Chapter 6
A Girls-Only Online Virtual World Environment and its Implications for Game-Based Learning

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ABSTRACT

This chapter outlines how and why virtual worlds are the best gaming environments for female game players. It explores strategies for utilizing this information to provide a mass multiplayer online game environment to improve the negative perceptions of computer science and programming by teenage girls. The author shares insights from a case study involving workshops, utilizing a 3D virtual world called Gamher World to teach Java programming to forty-nine 13- to 17-year-old girls. The chapter concludes with recommendations for using virtual worlds to improve the methods used to introduce STEM to girls.

INTRODUCTION

In 2014, the American Association of University Women (AAUW) revealed that only 1% of first-year university women intended to study computer science (CS) (Corbett & Hill, 2015).

Over the span of nine years, between 2004 to 2013, women in the United States have earned an average of only 14% of the undergraduate computer science degrees yearly (College Entrance Examination Board, 2004; Frieze & Quesenberry, 2013; Marklein & Marinova, 2012; National Girls Collaborative Project, 2011; Stross, 2008; Zweben, 2013). Factors that influence such statistics include lack of role models, effects from peers, media and popular culture; and influences from formal and informal education (NCWIT, 2012). With fewer women earning computer science degrees, it is not suprising to learn that women make up only 25% of the mathematical and computer science industry (National Girls Collaborative Project, 2011). What is even more disheartening is that 56% of the few women in

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CS careers quit double the rate of men, due to such reasons as too many hours and dislike of the work culture (Gammal & Simard, 2013).

This problem hinders women's future earning potential in a technological world; and the technological world needs more women because of innovation. Without women in the field, technical decisions are based on opinions and judgments of men and innovative ideas that are unique to women are overlooked (Corbett & Hill, 2015). Diversity generates better ideas; diverse teams do better and can promote better products and business success in the CS industry (Khanna, 2013).

Two types of stereotypes deter women from studying computer programming: culture and ability (Cheryan, Master & Meltzoff, 2015). In culture, it is the depiction of the computer scientist as male and the subject as masculine. In ability, it is the stereotypical view that girls have lesser ability than boys in computing subjects (Cheryan, Master & Meltzoff, 2015). Both stereotypes feed into girls' negative view of computing and self-confidence in the subject matter.

Girls' lack of self-confidence and view of ability are transmitted by their parents and teachers ("Early gender gaps drive career choices," 2015; Shapiro & Williams, 2012). Parents are more likely to expect their sons to work in STEM careers even if both daughter and son show the same ability. Teachers give better marks to girls even if boys and girls performed the same, which hurts the girls' growth in abilities ("Early gender gaps drive career choices," 2015). Environmental factors can undermine girls' interest and performance in STEM, and thus these factors must be considered to close the gender gap in STEM fields (Shapiro & Williams, 2012).

Students with higher computer self-efficacy are more likely to take computer science courses (Beyer, 2014, Busch, 1995). Early exposure to computing can build computer self-efficacy; however, research has discovered that female students lacked precollege encouragement and exposure to computing more so than their male counterparts. Children's first exposure to digital technologies starts with video games (Agosto, 2002; Busch, 1995; Cherney, 2008; Denner, Werner, Bean and Campe, 2005; Gorriz and Medina, 2000; Hayes, 2005; Inkpen et al. 1994; Li, 2008). Early gaming experience can lead to the study of computer programming (Agosto, 2002; Gorriz and Medina, 2000). Losing interest in computer games and computing early in the pipeline, leads to lack of interest in computers and lack of interest in CS careers (Gorriz and Medina, 2000). Gaming can be the gateway to confidence in using digital tools and increased interest in careers in technological fields (Hayes, 2005).

Many literature points to the appeal of digital games as effective learning tools (Anderson, 2008; Devlin, 2011; Dorman, 1997; Gredler, 1994; Gros, 2007; Hayes & Games, 2008; Kafai, 1996; Ke, 2009; Klopfer, Osterweil & Salen, 2009; Moline, 2010; Peppler & Kafai, 2007; Schwartzman, 1997; Tzeng, 1999). Computer games are the future of STEM (Science, Technology, Engineering and Mathematics) education. Computer games are useful educational tools because they appeal to children, motivate and engage them, provide them a safe place to learn from their failures, and influence their learning process (Dorman, 1997; Gredler, 1994; Johnson, Adams, Cummins & Estrada, 2012; Kafai, 1996; Klopfer, Osterweil & Salen, 2009; Schwartzman, 1997; Tzeng, 1999).

Game-Based Learning (GBL), the act of using games as a learning tool, incorporates situated learning theory, active learning theory and mastery learning theory ("Why does GBL work?," 2012). The focus of this chapter is to report the results of a case study involving the use of GBL to attract women to the field of computer science. The case study was derived from a larger exploratory study entitled "Gamher: creating a game to increase girls' interest in programming" (Kamberi, 2015). The larger dissertation study composed of both a 2D single-player game called Array[7] and a mass multiplayer online (MMO) virtual world called Gamher World. This chapter will focus mainly on the development of Gamher World, and