Chapter 5
Perceptions and New Realities for the 21st Century Learner

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ABSTRACT
Of all the technologies emerging today, augmented reality (AR) stands to be one of, if not the, most transformational in the way we teach our students across the spectrum of age groups and subject matter. The authors propose “best practices” that allow the educator to use AR as a tool that will not only teach the processes of a skill but will also encourage students to use AR as a motivational tool that allows them to discover, explore, and perform work beyond what is capable with this revolutionary device. Finally, the authors provide and explore the artificial intelligence (AI) processors behind the technologies driving down cost while driving up the quality of AR and how this new field of computer science is transforming all facets of society and may end up changing pedagogy more profoundly than anything before it.

INTRODUCTION
Mixed Reality (MR) the cousin to Virtual Reality (VR), is starting to gain a foothold in today’s technological ecosystem. In (Penland, Laviers, Bassham and Nnochiri 2018), the use of Virtual Reality for distance learning was demonstrated on a small scale however VR while being more immersive, does not integrate with the user’s environment and therefore makes it difficult to teach students with a tangible example of the subject matter. Mixed Reality (MR) is used as an independent concept or to classify the spectrum of reality technologies, as referenced in reality virtuality continuum 1994; 2007). As an independent concept, MR combines the best of both virtual reality and augmented reality. When used to classify the larger scope of reality technologies, it refers to the coverage of all possible variations and compositions of real and virtual objects.

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This type of connectivity has now reached the pinnacle where technology has emerged both the quality and cost to a practical level. While this is fantastic, allowing someone to engage in a task totally unfamiliar to them such as, rebuilding a carburetor, as a pedagogical medium we propose a note of caution and suggest prior instruction with this as a continued practice strategy. If the AR or Mixed Reality can take them step-by-step through a process, we can make an argument that the students will not find it insignificant to remember or learn the process because they don't have to, the AR will do it for them (Callaghan, Gardner & Davies, 2008). In this chapter, we will explore various ways for AR to be used as a pedagogical tool and propose methods to avoid letting the student side-step the learning process.

Over time, it is likely that only a few adaptive learning software packages will prevail. Hopefully, software vendors not controlled by very large universities or companies will choose to share how their algorithms work. We have learned enough about how people learn to know that not everyone learns the same way. Beyond the seven learning styles (visual, aural, verbal, physical, logical, social, and solitary) with which many educators are familiar, modern technologies are enabling researchers to determine there may be more. In fact, one recent book by David Schwartz, Jessica Tsang, and Kristen Blair (2016), “The ABCs of How We Learn”, identifies 26 unique learning styles. As datasets of learners’ activities increase and algorithms improve their abilities to discern different styles, this higher number will likely increase.

Sophisticated software increases the potential to tease out the most effective way to help each person learn. The weakness of today’s educational system is that we often teach to the average, excluding learners on the upper and lower edges with a Bell Curve focus (Herrnstein & Murray, 1994). A learner who conforms survives, while non-conformers do not. As colleges, universities, and corporations develop and refine stronger adaptive learning algorithms, I hope they avoid the bias toward conformity.

As we embrace adaptive learning software, we have to make sure that we choose learning algorithms that work to the learners’ strengths instead of forcing them to adapt to a norm. In the end, we lose if we are all coached to think alike. One of the surest signs that a technology trigger is starting its roller-coaster ride through the Gartner’s “Hype cycle of innovation” is when the name we all call that trigger becomes a part of the public lexicon (2014).

**The Technology Explained**

Augmented Reality (AR) and Mixed Reality (MR) are often used synonymously, however, some separate the two terms to mean slightly different things. We choose to use the two as the same. While it is counter-intuitive to envision, AR is actually much more sophisticated and difficult to implement than VR. With VR, the hardware and software do not need to keep track of the real world that the user is in whereas in AR not only does it need to track the real world, it also needs to understand what it observes in the real world and translate that to the software so the simulation can be matched with the world. Until most recently, this process was just not fast enough and there was a big delay in the simulation updating the movements of the user in the simulation and often the simulation would get out of synch with the world cause uncomfortable jarring in the experience for the user. Part of the solution to this problem is generating an immediate modality for the computer to understand items and features in the real world that could be used to track movements and places of interest pertaining to the application in us (Penland and Laviers, 2018). In order to accomplish this, developers turned to artificial intelligence and hardware implementations of complex algorithms that take too much time.
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