Television, Games, and Mathematics: Effects of Children’s Interactions with Multiple Media

Sandra Crespo, Michigan State University, USA
Vincent Melfi, Michigan State University, USA
Shalom M. Fisch, MediaKidz Research & Consulting, USA
Richard Lesh, Indiana University, USA
Elizabeth Motoki, Indiana University, USA

ABSTRACT

Research has shown that educational media, such as television series or interactive games, can promote significant learning. However, it is quite common for producers to create several interconnected media, such as a television show and an associated web site, under the assumption that multiple platforms elicit greater learning than a single medium would. The research reported in this paper uses Cyberchase media as the setting in which to investigate the effectiveness of multiple media as a tool for mathematical learning for elementary school children. The study includes both a naturalistic phase, which mirrors children’s typical use of the media, and an experimental phase, which allows for causal inference to be drawn about their learning outcomes.

Keywords: Cyberchase Media, Educational Media, Interactive Games, Interconnected Media, Multiple Media, Television Series

INTRODUCTION

Children’s love for good stories and for playing games lie at the heart of our interest in exploring what makes interactions with electronic storytelling and online game play not only entertaining but also educational. Even before children start school, they interact with all kinds of electronic media. Research reports that children 6 months through 6 years of age spend an average of 2 hours daily with screen media, and that 50 percent of 4-6 year olds play regularly with computer games (Rideout, Vandewater, & Warthella, 2003). The ubiquity of media in children’s lives has given rise to concerns over potential contributions of electronic media to negative outcomes, such as obesity or violent behavior (e.g., American Academy of Pediatrics, 2001, 2009). For many years, critics have doubted

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whether even positive, educational media can succeed in promoting learning, suggesting that the very nature of television and computers impairs attention spans and deep thinking (e.g., Healy, 1990, 1998; Postman, 1985). However, both theoretical analyses (e.g., Gee, 2003) and the empirical research literature (e.g., Fisch, 2004, 2009) have proven these critics wrong. Research shows that children do learn from their use of well-designed educational television programs and interactive computer games.

Yet, even this body of research does not tell the whole story. Amid industry buzzwords such as “multiple platforms” and “transmedia,” it is increasingly common for projects to span several media platforms, such as a television series, web site, hands-on outreach materials, museum exhibit, and live stage show. This approach to offering educational content follows the entertainment industry’s approach to disseminating and advertising their products but it is unclear whether this model also works in education. From an educational standpoint, producers assume this combination of media yields added benefits for children’s learning, beyond those that might be provided by one medium alone. But is this assumption true? Past research has focused almost entirely on the impact of one media component, such as a television series or a computer game in isolation. This leaves open the question of whether greater learning might emerge from using a group of components that span multiple platforms (which we shall refer to as cross-platform learning).

THEORETICAL BACKGROUND

Our study of children’s cross-platform learning is grounded in the theoretical and empirical literature on transfer of learning – students’ ability to apply concepts or skills acquired in one context to a new problem or context. The literature has documented many different types of transfer of learning (for example Haskell [2001] distinguished among 14 types of transfer), and numerous theoretical mechanisms have been offered to explain how and why they occur (e.g., Gentner, 1983; Greeno, Moore, & Smith, 1993; Holyoak, 1985; Salomon & Perkins, 1989; Schwartz, Bransford, & Sears, 2005).

Particularly relevant to our research is the principle, adopted by several existing theories, that transfer can be elicited through varied practice (i.e., providing learners with multiple examples of the same concept or repeated practice of a skill in multiple contexts). Varied practice helps learners create a generalized mental representation of the material that is less context dependent, and more easily applied to new tasks and situations (e.g., Gick & Holyoak, 1983; Salomon & Perkins, 1989; Singley & Anderson, 1989). For informal education, we hypothesize that encountering similar content (e.g., a mathematical concept or problem-solving heuristic) in multiple contexts and media would lead, not only to a better grasp of the content, but also a greater likelihood of transfer to new problems as well.

Apart from the potential for varied practice to contribute to learning, research suggests that repeated, varied engagement with mathematical content can also promote positive attitudes toward mathematics (e.g., interest, motivation). Several theoretical approaches argue that interest in an academic subject develops from repeated, positive engagement with its content – for example, from repeated practice that results in positive emotional outcomes, from seeing the broader applicability and usefulness of the content, or from internalizing interest via encountering the content in engaging situations (e.g., Bransford, Brown, & Cocking, 1999; Hoffman, Krapp, & Renninger, 1998).

Indeed, even the literature on attitude change in the context of advertising indicates that positive attitudes are more likely to occur from repeated exposure to persuasive messages – particularly if the precise content of the messages is somewhat varied (e.g., Kunkel, 2001; Petty, Priester, & Brñol, 2002). Under Hidi and Renninger’s (2006) four-phase model of interest development, interest in an academic subject such as mathematics originates as interest sparked by the context in which the math
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