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Information technology use and creativity: Findings from the Children and Technology Project

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ABSTRACT

This research examined relationships between children's information technology (IT) use and their creativity. Four types of information technology were considered: computer use, Internet use, videogame playing and cell phone use. A multidimensional measure of creativity was developed based on Torrance's (1987, 1995) test of creative thinking. Participants were 491 12-year olds; 53% were female, 34% were African American and 66% were Caucasian American. Results indicated that videogame playing predicted of all measures of creativity. Regardless of gender or race, greater videogame playing was associated with greater creativity. Type of videogame (e.g., violent, interpersonal) was unrelated to videogame effects on creativity. Gender but not race differences were obtained in the amount and type of videogame playing, but not in creativity. Implications of the findings for future research to test the causal relationship between videogame playing and creativity and to identify mediator and moderator variables are discussed.

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1. Introduction

Creativity has been defined as a mental process involving the generation of new ideas or concepts, or new associations between existing ideas or concepts. From a scientific standpoint the products of creative thought are usually considered to have both originality and appropriateness.

Although creativity appears to be a simple concept in the parlance of everyday life, its meaning and measurement have eluded the scientific community for decades. In fact it is a very complex concept that is difficult to define and measure (Runcho & Albert, 2010). Over one hundred definitions of creativity exist in the literature, spanning a variety of disciplines (Hocevar & Bachelor, 1989; Park & Byrnes, 1984; Parkhurst, 1999). Creativity is unique among scientific phenomena insofar as there is no single, authoritative perspective or definition of creativity.

Given the diversity in conceptualizations of creativity it is no surprise that there is also diversity in how it is measured. A popular approach to the measurement of creativity is the psychometric approach, pioneered by Guilford (1967). Most creativity measures in use today are based at least in part on Guilford's theory of creativity. The theory posits that the ability to envision multiple solutions to a problem lies at the core of creativity (Guilford, 1967, 1982). The Torrance Test of Creativity (Torrance, 1987) is based on Guilford's theory and is one of the most reliable and valid measures of children's creativity. In this research we used the Torrance Test to obtain a multidimensional measure of creativity in our 12-year old participants.

Research on the effects of using information technology has increased exponentially during the Information Age, outpaced only by the growth of information technology itself. In the previous century the primary focus was on the effects of computer-based learning on children's cognitive development (Wartella & Jennings, 2000). This line of research was quickly replaced by research on Internet effects, ignoring the fact that the computer is the primary vehicle for delivering the Internet, although the handheld may soon take the lead. The Pew Internet and American Life Project holds what is probably the most comprehensive set of national (US) survey research on the who, what, where, when and why of Internet use (e.g., Pew Internet and American Life Project, 2005, 2006, 2007).

Videogames effects have been a popular research topic perhaps because playing videogames is a popular activity. According to the Entertainment Software Association (2011) 72% of American households play video or computer games. Both "good news" and "bad news" have emerged from the research. On the positive side, videogame playing has been related to visual-spatial skills (Green & Bavelier, 2003, 2006, 2007), skills which may be linked to performance in mathematics, engineering and science (Subrahmanyam, Smahel, & Greenfield, 2006). One experimental study

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suggested a causal relationship between videogame playing and visual-spatial skill in adults (Green & Bavelier, 2007). A recent correlational study suggested a positive relationship between videogame playing and visual-spatial skills in children (Jackson, von Eye, Fitzgerald, Witt, & Zhao, 2009). On the negative side, videogame playing has been linked to aggressive cognition and behavior in children and adults (Anderson, Gentile, & Buckley, 2007; Bushman & Anderson, 2002; Gentile & Anderson, 2003; Gentile, Lynch, Linder, & Walsh, 2004). A handful of studies have demonstrated a causal relationship (e.g., Anderson et al., 2003). However, as gaming enthusiasts were quick to point out, the effect size for the relationship between videogame playing and children's aggression is half the effect size for the relationship between watching violent TV and children's aggression (Gee, 2005).

Jackson and colleagues summarized the research on the cognitive, social, psychological and physical consequences of Internet use for children (Jackson, Zhao, Fitzgerald, von Eye, & Harold, 2006) and adolescents (Jackson, 2008). Most of the studies included in these summaries were correlational studies. Whether using the Internet *causes* real changes in cognitive, social, psychological and moral thinking and/or behavior remains an unanswered question. Even the much discussed relationship between Internet use and obesity is likely mediated by other factors (e.g., creen time versus activity time).

Research has only quite recently turned its attention to cell phones. The questions addressed vary widely, ranging from "Does using a cell phone increase the probability of developing brain cancers?" to "Are cell phones decimating your social life?" At this early stage of studying a rapidly changing technology the only conclusion that can be drawn is that cell phones should not be used while driving. They divert attention away from the driving task and use up cognitive resources needed for that task (Butt & Phillips, 2007; Cell Signs Report: Text Message Statistics, 2008; Nielson Mobile, Neilson Company, NY: NY, retrieved August 3, 2011, from http://www.cellsigns.com; Pew Internet and American Life Project, 2010, 2011).

In this research we took an exploratory approach to examining relationships between a complex and important concept – creativity, and a variety of information technologies, specifically, computers, the Internet, videogames and cell phones. Because so little is known about the causes of creativity, and because so little is known about the effects of IT use, examining their relationships is an important first step in understanding both. We were particularly interested in the relationship between videogames playing and creativity because playing videogames has become a core activity in the lives of today's children (Entertainment Software Association (2011) and, most likely, tomorrow's adults. The average age of videogame players is 37 years old (Entertainment Software Association, 2011).

2. Materials and methods

2.1. Participants and procedures

Participants were 491 children, average age 12.34 years old, who completed surveys containing the creativity measures and the technology use measures as part of their participation in the Children and Technology Project (NSF-HSD # 0527064). Child participants and their parents were recruited from 20 middle schools geographically distributed in the southern lower peninsula of Michigan. An additional 100 participants were recruited from YouthVille Detroit, and after-school center for underserved groups in Detroit. About half (53%) of the participants were female, 34% were African American and 66% were Caucasian American. Four types of information technology were considered: computer use, Internet use, videogame playing and cell phone use. Multiple measures of creativity were develop using Torrance's (1987, 1995) test of creative thinking.

Surveys were mailed to participants' parents and returned in stamped, pre-addressed envelopes. Participants' parents also completed surveys and were compensated $25 when both the completed Parent Survey and Child Survey were returned. Parents who returned surveys were eligible to participant in a raffle for a grand prize drawing of $500. Response rate was 65%.

2.2. Measures

2.2.1. Creativity

The Torrance Test of Creativity – Figural (Torrance, 1987) was the basis for constructing a multidimensional measure of creativity with two objectives in mind. The first was to capture the richness and complexity of the creativity construct. The second was to minimize the contribution of alternative constructs to the creativity measure. In particular, creativity measures have been criticized for being saturated with the generalized intelligence factor, "little g" (e.g., Cooper, 1991; Fleenor & Taylor, 1994; Hocevar & Bachelor, 1989; Sternberg, 2001; Torrance, 1988, 1995; Treffinger, 1985). Every effort was made to minimize the contribution of little g to our measures of creativity while acknowledging that any measure requiring a verbal/written response will to some extent be influenced by generalized intelligence.

Participants responded to two target stimuli to assess creativity. The first stimulus took the form of an "egg" presented alone on a blank sheet of paper. Instructions were as follows:

> On the following page is a curved shape. Think of a picture or object that you can draw with this shape as a part of it. Try to think of a picture that no one else will think of. Keep adding new ideas to your first idea to make it tell as interesting and exciting a story as you can. When you have completed your picture make up a name or title for it and write this in the space provided under your picture. After you have drawn your picture and given it a title, come back to this page and write a story about your picture in the space below.

The second stimulus was a picture of an elf-like figure lying in front of a small pool of water, staring at its reflection in the water. Instructions were as follows:

> Look at the picture. Think about what is happening. What can you tell is happening for sure? What do you need to know to understand what is happening, what caused it to happen, and what will happen next, as a result? After you have looked at the picture and thought about these questions then go to the next page, after the picture.

The next three pages contained the following instructions:

> Write out all of the QUESTIONS you can think of about the picture. Ask all the questions you need to ask to know for sure what is happening. Do not ask questions that can be answered just by looking at the picture. You can look back at the picture as much as you want to.
> List as many possible CAUSES as you can think of for the activity (what is happening) in the picture. You may use things that might have happened just before the things that are happening in the picture, or you can use things that happened a long time ago that made the things in the picture happen. Make as many guesses as you like. Don't be afraid to guess. You can look back at the picture as much as you want to.
> List as many POSSIBILITIES as you can think of for what might happen next as a result of what is happening in the picture. You may use things that might happen right afterward, or you