Chapter  6
Looking In, Looking Out:
A Discussion of the Educational Affordances of Current Mobile Augmented Reality Technologies

Daniel Novak  
The University of Washington – Seattle, USA

Minjuan Wang  
San Diego State University, USA

Victor Callaghan  
Essex University, UK

ABSTRACT
This chapter explores the format of Augmented Reality (AR) and its use in mobile learning. It first addresses precedents and theories of mLearning that inform the discussion of AR and Virtual Reality (VR), explores the “virtuality continuum” and the concept of mixed reality, and discusses some of the technologies in the mobile-AR ecosystem. It then describes the potential uses of AR in mobile education. At the end, the authors present potential applications of mobile-AR to curation activities and provide ideas for future areas of exploration in AR-based mLearning.

MOBILE LEARNING (MLEARNING) AND AUGMENTED REALITY
Mobile devices allow on-the-go people to access a world of digital information via the Internet from any location. Mobile learners, who are marked by a high degree of physical mobility, frequently use these devices to find just-in-time information about their environment. This constant connection to computer-mediated information about products, stores, buildings, or the natural world allows physically mobile learners to locate information and answer questions about their surroundings in novel and, sometimes, surprising ways. In recent years, the intersections of virtual and physical ‘realities’ have lead to a provocative new technology

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called “Augmented Reality,” or AR, which might have profound implications for mobile education. Even more, these systems provide an environment that supports opportunities for higher quality human interaction across the digital and physical worlds. Cawood and Fiala (2007), two AR designers, made a statement in 2007 about “the ambitious goal of AR,” as creating the sensation of virtual objects being present in the real world. Pribneau and Iordache (2010) describe AR as a technology that “can bridge the gap between the theoretical knowledge acquired through analytical activities (such as reading textbooks and listening to lectures) and the practical experience learned from constructive activities” (p. 247). And, indeed, empirical experiments in static AR by Chen and Wang (2008) indicate that the realization of this goal can improve student performance in open-ended creative tasks. In their primary experiment, Chen and Wang (2008) asked urban design students to develop an urban space using physical wooden blocks to represent buildings and roads. Students were also able to share the workspace through an augmented reality environment, where they used the system to visualize the actual design structures and to create a shared design workplace for multiple learners. In this case, AR helped to simplify and to facilitate the overall design process.

Before we examine mobile-AR learning technologies, it is important to note that mLearning and AR are only technological contrivances; they have specific constraints and affordance. Fisher and Baird (2007) see the mobile environment as merely another platform for interaction, collaboration, and knowledge transfer to occur. From their perspective, mobile technology provides opportunities for the social exchange of information and instruction. In addition, mobile technology enables students to “reconcile their authentic use of technology in a learning context,” (p. 8) which in turn can motivate them to actively engage in the learning process. From this perspective, the same principles of human learning should apply in all realities and modalities, mobile, virtual, or augmented.

Fisher and Baird also provide a number of useful qualities and values that mobile-AR designers should keep in mind. These include designing for interactivity, learner centrality, authenticity, collaboration, and on-demand service. In foregrounding these design guidelines and teaching characteristics, instructional designers working on mobile platforms can create novel and innovative learning experiences for students on the move. As noted by Callaghan, Shen, Gardner, Shen, and Wang (2010) and Davies, Callaghan, and Gardner (2008), a significant feature of augmented reality is its ability to help visualize abstract concepts and to bring a sense of community to otherwise isolated learners. However, the real promise of AR-supported mLearning comes from its ability to integrate mLearning teaching methods into an immersive experience that creates authentic learning situations. As Liu, Tan, and Chu (2010) note, Augmented Reality (AR) has the potential to enrich the learning outcomes and educational experience if integrated effectively into a mobile environment.

Improved mobile technology now puts Cawood and Fiala’s “ambitious goal” within reach from a hardware perspective. SmartPhones and other devices now have the necessary battery power, processing power, Internet connectivity, multimedia capabilities, and location-based services to make Augmented Reality practical for use in education. However, recent studies of large-scale mobile learning programs (e.g., Shen, Wang, Gao, Novak, & Tang, 2009; Wang, Novak, & Shen, 2008; Wang, Shen, Novak, & Pan, 2009) found that mobile devices are limited by two major factors: small input interfaces and small displays. As a result, students tended not to tune into the live course on their cell phones. Instead, they downloaded the recordings and watched them on-the-go. These problems are compounded in current SmartPhones with touch-screen keypads, where the display space is also used for input.
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