"Together we can beat this game: The prevalence of collaborative learning in educational video game play"

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Abstract: The ever-increasing popularity of video games has raised questions about their role in generating meaningful learning experiences. Despite the prevalence of digital media and social networking, relatively little research has been conducted on the presence and benefits of social learning in educational video games. Preliminary studies suggest that by facilitating interactive and engaging experiences, video games offer opportunities for players to engage in problem-solving, socialization, and most importantly, collaborative learning.

As the doctor began to extract the ectoderm cells that he had painstakingly cultured for today's spinal surgery he cringed at the idea of repeating this procedure again. *"You're going to kill those cells*," said his assistant. *"Shut up,"* replied the doctor, *"I know what I'm doing."* Just then the cells began to decompose. *"See,"* affirmed his assistant, *"I told you"*. *"It's fine,"* sighed the doctor *"You were right, next time we'll try it your way."*

While this vignette may sound at first like an exchange between two physicians, it is actually a conversation between two high school students playing Progenitor X, an educational video game focused on regenerative biology concepts. Interactions of this nature are commonplace and frequently written off as a casual disagreement amongst game players. However, these conversations provide evidence of a rich collaborative learning experience taking place during video game play. Unlike other educational delivery systems, video games offer the opportunity to construct learning experiences through a combination of social interactions and immersive gameplay.

Early research has indicated that some games are effective at facilitating learning gains (Squire, 2004) but the source of these gains is unknown. Studies suggest the primary benefit of educational gaming is purely motivational. While content knowledge has served as the benchmark for assessing the effectiveness of learning from video games. Current findings suggest that a tremendous amount of experiential learning is taking place unbeknownst to the player or observer. This aspect of collaborative learning could have far reaching implications for future game development, but has thus far gone largely unobserved.

There have been myriad applications of digital media for creating communities of gamers in online networks, but these have largely been viewed as serving a recreational function. Collaborative learning, on the other hand, has been studied extensively and shown to result in content learning gains by as much as 50% in formal educational settings (Johnson et al, 1981). Despite widespread acceptance of the benefits of collaborative learning and the nature of games as a catalyst for social interaction, relatively little research has been conducted on the benefits of video games towards stimulating collaborative learning (Amory, 2007). While the focus of video game effectiveness has centered largely on individual content learning, Foko asserts that games provide the context and information to accomplish a task; yet it is the social interactions between peers and technology that result in new understanding (Foko, 2006). It has been determined that the observational recording of gameplay provides a unique and naturalistic approach to observing collaborative learning without hindering experimentation of the subject.

The CyberSTEM games study focuses on collaborative learning within a suite of educational STEM-focused games developed by the Educational Research Integrated Area (ERIA) under the direction of Dr. Kurt Squire. Rockman et al (REA), an independent research and evaluation company is utilizing a multi-method approach to study social interaction and problem solving during game play. To date, REA has observed 28 peer-peer dyads playing Progenitor X. These dyads were recorded via webcam and screen capture software to observe social interactions and conversations off-screen while simultaneously recording their activities on-screen as they navigated through various game activities. Instances of collaborative discussion including shared problem solving, providing and requesting help, delivering praise, as well as task switching and player conflicts over controls have been recorded and coded for the purposes of observing collaborative learning patterns within gameplay. These recordings were supplemented with pre/post survey data and post-interviews which

examined changes in conceptual understanding and interest as well as players' perceptions of the game experience and the benefits and drawbacks of partnered gameplay.

The following example illustrates the types of social interactions targeted for the CyberSTEM study. Here, "Amy" and "Barrett" have arrived at a place in Progenitor X where they must replicate and collect mesoderm cells. As Amy begins to collect them, Barrett reminds her that she should pay attention to the health meter, which is getting low. "The what?" she replies. "The health meter is at 24%, you're going to die!" he says. Quickly Amy selects the micropipette to collect her cells before they break down. "Yeah, we bad!" Amy exclaims in triumph. This small but significant interaction highlights how the collaborative process supports experimentation, helps point out missed or unclear objectives, guides player decisions, and ultimately provides a supportive framework that builds confidence amongst players. Without Barrett's assistance, Amy would have made more mistakes, exhibited less confidence, and increased the likelihood of quitting the game from frustration.

Preliminary survey and interview findings from those who engaged in peer-peer gameplay suggest that players found partnered game play useful in learning game instructions, overcome game challenges, and monitoring in game prompts. A majority of participants (70%, N=56) reported that playing the game with a partner made the game easier, due to their ability to share the inquiry process: "It felt a lot easier, we could discuss what's going on and how we need to finish." 75% of players reported that they had learned more as a result of having a partner present during gameplay. These findings are consistent with Gee's assertion that the benefit of video games is that they are "sites of naturally occurring, intrinsically motivated learning" (Gee, 2004) and that this learning largely takes place in the form of collaborative problem solving.

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