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Youth and New Media: The Appeal and Educational Ramifications of Digital Game Play for Children and Adolescents

The prevalence of digital media use among children and adolescents in developed nations is indisputable. This contention is supported by examination of international survey results addressing children and adolescents' use of computers and access to the internet. For example, findings from the UK Children Go Online survey (Livingstone & Bober, 2005) indicated that of the 9-19 year olds surveyed during 2003-2005, 98% had used the Internet and 75% had access to it at home. In the US, similar findings from the Kaiser Family Foundation showed that among the 89 minutes a day that 8-18 year olds reported using their computers in 2009, much of that time was spent online (See Rideout, Foehr, & Roberts, 2010). The results of an extensive survey of Italian 11-16 year olds indicated that during 2007, 85% of participants reported using their computers about 70 minutes per day (Patriarca, Di Giuseppe, Albano, Marinelli, & Angelillo, 2009). Further, findings among 6-13 year olds in Germany also attested to access to the internet for, on average, about 42 minutes a day (Feierabend & Klingler, 2008). Consistent and notable across these samples of children and adolescents is that time spent online is often allocated to the playing of recreational digital games, independent of that which they also may play on game consoles or increasingly on their mobile phones (see Neilsenwire, 2012).

In this volume, we highlight new research and practice concerning the impact of this very popular and frequently engaged in activity on children's and adolescents' cognitive development. As we discuss below, examining the impact of game play from a positive rather than negative vantage point (e.g. the ill effects of violent game play) is relatively new in the psychological literature. However, as we also discuss, focus on the positive effects is necessary

as educational efforts turn more to the use of digital games as a vehicle for academic intervention and instruction (see Durkin, this volume; de Freitas, 2006; DiPietro, Ferdig, Boyer, & Black, 2007). This thrust is highly evident in the US as private (e.g. MacArthur Foundation Digital Media Digital Learning Initiative, 2006) and federal (e.g. National Science Foundation) funding agents have invested heavily in the incorporation of digital games in both formal and informal learning situations. A very recent manifestation of this investment, in fact, is the development of the Quest to Learn[1] middle schools (serving pre- and early adolescents) in New York City and Chicago whereby the curriculum is grounded in principles of effective digital game design (See Salen & Zimmerman, 2004). This development, coupled with the expanding base of digital game players, attests to the need to better understand the educational ramifications of game play for today's youth, a goal that we purse throughout the course of the volume.

What do we know about digital game play?

The strong appeal of digital game play among children and adolescents (and among adults) has been linked to features such as curiosity, challenge, and fantasy, as cited by Malone in his seminal 1981 article concerning the motivations for digital game play. Additional features since have been linked to engagement in digital game play including interactivity, agency or control, identity, feedback, and immersion, (Hays, 2005; Thompson et al., 2008; Bryant & Fondren, 2009; Klimmt, 2009; Ritterfeld et al., 2009; Annetta, 2010; Charsky, 2010). Interactivity refers to players' opportunities within the game to initiate and receive feedback about their actions which has ramifications for the course of game play (Ritterfeld et al., 2009); agency or control refers to players' ability to manage aspects of their play such as the use of the control mechanisms and/or how the game's story line unfolds (Wood, Griffiths, Chappell, &

Davies, 2004; Qin, Rau, & Salvendy, 2009); identity refers to the players' ability to form relationships and linkages with characters within the game or become a game character by creating an avatar (see Blascovich & Bailenson, 2011; Przybylski, Weinstein, Murayama, Lynch, & Ryan, 2012); feedback refers to the information players receive about the efficacy of their game actions which in turn, furthers their interest in game play by scaffolding that play (Lieberman, 2006; Liao, Chen, Cheng, Chen, & Chan, 2011); and immersion refers to players' sense of presence or integration within the game (see Tamborini & Skalski, 2006). This last feature is frequently viewed as the hallmark of digital games (Kickmeier-Rust & Albert, 2010) and has been associated with attainment of the highly desirable and pleasurable state of flow (Csikszentmihalyi & Csikszentmihalyi, 1988; Sherry, 2004; Weber, Tamborini, Westcott-Baker, & Kantor, 2009). Collectively, all features contribute to engaging game experiences that are intended to promote sustained and repeated play (see Sherry, this volume).

The persistent draw of digital game play has given rise to the development of academic/educational games and apps (See Evans, et al. this volume) that capitalize on the features of recreational games (Moreno-Ger, Burgos, Martinez-Ortiz, Sierra, & Fernandez-Manjon, 2008), and to greater interest in examining cognitive gains acquired via digital game play (see Hamlen, this volume; Gee, 2003; Salonius-Pasternak & Gelfond, 2005; Squires, 2006). Focus on the benefits of game play stands in stark contrast to the long-standing emphasis on the negative impact of violent game play which is probably the most widely known and cited in the psychology literature (see Anderson, Shibuya, et al. 2010; Gentile, 2009; Gentile, Lynch, Linder, & Walsh, 2004). However, evidence has been steadily accruing that demonstrates the positive ramifications of game play. For example, compelling evidence reported by Bavalier, Green, and colleagues (Bavelier, Green, Pouget, & Schrater, 2012; Green & Bavelier, 2003; Green, Pouget,

& Bavelier, 2010) indicates that frequent action game play promotes neural plasticity and cognitive abilities supporting one's overall ability to learn. Ferguson and Garza (2011) also found that frequent adolescents players of violent action games whose parents were involved in their play of these games showed greater evidence of civic attitudes and behaviors than less frequent players whose parents were less involved in their play. Researchers such as Dickey (2011) also have cited violent game play as facilitating scientific reasoning and collaborative work with others. While our goal here is not to advocate violent video game play, we do wish to point to the increasing body of research demonstrating the benefits of such play (Bavelier et al., 2012; Ferguson, 2010). This expanding body of work, in turn, has contributed to the changing face of digital game research and to further diversification of the type of researchers (i.e. developmental psychologists; see Blumberg, 2011; Blumberg & Fisch, in press) and practitioners interested in this research (such as educators and funding agents as noted earlier). Clearly, the benefits of violent game play need to be considered in light of perceived risks.

Frequent play of digital games, aside from those violent in nature, has been associated with enhanced inductive reasoning and problem-solving (Greenfield, Camaioni, et al., 1994; Hoffreth, 2010; Pillay, 2002); mental rotation and spatial visualization skills (DeLisi & Wolford, 2002; Okagaki & Frensch, 1994; Sims & Mayer, 2002), metacognition (VanDeventer & White, 2002); memory (Boot et al., 2008); and spatial distribution of attention and visual selective attention (Boot et al., 2008). A relatively new genre of digital games that incorporates exercise as part of game play, referred to as exergames, also has been shown to promote executive functioning as reflected by skills such as task switching and perceptual speed (see Best, this volume; Staiano, Abraham, & Calvert, 2012; Staiano & Calvert, 2011).

To date, the majority of these linkages have been studied among young adult samples. Relatively few researchers have examined these linkages among child and adolescent samples (Blumberg, 2011; DeLisi & Wolford, 2002; Salonius-Pasternak & Gelfond, 2005) although this situation may change with advent of greater research exploring the impact of exergames which has included youth as study participants (see Staiano, Abraham, & Calvert, 2012). Regardless, the dearth of research examining youth is surprising as, at least in the US, nearly one third of all players (32%) are younger than age 18 (Entertainment Software Association, 2012) and 97% of 12 to 17 year olds are reported to play video games (Lehrman, 2012). Recent US findings also indicate that 8-14 year olds, on average, play over an hour per day (See Rideout, Foehr, & Roberts, 2010). Further, as we noted earlier, efforts to incorporate digital games into educational settings are largely directed to child and adolescent learners.

Those who have examined children and adolescents' cognition during game play have primarily studied the impact of game play on spatial skills and strategy use. For example, Subrahmanyam and Greenfield (1994) examined the extent to which the playing of the commercial game Marble Madness, which highlights spatial ability, would enhance fifth-graders' (10-11 year olds) spatial ability. Improved spatial skill ability was found, particularly among those children who showed relatively weak skills before playing. Okagaki and Frensch (1994) found that experience playing the game Tetris, which requires the ability to engage in two-dimensional mental rotation and spatial visualization, yielded improved performance on tasks assessing these skills among late adolescents. De Lisi and Wolford (2002) confirmed these findings among a group of third graders (7-8 year olds) who after repeated play of Tetris for several sessions showed significantly improved scores on a mental rotation skills task relative to their scores at the start of the sessions. More recently, Masson, Bub, and Lalonde (2011) found

that early to middle adolescent participants' conceptualizations about the trajectories of objects in motion improved after they played a game in which they could manipulate these trajectories. Notably, students' learning about objects in motion was limited to a general understanding of the shape of trajectories alone.

Overall, further understanding of the benefits of digital game play among youth holds has the potential to enhance our understanding cognitive development in applied contexts and inform effective use of game play in formal and informal learning situations. The articles that follow address these issues in some detail.

Notes

[1] See q2l.org for further information about the Quest to Learn schools.

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