Exploring Student Engagement in an Augmented Reality Learning Game

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ABSTRACT

This article investigates the behaviors of middle school students during their participation in an AR game called Play the Past. The findings of this study show that engagement differed during discrete activities in the game environment and that there was a relationship between the roles that students were assigned and their engagement.

KEYWORDS

AR, Augmented Reality, Design, Digital, Engagement, Game, History, Situated, Telemetry

INTRODUCTION

Augmented Reality (AR) games integrate virtual activities with real life environments using technologies like handheld computers and mobile devices to allow players to engage in authentic, meaningful, and engaging activities. AR games are utilized in both formal and informal learning environments to create rich learning experiences and increase student motivation. When students participate in these AR activities they are able to immerse themselves into more complex scenarios and participate in activities in a more personalized manner.

AR games in museums should encourage students to be more active learners, make connections between exhibits, and generally have more engaging experiences in the museum setting. Students visiting museums often move through the exhibits at their own pace and interact with the exhibits in a number of ways. Researchers and educators interested in supporting these types of informal learning experiences are striving to understand students’ experiences and to ultimately link them with learning outcomes. This involves understanding how students are participating in the activities and understanding which design features support specific behaviors.

This paper presents a study focusing on the behaviors of students playing an AR game that is embedded in an exhibit at the Minnesota History Center called Play the Past. The game bridges the real context of the museum exhibits with AR games that students can engage with through mobile devices. Using situated cognition as a theoretical framework, we focus on how different game design features affect students’ behaviors during gameplay. Examining these actions allows us to make inferences about engagement, an important aspect of learning.

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Situated Cognition

AR games allow players to participate in authentic activities and engage in social interactions. They include tasks that require players to engage in shared tasks, participate in discussions, share ideas, and collaboratively solve problems. Situated cognition is a theoretical framework that emphasizes that learning involves an interactive relationship between the activities, environment and social processes that individuals experience as they learn new information (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991). Therefore, the situated cognition framework is ideal for thinking about the educational value of AR games. Situated cognition research considers the context that learners experience and describes the interaction of knowing and doing that occurs as they complete cognitive tasks. Studies of situated cognition focus on thinking about the social dynamics and practices that learners engage in and how the environment guides those interactions (Brown, Collins, & Duguid). Finally, theories of situated cognition highlight the social aspects of learning in authentic environments and explore the processes present at multiple levels of engagement (Lave & Wenger, 1991). It is this focus on engagement that makes situated cognition an especially useful framework for the work presented in this paper.

Brown, Collins, and Duguid (1989) argue that approaches to education should embed learning in activities that reflect the social and physical environments in which the knowledge is relevant. They focus on how learners experience concepts and ideas as tools that are best understood as interconnected experiences that include social dynamics and can be supported via scaffolding activities incorporating cognitive apprenticeship practices. Technology offers multiple mechanisms to support these types of learning experiences. It enables researchers, educators, curriculum, and game designers to situate students’ educational activities in their physical environment. Technology can also support interactions and direct learner behaviors so that students are able to participate in activities individually and collaboratively. Technology based games are incorporating AR to support authentic learning experiences.

Augmented Reality

Today more than ever, it is possible to situate learning in meaningful ways by using new technologies, such as, AR games. In general, AR addresses the major facets of how to design a learning environment that facilitated situated cognition by providing meaningful context and supporting social interactions. AR further supports learning by helping students to engage in high level cognitive activities such as reciprocal teaching, scientific reasoning, and peer coaching to name a few (Dunleavy, Dede, & Mitchell, 2009). AR is defined as a real-time view of a physical real-world environment that has been enhanced by adding a layer of relevant computer-generated information (Hugues, Fuchs, & Nannipieri, 2011) that can apply to all senses (smell, touch, hearing, visual, etc). Thanks to these affordances, AR has the potential to significantly enhance learning environments, especially when combined with the engaging qualities of digital games (Das, Zhu, McLaughlin, Bilgrami, & Milanaik, 2017). AR games are defined as, “…games played in the real world with the support of digital devices (PDAs, cell phones) that create a fictional layer on top of the real-world context…” (Jan & Squire, 2007, p. 6).

AR is often used to enhance students’ learning and engagement in informal learning contexts like museums or field trips (Huang, Chen, & Chou, 2016). In a study of AR use with middle school students in a science museum, Yoon and colleagues (2012) investigated how different combinations of scaffolds and AR approaches supported student learning. They found that students were able to
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