Augmented Reality in Education and Training

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Abstract

There are many different ways for people to be educated and trained with regard to specific information and skills they need. These methods include classroom lectures with textbooks, computers, handheld devices, and other electronic appliances. The choice of learning innovation is dependent on an individual's access to various technologies and the infrastructure environment of a person's surrounding. In a rapidly changing society where there is a great deal of available information and knowledge, adopting and applying information at the right time and right place is needed to main efficiency in both school and business settings. Augmented Reality (AR) is one technology that dramatically shifts the location and timing of education and training. This literature review research describes Augmented Reality (AR), how it applies to education and training, and the potential impact on the future of education.

Keywords: Augment Reality, Virtual Reality, Training, Educational Technology

Augmented Reality (AR) is a technology that allows computer-generated virtual imagery information to be overlaid onto a live direct or indirect real-world environment in real time (Azuma, 1997; Zhou, Duh, & Billinghurst, 2008). AR is different from Virtual Reality (VR) in that in VR people are expected to experience a computer-generated virtual environment. In AR, the environment is real, but extended with information and imagery from the system. In other words, AR bridges the gap between the real and the virtual in a seamless way (Chang, Morreale, & Medicherla, 2010).

According to Johnson, Levine, Smith, & Stone (2010), the history of AR goes back to the 1960s and the first system was used for both AR and VR. It used an optical see-through head-mounted display that was tracked by one of two different methods: a mechanical tracker and an ultrasonic tracker. Due to the limited processing power of computers at that time, only very simple wireframe drawings could be displayed in real time (Sutherland, 1968). Since then, AR has been put to use by a number of major companies for visualization, training, and other purposes. The term 'Augmented Reality' is attributed to former Boeing researcher Tom Caudell, who is believed to have coined the term in 1990.

According to Johnson, et al. (2010), AR systems can either be marker-based or markerless-based. Marker-based applications are comprised of three basic components which include a booklet for offering marker information, a gripper for getting information from the booklet and converting it to another type of data, and a cube for augmenting information into 3D-rendered information on a screen. On the other hand, markerless-based applications need a tracking system that involves GPS (Global Positioning System), a compass, and an image recognition device instead of the three elements of maker-based systems. Markerless applications have wider applicability because they function anywhere without the need for special labeling or supplemental reference points.

According to Chang, Morreale, and Medicherla (2010), several researchers have suggested that learners can strengthen their motivation for learning and enhance their educational realism-based practices with virtual and augmented reality. In spite of a great amount of research during the last two decades, adopting AR in education and training is still quite challenging because of issues with its integration with traditional learning methods, costs for the development and maintenance of the AR system, and general resistance to new technologies. Now that AR, however, has the promise to attract and inspire learners with exploring and controlling materials from a number of different perspectives that have not previously been taken into consideration, AR in education and training is believed to have a more streamlined approach with wider user adoption than ever before due to the improvement in computer and information technology. Kerawalla, et al. (2006) stated that even though many AR applications have been developed for educational and training purposes since the advent of AR in the late 1960s, its potential and pragmatic employment has just begun to be explored and utilized. He emphasized that AR has the potential to have learners more engaged and motivated in discovering resources and applying them to the real world from a variety of diverse perspectives that have never been implemented before.

How AR Works in Education and Training

Johnson, et al. (2010) stated, "AR has strong potential to provide both powerful contextual, on-site learning experiences and serendipitous exploration and discovery of the connected nature of information in the real world." (p. 21). AR has been experimentally applied to both school and business environments, although not as much as classic methods of education and training during the last two decades. In addition to that, now that the technologies that make AR possible are much more powerful than ever before and compact enough to deliver AR experiences to not only corporate settings but also academic venues through personal computers and mobile devices, several educational approaches with AR technology are more feasible. Also, wireless mobile devices, such as smart phones, tablet PCs, and other electronic innovations, are increasingly ushering AR into the mobile space where applications offer a great deal of promise, especially in education and training.

AR in School

Professionals and researchers have striven to apply AR to classroom-based learning within subjects like chemistry, mathematics, biology, physics, astronomy, and other K-12 education or higher, and to adopt it into augmented books and student guides. However, Shelton (2002) estimated that AR has not been much adopted into academic settings due to little financial support from the government and lack of the awareness of needs for AR in academic settings.

AR in Business

In corporate venues, AR is a collaborative, skill-learning, explainable, and guidable tool for workers, managers, and customers. Also businesses have a better environment than those of educational settings regarding the ability to maintain the costs and support of AR applications. Many corporations are interested in employing AR for the design and the recognition of their products' physical parts. According to the evaluation of Shelton (2002), for example, enterprises not only may imagine designing a car in three dimensions in which they can make immediate changes when needed but also can create virtual comments that explain to the technicians what needs to be fixed.

The Current Position of AR in Education and Training

During the last few decades, many professionals and researchers have been developing pragmatic theories and applications for the adoption of AR into both academic and corporate settings. By virtue of those studies, some innovations of AR have been developed and are being used to enhance the education and training efficiency of students and employees. In addition to that, there are a great number of studies going on to improve the compatibility and applicability of AR into real life. However, according to Shelton & Hedley (2004), many questions still linger about its use in education and training, including issues of cost effectiveness, of efficiency between AR instructional systems and conventional methods, and the like.

AR in K-12 Settings

Freitas & Campos (2008) developed SMART (System of augmented reality for teaching) that is an educational system using AR technology. This system uses AR for teaching 2nd grade-level concepts, such as the means of transportation and types of animals. This system superimposes three dimensional models and prototypes, such