

# Chapter 11

## Augmented Reality: A New Direction in Education

Çelebi Uluyol  
Gazi University, Turkey

Sami Şahin  
Gazi University, Turkey

### ABSTRACT

*Augmented Reality (AR) is an emerging technology that bridges the gap between the computer-generated digital information and the reality in real time. Despite the use of AR in numerous disciplines such as architecture, e-learning system, entertainment, medicine, engineering, and e-commerce, it has also potential implications in education. Therefore, in this study, augmented reality use in education is considered in all aspects. After the advantages and disadvantages of AR use in education is explained detailed, the phases of augmented reality book development are discussed. As a result, researchers should work on experimental studies to investigate how AR applications can be applied in educational settings in the future.*

### INTRODUCTION

In the last decade there has been a significant increase in the use of mobile technologies such as handheld devices, tablet computers and personal digital assistants (Dieterle & Dede, 2006; Lenhart & Madden, 2007). A learner's choice of technology is dependent on the educational environment and on his or her access to different technologies. Providing access to effective information technology at any time and place in a rapidly changing society is a vital factor in classroom and school settings. Augmented reality (AR) is one technology that shifts the location and timing of training.

Researchers have explored using Augmented Reality (AR) applications within various disciplines such as medicine (Liu, Jenkins, Sanderson, Fabian, & Russell, 2010; Sielhorst, Feuerstein, & Navab, 2004), e-commerce (Zhu, Owen, Li, & Lee, 2004), architecture (Billinghurst & Henrysson, 2009), and interior design (Phan & Choo, 2010). The field of education has also demonstrated an interest in integrating AR, including distance learning environments (Cho, Lee, Soh, Lee, & Yang, 2007; Liarokapis, Petridis,

DOI: 10.4018/978-1-4666-9837-6.ch011

Lister, & White, 2002), science education (Kerawalla, Luckin, Seljeflot, & Woolard, 2006; Shelton & Hedley, 2002), engineering education (Liarokapis et al., 2004), and mathematics and geometry education (Kaufmann & Dünser, 2007). Educational technologists and researchers have stressed the need for more research that investigates whether and how these technologies can be used in an effective and useful way for learning (Means & Haertel, 2004).

The 2010 and 2011 Horizon reports (New Media Consortium, 2011), which predict the impact of emerging technologies on different sectors, emphasized that AR will be used widely on US college campuses in the coming years. The reports also indicated that AR can positively impact learning and lead to a creative education. In this chapter, the topic of augmented reality will be explored, as well as the use of augmented reality in education. A case is made for AR being a viable and effective technology tool for teaching and learning in higher education.

## **DEFINING AND DESCRIBING AUGMENTED REALITY**

AR is a technology in which the real environment or object is enhanced by digital content that is tied to certain activities, places or objects. AR allows digital content to be mixed into the perception of reality. 2D or 3D digital objects such as texts, audio materials, animations, graphics and pictures can be combined with individuals' perceptions of the real environment. These digital objects aim to aid and improve users' knowledge and understanding of what is going on around them.

AR was first described by researchers in terms of specific tools, such as head mounted displays (HMDs). Zhou, Duh, and Billinghurst (2008) define the three main characteristics of AR as (1) the combination of real-world and digital objects, (2) which are interactive in real-time, and (3) in which the display of digital information is tied to real-world orientation. Höllerer and Feiner (2004) similarly describe AR environments as those which integrate "real and computer generated information in a real environment, interactively and in real time, and virtual objects with physical ones" (p. 150). Ludwig and Reimann (2005) describe AR as "human-computer-interaction, which adds virtual objects to real senses that are provided by a video camera in real time" (p. 387). Zhou, Duh, & Billinghurst (2008) describes it as a technology "which allows computer generated virtual imagery to exactly overlay physical objects in real time" (p. 387).

According to Milgram, Tekamura, Utsumi, and Kishino (1994), augmented reality is closely linked to virtual reality (VR). They also emphasize that AR is an extension or variation of VR, very similar to VR. Both AR and VR of them are challenging, interactive and contain information sensitivity. As Azuma (1997) states, the user's frame of reference is fully tied to the virtual environment in VR, whereas in AR the user's perception is still centered within reality. The Second Life environment is an example of VR. On the other hand, sport games in game consoles such as the Xbox, Playstation and Nintendo Wii and smart phone applications that utilize GPS data or tie digitally-generated objects to real world places are the best-known examples of AR applications.

As Johnson, Levine, Smith, and Stone (2010) observe, AR applications can occur in two forms: marker-based or markerless-based. Marker-based applications contain three features, which include a booklet for introducing marker information, a gripper for taking information through the booklet and a cube for rendering information on the screen (Johnson et al., 2010). On the other hand, markerless-based applications contain a tracking system, a compass and an image recognition device instead of the

17 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

[www.igi-global.com/chapter/augmented-reality/144062](http://www.igi-global.com/chapter/augmented-reality/144062)

## Related Content

---

### "World of Uncertainty" Game for Decision-Makers

Jyldyz Tabyldy Kyzy (2011). *International Journal of Virtual and Personal Learning Environments* (pp. 40-45).

[www.irma-international.org/article/world-uncertainty-game-decision-makers/53861](http://www.irma-international.org/article/world-uncertainty-game-decision-makers/53861)

### Conceptualizing Codes of Conduct in Social Networking Communities

Ann Dutton Ewbank, Adam G. Kay, Teresa S. Foulger and Heather L. Carter (2010). *Collective Intelligence and E-Learning 2.0: Implications of Web-Based Communities and Networking* (pp. 27-43).

[www.irma-international.org/chapter/conceptualizing-codes-conduct-social-networking/37068](http://www.irma-international.org/chapter/conceptualizing-codes-conduct-social-networking/37068)

### Organisational Blogging: The Problem of Engagement

Gavin J. Baxter, Thomas Connolly and Mark Stansfield (2011). *International Journal of Virtual and Personal Learning Environments* (pp. 1-17).

[www.irma-international.org/article/organisational-blogging-problem-engagement/55933](http://www.irma-international.org/article/organisational-blogging-problem-engagement/55933)

### Personalising Teaching and Learning with Digital Resources: DiAL-e Framework Case Studies

Kevin Burden and Simon Atkinson (2010). *Technology-Supported Environments for Personalized Learning: Methods and Case Studies* (pp. 91-108).

[www.irma-international.org/chapter/personalising-teaching-learning-digital-resources/39689](http://www.irma-international.org/chapter/personalising-teaching-learning-digital-resources/39689)

### Massively Multiplayer Online Role Playing Games for Health Communication in Brazil

Marcelo Simão de Vasconcellos and Inesita Soares de Araújo (2013). *Serious Games and Virtual Worlds in Education, Professional Development, and Healthcare* (pp. 294-312).

[www.irma-international.org/chapter/massively-multiplayer-online-role-playing/75821](http://www.irma-international.org/chapter/massively-multiplayer-online-role-playing/75821)