greater variety of experiences and materials more representative of different perspectives that can greatly enhance the learning experience.[51]

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[44] Larsson, T. (2018, June 12). Our mobile business sim for Walmart unveiled. Gronstedt Group. http://gronstedtgroup.com/mobile-business-sim-walmart-unveiled/

[45] United Rentals Case Study. *Strivr.* https://www.*Strivr*.com/wp-content/uploads/2018/01/STRIVR_UR_case-study_nq.pdf

[46] Dallke, J. (2015, March 23). Google Exec Explains How Google Glass is Alive on the Manufacturing Floor. AmericanInno. https://www.americaninno.com/chicago/google-glass-is-used-at-general-motors-and-other-manufacturing-companies/

[47] Porter, M. E., & Heppelmann, J. E. (2017, November/December). A Manager's Guide to Augmented Reality. *Harvard Business Review*. https://hbr.org/2017/11/a-managers-guide-to-augmented-reality

[48] Goodwin, B. (2015, October 23). German rail and transport group turns to virtual reality in war for talent. *Computer Weekly*. http://www.computerweekly.com/news/4500255941/German-rail-and-transport-group-turns-to-virtual-reality-in-war-for-talent

[49] Ibid.

[50] Bender, A. (2015, February 11). AGL tests virtual reality for employee training. *Computer World*. https://www.computerworld.com.au/article/566044/agl-tests-virtual-reality-employee-training/

[51] Lee, K. (2012, March/April). Augmented Reality in Education and Training. *TechTrends*, 56(2), 14.

Other

Various forms of DR are increasingly being used in human daily lives and everyday tasks. A common example is an automobile GPS navigation system, particularly those in which navigational images overlay directly onto the driver's view of the windshield. This is referred to as "converged view" in that the digital data is superimposed with the real world and, in this case, is used for instruction. One advantage of such an enhancement is that it "reduces [the] mental effort of applying the information, prevents distraction, and minimizes driver error, freeing people to focus on the road" rather than having to look back and forth between the actual road and a monitor displaying directions.[52]

Another example of AR shared by Porter and Heppelmann is the design and manufacturing of U.S. Navy aircraft carriers. Rather than having to rely on 2D prints, engineers can use AR technology that superimposes a final design on the carrier and identifies which steel construction structures are not needed for the finished product. Using this technology is said to reduce inspection time by 96 percent (from 36 hours to 90 minutes).[53]

As companies consider introducing DR technologies into their workplaces and operations, strategic decision-making and planning will play a larger role. Porter and Heppelmann suggest a list of essential questions that companies should consider, which can also be applied to the higher education industry:

1. What is the range of AR opportunities in the industry, and in what sequence should they be pursued?
2. How will AR reinforce a company's product differentiation?
3. Where will AR have the greatest impact on cost reduction?
4. Should the company make AR design and deployment a core strength, or will outsourcing or partnering be sufficient?
5. How will AR change communications with stakeholders?[54]

The use of DR technology in the education space has been discussed more and more as universities embrace new forms of technology in their classrooms, and as incoming generations of students exhibit greater familiarity with the technology, as well as a new set of expectations on technology's role in the learning process.

[52] Porter, M. E., & Heppelmann, J. E. (2017, November/December). A Manager's Guide to Augmented Reality. *Harvard Business Review*. https://hbr.org/2017/11/a-managers-guide-to-augmented-reality

[53] Ibid.

[54] Porter, M. E., & Heppelmann, J. E. (2017, November/December). A Manager's Guide to Augmented Reality. *Harvard Business Review*. https://hbr.org/2017/11/a-managers-guide-to-augmented-reality

Digital Reality Within Higher/ Business Education

Some of the more frequently discussed potential benefits of leveraging VR in education are the possibility for it to do the following:

- Inspire creative learning
- Allow for delivery of education that is not possible in reality because it is too dangerous, expensive, or physically impossible
- Help with understanding of complex subjects or concepts, for example, through learning experiences better suited to an individual's learning style or by better showing the applicability of a concept in real life
- Serve as a complementary learning tool to the traditional case study
- Increase student motivation through virtual game-based experiences and allow for immediate engagement, especially in light of limited attention spans
- Foster social integration of learners (regardless of physical location) through collaboration in virtual reality classroom
- Encourage learning that is achieved by direct interaction and that is active, rather than passive
- Allow for new opportunities for assessment of the learning process, as well as immediate feedback

- Benefit various learning styles and preferences, especially visual-spatial and kinesthetic, which are not addressed as much within higher education compared to earlier levels of education
- Create new opportunities for a school's marketing, such as in recruitment of prospective students through virtual campus tours
- Offer new options for distance learners to take offline and online classes that could achieve a full student immersion in the college experience, allowing them to feel present in a classroom discussion or lecture
- Allow for immersion of students in cultural or social events
- Serve as a networking tool by allowing students to virtually attend events where they can meet and discuss their experience and achievements with fellow alumni and others[55,56]

DR technology is enabling educators to experiment with new pedagogies that help schools move away from "rigid and overloaded curricula," as can be characteristic of traditional academic structures.[57] As experiential learning and other similar pedagogical innovations continue to gain momentum for motivating students to learn, as well as to better understand certain concepts or subject areas, more and more university classrooms will look to implementing DR technology, which provides students with more "learn by doing" experiences.

Having spent nearly two decades observing and working with VR, Stanford professor Jeremy Bailenson believes that one of the biggest misconceptions about VR is that its greatest opportunity for impact is in entertainment and the ability to create new media experiences. Rather, he believes, people should treat VR as they would actual experiences—which is one reason it can be so beneficial as a teaching tool. In an *InsideHigherEd* interview about his recent book, *Experience on Demand: What Virtual Reality Is, How it Works and What It Can Do*, he discusses the value, in addition to general support by professors, for virtual field trips that help enhance existing course materials and provide special experiences to students on a more regular basis, rather than just a couple times a year, or never at all.[58]

[55] Velev, D., & Zlateva, P. (2017). Virtual Reality Challenges in Education and Training. *International Journal of Learning and Teaching*, 3(1), 33–37.

[56] Virtual Reality Society. (2017, June 28). Virtual reality in the classroom. https://www.vrs.org.uk/virtual-reality-education/in-the-classroom.html

[57] Castellanos, A., & Pérez, C. (2017). New Challenge in Education: Enhancing Student's Knowledge through Augmented Reality. *Augmented Reality*, 281.

[58] Lieberman, M. (2018, March 28). Q&A: What virtual reality can (and could) do. *InsideHigherEd*. https://www.nsideHigherEd.com/digital-learning/article/2018/03/28/expert-virtual-reality-believes-its-higher-ed-impacts-are-still

A number of universities and business schools have been experimenting with DR technology in various ways, including the admission processes, pedagogy, and actual course content. Below are some examples.

- **Massachusetts Institute of Technology, Sloan School of Management**: Executive education faculty and staff have used AvayaLive Engage since 2011; however, the technology was used with a more serious purpose during Hurricane Sandy in October 2012. The storm left many students without a way to get to campus, but through the VR platform students were able to connect and attend their classes.[59]
- **Stanford University, Graduate School of Business**: The school launched an online certificate program that features customizable avatars for students who attend classes in a virtual space resembling the GSB campus.[60] Students in the school's LEAD program can immerse themselves in a 360-degree learning environment, also powered by AvayaLive Engage. Faculty have shared that avatars allow students to interact with each other more naturally than through video-conferencing. As networking and learning from peers play a critical role in executive education, the simulation features can help replicate the on-campus experience.[61]
- **SP Jain School of Management**: A nine-month Weekend Professional Technology Program in Virtual Reality was designed to "produce graduates with the skills and competencies to develop sophisticated Virtual Reality interfaces and deliver entire experiences to the human mind seamlessly." The program uses a blended learning model that allows working professionals to build real-world skills and competencies in the subject without interrupting their full-time careers.[62]
- **ESSEC Business School**: The ESSEC Managerial Innovation and Operational Excellence Chair is innovating with a new educational model, the Management Game 360,[63] which places the learner directly into a change-management situation via an immersive VR experience. Program participants use a VR helmet that can be used in a face-to-face training environment, as well as independently. The device alternates between immersion phases in a company's key locations, during which the participant is presented with opportunities to analyze and interpret certain elements or scenarios as presented by the professor.

[59] Gellman, L. (2015, July 1). B-Schools Get a Feel for Virtual Reality. *The Wall Street Journal*. https://www.wsj.com/articles/b-schools-get-a-feel-for-virtual-reality-1435776045

[60] Ibid.

[61] Murray, S. (2016, August 25). EDTECH: Elite Business Schools Are Betting On Virtual and Augmented Reality. *BusinessBecause*. https://www.BusinessBecause.com/news/mba-distance-learning/4140/schools-bet-on-virtual-and-augmented-reality

[62] SP Jain Professional Technology Program in Virtual Reality. https://www.spjain.org/programs/professional-technology/virtual-reality

[63] L'ESSEC Business school partenaire de Revolution@Work. (2017, September 11). http://www.essec.edu/fr/actualites/lessec-business-school-partenaire-de-revolutionwork/

- **Babson College**: The Digital Experience Initiative (dXi) brings together research, industry partnerships, and co-curricular experimentation in areas related to digital innovation, including topics such as artificial intelligence and VR.[64] Ruban Mancha, one if the initiative's founding members, describes dXi's goal is to explore "how startups and organizations embrace digital technologies, the influence these technologies have on innovation and strategy, and the social challenges and opportunities they generate."[65]
- **University of Hartford, Barney School of Business**: In spring 2016, 1,200 students who had been accepted to the school's undergraduate program received school-branded Google Cardboard headsets that allowed for virtual tours of the business school and university campus. The headsets were part of a campaign to increase enrollment of students accepted into the Barney School's class of 2020. The school's marketing department worked with digital agency Primacy to develop the VR experience, which included tours of classrooms and athletic facilities. It also highlighted two events from the business school: a study abroad and a student engagement. When the school sent follow-up emails to students about the VR campaign, it had a 56 percent "open" rate, and over 32,000 people posted on the campaign's Facebook page. In the two weeks following the campaign, the business school saw an increase in the number of tuition deposits that was 70 percent higher than the increase in deposits for the rest of the university in the same time frame.[66]
- **University of St. Thomas-Minnesota, Opus College of Business:** The school launched a VR-enabled leadership simulation in which students using Google Cardboard practice ethical decision-making and experience outcomes based on the decisions they choose to make. The immersive exercise allows students to experience certain things that the traditional case study is unable to, such as reading nonverbal cues, ambiguous situations, and regulating emotion.[67]
- **NEOMA Business School:** VR enables students to become "actors in the learning process" by solving specific problems in a virtual sales outlet environment as individuals or in groups, as presented by their teachers.[68]

[64] Digital Experience Initiative. Babson College. http://www.babson.edu/Academics/teaching-research/Pages/digital-experience-initiative.aspx

[65] B-Schools Embrace Digital Tech. (2017, August 28). *BizEd*. https://bized.aacsb.edu/articles/2017/09/b-schools-embrace-digital-tech

[66] Virtual Impressions. (2016, September 04). *BizEd*. http://bized.aacsb.edu/articles/2016/09/virtual-impressions

[67] University of St. Thomas-Minnesota, Opus College of Business. Bringing Business Ethics Case Studies to Life Through Virtual Reality: Transforming a Leader's Ability to Make Ethical Decisions in Complex Situations. 2017–18 AACSB Innovations That Inspire submission. https://www.aacsb.edu/about/advocacy-and-awareness/member-challenges/innovations-that-inspire/2018/university-of-st-thomas

[68] NEOMA Business School. ExE-6netic. 2017–18 AACSB Innovations That Inspire submission. https://www.aacsb.edu/about/advocacy-and-awareness/member-challenges/innovations-that-inspire/2018/neoma-business-school

In 2016, the American Accounting Association gave two of its Innovation in Accounting Education awards to teams of professors whose work centered on VR. One of the teams was spotlighted for their use of Second Life — an online virtual world where users can create avatars that interact with places, objects, and other avatars — to teach students how to conduct a physical examination of inventory. Because it was not possible to find a warehouse that would stop operations in order for students to get extensive on-site inventory experience, the team aimed to create one in a virtual environment. With funding from the EY Foundation and North Carolina State University alumni, the team built the stocked warehouse, office, and brewery space for the virtual RedPack brewing company using Second Life, where students could learn the processes involved in this area of accounting. Since the simulation was completed in 2010, nearly 800 students have simulated inventory procedures at RedPack.[69]

[69] Accounting Professors Honored for Innovation. (2016, November 1) *BizEd*. https://bized.aacsb.edu/articles/2016/11/accounting-professors-honored-for-innovation

Challenges

Some of the most widely discussed challenges regarding implementation of DR technology in the higher education space are that it is too labor-intensive for staff and requires a learning curve to deliver effectively. Some educators acknowledge such challenges, for example, associate dean of executive education at Stanford Graduate School of Business, Dave Weinstein, who has said, "I don't think there will be a groundswell of people running to use this,"[70] or Robin Teigland of Stockholm School of Economics, who has shared that the majority of universities continue to struggle to keep up with the demands, innovations, and potential opportunities associated with online education, let alone integrating DR.[71] Although most universities aim to be at the forefront of new innovations in student learning, for many the reality is that implementing change is often a slow process. Some of this lag is due to general resistance from faculty or university bureaucracy that makes securing personnel or financial resources a challenge.

Experimentation with DR technologies is most likely to first take place in the executive education space, given the smaller size and shorter duration compared to undergraduate programs, as well as the more practical and applied nature of these programs. Some educators are not convinced that the current technology is at a point where it is dependable enough for effective course delivery. For example, Stockholm School of Economics provided its executive students with Samsung Gear VR headsets to interact in a virtual classroom and came to the realization that the latency between students' movements and the headsets prevented students from having more in-depth discussions and exchanges. Additionally, faculty found setup time distracting and consuming of teaching time.[72] Alternatively, others like Jeremy

[70] Gellman, L. (2015, July 1). B-Schools Get a Feel for Virtual Reality. *The Wall Street Journal*. https://www.wsj.com/articles/b-schools-get-a-feel-for-virtual-reality-1435776045

[71] Murray, S. (2016, February 15). EDTECH: These Four B-Schools Are Exploring Virtual Reality with Oculus, Google, Samsung. *BusinessBecause*. https://www.businessbecause.com/news/mba-distance-learning/3783/bschools-explore-virtual-reality-with-oculus-samsung-google

[72] Ibid.

Bailenson believe that content, rather than the hardware or technology, is the major barrier to wider implementation of VR in the classroom. He adds that a two-dimensional screen is sufficient for most learning content and that what is continually lacking is curricula designed specifically for VR. Learning content that is "procedural and active" and that benefits from interactive experiences in the learning process is better suited for VR (as it stands right now) versus subjects that are a bit more abstract or less applicable in real-life experiences.[73]

Some other challenges regarding the implementation of DR within higher education include:

- Expense of needed equipment (hardware and software) for using DR in group educational environments
- Uncertainty and gaps regarding student learning measurement and assessment
- Faculty resistance in adapting their teaching to DR capabilities
- Parent reluctance for accepting DR technology as an appropriate vehicle for student learning
- Technical and technological limitations of standard computer equipment for smooth implementation of DR technology
- Technology compatibility challenges across various DR provider platforms
- Social, personal, and cultural hurdles for students who may be less comfortable using DR technology, which can lead to varying results and levels of receptiveness
- A learning curve for social nuances within virtual experiences and contexts; for example, professional attire norms in the real-world workplace versus in professional virtual environments, or networking formalities

Further, many students and faculty still say there is no substitute for face-to-face interaction, and a major drawback of DR remains the lack of ability to read facial and body cues.[74] However, as the technology continues to improve and people become more accustomed to operating in virtual environments, sentiment may change. AR, specifically, may present new opportunities for student learning enhancement; its ability to "add" to a user's immediate environment (rather than replacing it) presents more cost-effective, user-focused, and immediate opportunities for classroom use.[75]

[73] Lieberman, M. (2018, March 28). Q&A: What virtual reality can (and could) do. *InsideHigherEd*. https://www.insidehighered.com/digital-learning/article/2018/03/28/expert-virtual-reality-believes-its-higher-ed-impacts-are-still

[74] Gellman, L. (2015, July 1). B-Schools Get a Feel for Virtual Reality. *The Wall Street Journal*. https://www.wsj.com/articles/b-schools-get-a-feel-for-virtual-reality-1435776045

[75] Reynard, R. (2017, April 26). The Impact of Virtual Reality on Learning. *Campus Technology*. https://campustechnology.com/Articles/2017/04/26/The-Impact-of-Virtual-Reality-on-Learning.aspx

What Can We Expect in the Future?

Regardless of the challenges and current limitations of DR technology, interest persists from a monetary standpoint. Venture capital investments in VR endeavors, such as Magic Leap, hit nearly 4 billion USD between 2010 and 2015.[76] While technology involved in DR is becoming more complex, its use is expanding across sectors, as discussed earlier, and among more consumers. According to a 2015 Research and Markets report, "the installed base of actively used mobile Augmented Reality apps will increase from 135 million in 2014 to 2.2 billion by 2019; moreover, this growth might create a market of 1.6 billion USD for mobile Augmented Reality apps in 2019."[77] In 2017, International Data Corporation predicted that worldwide revenues for the DR market will increase by 100 percent each year for the next four years, and total spending on DR products and services is expected to increase from 11.4 billion USD in 2017 to nearly 215 billion USD in 2021.[78] Supporters and optimists of DR predict that its expected ability to enhance learning

[76] Murray, S. (2016, August 25). EDTECH: Elite Business Schools Are Betting On Virtual and Augmented Reality. *BusinessBecause*. https://www.businessbecause.com/news/mba-distance-learning/4140/schools-bet-on-virtual-and-augmented-reality

[77] Castellanos, A., & Pérez, C. (2017). New Challenge in Education: Enhancing Student's Knowledge through Augmented Reality. *Augmented Reality*. 277–78.

[78] Violino, B. (2017, October 17). Dell Technologies Voice: More Than Half of Colleges Will Use Virtual Reality to Enhance Education by 2021. *Forbes*. https://www.forbes.com/sites/delltechnologies/2017/10/17/more-than-half-of-colleges-will-use-virtual-reality-to-enhance-education-by-2021/#4ca4747f6c48

efficacy, student recruitment and retentions, and career preparation will result in 60 percent of higher education institutions using DR to create "enhanced simulation and learning environment[s]" by 2021.[79]

From a social or user perspective, VR at its early stages is largely discussed as a personal experience that pulls individuals away from public life. But researchers predict that this behavior will eventually shift, as virtual reality will be used more for promoting collective experiences.[80] Several companies are focusing on ways to make VR more social; one example is Oculus, which launched "Social Beta" software through which people can watch online video services Twitch and Vimeo in a virtual cinema with other people. Another example is tech startup AltspaceVR, which allows people to "be together in a more natural way than a phone call, text or video chat" through the use of avatars that can wander in its virtual environments, and is available for some headsets already.[81] Mark Zuckerberg foresees the Oculus platform to be used more as a space to connect with others: "By feeling truly present, you can share unbounded spaces and experiences with the people in your life. Imagine sharing not just moments with your friends online, but entire experiences and adventures."[82]

[79] Ibid.

[80] Cowen, T. (2017, December 19). Virtual Reality Will Make Lives Better ... Mostly. *Bloomberg*. https://www.bloomberg.com/view/articles/2017-12-19/virtual-reality-will-make-lives-better-mostly

[81] Dredge, S. (2016, November 10). The complete guide to virtual reality—everything you need to get started. *The Guardian*. https://www.theguardian.com/technology/2016/nov/10/virtual-reality-guide-headsets-apps-games-vr

[82] Ibid.

Further Viewing/Reading on AR and VR

6×9: A virtual experience of solitary confinement. *The Guardian*. https://www.theguardian.com/world/ng-interactive/2016/apr/27/6x9-a-virtual-experience-of-solitary-confinement

Accounting Professors Honored for Innovation. (2016, November 1) BizEd. https://bized.aacsb.edu/articles/2016/11/accounting-professors-honored-for-innovation

Ariso, J. M. (2017). Augmented Reality. Berlin Studies in Knowledge Research, 11, 273.

Bailenson, J. (2018, January 15). How virtual reality could change the journalism industry. *PBS News Hour*. https://www.pbs.org/newshour/economy/making-sense/how-virtual-reality-could-change-the-journalism-industry

BeAnotherLab. http://beanotherlab.org/

Bender, A. (2015, February 11). AGL tests virtual reality for employee training. *Computer World*. https://www.computerworld.com.au/article/566044/agl-tests-virtual-reality-employee-training/

B-Schools Embrace Digital Tech. (2017, August 28). BizEd. https://bized.aacsb.edu/articles/2017/09/b-schools-embrace-digital-tech

Carter, T. (2017, November 22). Frank Kolkman creates death simulation machine using virtual reality. DeZeen. https://www.dezeen.com/2017/11/23/frank-kolkman-outrospectre-near-death-experience-virtual-reality-technology-robots-health/

Castellanos, A., & Pérez, C. (2017). New Challenge in Education: Enhancing Student's Knowledge through Augmented Reality. Augmented Reality, 273–93.

Cedars-Sinai. Virtual Reality | Cedars-Sinai. YouTube. (2016, February 15). https://www.youtube.com/watch?v=zpcNhnU-Aaw

Comstock, J. (2017, June 14). Osso VR gets $2 million to train surgeons in virtual operating rooms. MobiHealthNews. http://www.mobihealthnews.com/content/osso-vr-gets-2-million-train-surgeons-virtual-operating-rooms

Cowen, T. (2017, December 19). Virtual Reality Will Make Lives Better ... Mostly. Bloomberg. https://www.bloomberg.com/view/articles/2017-12-19/virtual-reality-will-make-lives-better-mostly

Dallke, J. (2015, March 23). Google Exec Explains How Google Glass is Alive on the Manufacturing Floor. AmericanInno. https://www.americaninno.com/chicago/google-glass-is-used-at-general-motors-and-other-manufacturing-companies/

Davis, N. (2016, April 14). Cutting-edge theatre: world's first virtual reality operation goes live. *The Guardian*. https://www.theguardian.com/technology/2016/apr/14/cutting-edge-theatre-worlds-first-virtual-reality-operation-goes-live

Digital Experience Initiative. Babson College. http://www.babson.edu/Academics/teaching-research/Pages/digital-experience-initiative.aspx

Dredge, S. (2016, November 10). The complete guide to virtual reality—everything you need to get started. *The Guardian*. https://www.theguardian.com/technology/2016/nov/10/virtual-reality-guide-headsets-apps-games-vr

Dredge, S. (2015, January 29). Virtual reality documentaries 'take the middle man out of journalism.' *The Guardian*. https://www.theguardian.com/technology/2015/jan/29/virtual-reality-documentary-middle-man-journalism-chris-milk-film

Feloni, R. (2017, June 1). Walmart is using virtual reality to train its employees. *Business Insider*. http://www.businessinsider.com/walmart-using-virtual-reality-employee-training-2017-6

Gellman, L. (2015, July 1). B-Schools Get a Feel for Virtual Reality. *The Wall Street Journal*. https://www.wsj.com/articles/b-schools-get-a-feel-for-virtual-reality-1435776045

Goodwin, B. (2015, October 23). German rail and transport group turns to virtual reality in war for talent. *Computer Weekly*. http://www.computerweekly.com/news/4500255941/German-rail-and-transport-group-turns-to-virtual-reality-in-war-for-talent

Google Earth VR. https://vr.google.com/earth/

Greenemeier, L. (2016, July 13). Is Pokémon GO Really Augmented Reality? Scientific American. https://www.scientificamerican.com/article/is-pokemon-go-really-augmented-reality/

Hoberman, D. (2017, April 26). What's The Difference Between VR, AR and MR? Key Lime™ Interactive Blog. http://blog.keylimeinteractive.com/whats-the-difference-between-vr-ar-and-mr

Hopkins, M. (2017, October 18). Pioneering Virtual Reality and New Video Technologies in Journalism. *The New York Times*. https://www.nytimes.com/2017/10/18/technology/personaltech/virtual-reality-video.html

Immersive Entertainment. The Grand Canyon VR Experience. https://www.immersiveentertainment.com/the-grand-canyon-vr-experience/

Johnson, E. (2015, July 27). What are the differences among virtual, augmented and mixed reality? Recode. https://www.recode.net/2015/7/27/11615046/whats-the-difference-between-virtual-augmented-and-mixed-reality

Kumar, S. (2018, January 06). 7 Signs Mixed Reality is a Secret Game Changer Technology for Tech Startups: Augrealitypedia. AugRealityPedia. https://www.augrealitypedia.com/mixed-reality-game-changing-technology/

Larsson, T. (2018, June 12). Our mobile business sim for Walmart unveiled. Gronstedt Group. http://gronstedtgroup.com/mobile-business-sim-walmart-unveiled/

L'ESSEC Business school partenaire de Revolution@Work. (2017, September 11). http://www.essec.edu/fr/actualites/lessec-business-school-partenaire-de-revolutionwork/

Lieberman, M. (2018, March 28). Q&A: What virtual reality can (and could) do. *InsideHigherEd*. https://www.*InsideHigherEd*.com/digital-learning/article/2018/03/28/expert-virtual-reality-believes-its-higher-ed-impacts-are-still

Mars 2030. http://mars2030-vr.com/

Medical Realities. https://www.medicalrealities.com/

Milk, C. (2015, March). How virtual reality can create the ultimate empathy machine. TED Talks. https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine

Mindmaze The Neurotechnology Company. https://www.mindmaze.com/

Modak, S. (2017, April 18). The New Google Earth Has 3D Views and Guided Tours. Condé Nast Traveler. https://www.cntraveler.com/story/the-new-google-earth-has-3d-views-and-guided-tours

Murray, S. (2016, August 25). EDTECH: Elite Business Schools Are Betting On Virtual and Augmented Reality. *BusinessBecause*. https://www.*BusinessBecause*.com/news/mba-distance-learning/4140/schools-bet-on-virtual-and-augmented-reality

Murray, S. (2016, February 15). EDTECH: These Four B-Schools Are Exploring Virtual Reality with Oculus, Google, Samsung. *BusinessBecause*. https://www.*BusinessBecause*.com/news/mba-distance-learning/3783/bschools-explore-virtual-reality-with-oculus-samsung-google

NEOMA Business School. ExE-6netic. 2017–18 AACSB Innovations That Inspire submission. https://www.aacsb.edu/about/advocacy-and-awareness/member-challenges/innovations-that-inspire/2018/neoma-business-school

Osso VR. http://ossovr.com/

Porter, M. E., & Heppelmann, J. E. (2017, November/December). A Manager's Guide to Augmented Reality. *Harvard Business Review*. https://hbr.org/2017/11/a-managers-guide-to-augmented-reality

Reynard, R. (2017, April 26). The Impact of Virtual Reality on Learning. Campus Technology. https://campustechnology.com/Articles/2017/04/26/The-Impact-of-Virtual-Reality-on-Learning.aspx

Rio, A. (2018, March 8). Brining the future forward. *Chief Learning Officer*. http://www.clomedia.com/2018/03/08/virtual-reality-bringing-future-forward/

Rivera, A. (2017, October 9). Virtual Reality vs. Augmented Reality vs. Mixed Reality. Business.com. https://www.business.com/articles/virtual-vs-augmented-vs-mixed-reality/

S.M. (2017, September 12). Education and technology: Virtually there? The Economist. http://www.economist.com/whichmba/education-and-technology-virtually-there-0

Sólfar. EVEREST VR. http://www.solfar.com/everest-vr/

SP Jain Professional Technology Program in Virtual Reality. https://www.spjain.org/programs/professional-technology/virtual-reality

The Antarctica Series. NYT VR. https://www.nytimes.com/interactive/2017/climate/antarctica-virtual-reality.html

The Daily 360. https://www.nytimes.com/video/the-daily-360

Tokareva, J. (2017, December 6). How virtual reality is changing the world of advertising. *Forbes*. https://www.*Forbes*.com/sites/quora/2017/12/06/how-virtual-reality-is-changing-the-world-of-advertising/#2cd6fdbd68d5

United Rentals Case Study. *Strivr.* https://www.*Strivr*.com/wp-content/uploads/2018/01/STRIVR_UR_case-study_nq.pdf

University of St. Thomas-Minnesota, Opus College of Business. Bringing Business Ethics Case Studies to Life Through Virtual Reality: Transforming a Leader's Ability to Make Ethical Decisions in Complex Situations. 2017–18 AACSB Innovations That Inspire submission. https://www.aacsb.edu/about/advocacy-and-awareness/member-challenges/innovations-that-inspire/2018/university-of-st-thomas

Velev, D., & Zlateva, P. (2017). Virtual Reality Challenges in Education and Training. *International Journal of Learning and Teaching*, 3(1), 33–37.

Violino, B. (2017, October 17). Dell TechnologiesVoice: More Than Half Of Colleges Will Use Virtual Reality To Enhance Education By 2021. *Forbes*. https://www.*Forbes*.com/sites/delltechnologies/2017/10/17/more-than-half-of-colleges-will-use-virtual-reality-to-enhance-education-by-2021/#4ca4747f6c48

Virtual Impressions. (2016, September 04). BizEd. http://bized.aacsb.edu/articles/2016/09/virtual-impressions

VirtualiTeach. (2017, August 4). Exploring the Virtuality Continuum and its terminology. VirtualiTeach. https://www.virtualiteach.com/single-post/2017/08/04/Exploring-the-Virtuality-Continuum-and-its-terminology

Virtual Reality Society. (2017, June 28). Virtual reality in the classroom. https://www.vrs.org.uk/virtual-reality-education/in-the-classroom.html

Virtual Reality vs. Augmented Reality. (2017, March 6). Augment Blog. http://www.augment.com/blog/virtual-reality-vs-augmented-reality/

Virtual Reality Society. What is Virtual Reality? https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html

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