# Learning from Paper, Learning from Screens:
## Impact of Screen Reading and Multitasking Conditions on Reading and Writing among College Students

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## ABSTRACT

*Electronic screens on laptop and tablet computers are being used for reading text, often while multitasking. Two experimental studies with college students explored the effect of medium and opportunities to multitask on reading (Study 1) and report writing (Study 2). In study 1, participants (N = 120) read an easy and difficult passage on paper, a laptop, or tablet, while either multitasking or not multitasking. Neither multitasking nor medium impacted reading comprehension, but those who multitasked took longer to read both passages, indicating loss of efficiency with multitasking. In Study 2, participants (N = 67) were asked to synthesize source material in multiple texts to write a one-page evidence-based report. Participants read the source texts either on (1) paper, (2) computer screen without Internet or printer access, or (3) computer screen with Internet and printer access (called the "real-world" condition). There were no differences in report quality or efficiency between those whose source materials were paper or computer. However, global report quality was significantly better when participants read source texts on a computer screen without Internet or printer access, compared with when they had Internet and printer access. Active use of paper for note-taking greatly reduced the negative impact of Internet and printer access in the real-world condition. Although participants expressed a preference for accessing information on paper, reading the texts on paper did not make a significant difference in report quality, compared with either of the two computer conditions. Implications for formal and informal learning are discussed.*

*Keywords:* *Electronic Screens, Multitasking, Paper, Reading Comprehension, Reading Time, Report Writing, Tablet Computers*

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## INTRODUCTION

Electronic screens such as those found in computers, laptops, tablet computers, and e-readers are increasingly used to read text, and it is important to consider their implications for student learning. Data collected by the Pew Internet and American Project suggest that, as of May 2013, 56% of American adults owned a smartphone (e.g., Android, iPhone) and 34% owned a tablet computer; as of April 2012, 61% owned a laptop and 58% owned a desktop computer (Brenner, 2013; Zickuhr, 2013). In 2010, between 59 and 93% U.S. college students (community college, undergraduate, and graduate students) reported owning a desktop or a laptop computer (Smith, et al., 2011). Among youth, a 2012 survey of U.S. 12- to 17-year-olds reported that 93% have home computer access, 37% own a smartphone, and 23% have a tablet computer; one in four reported that they are "cell-mostly" Internet users, who use their phone to go online most of the time (Madden & Lenhart, 2013). Moreover, tablets and electronic books are being adopted by students of all ages for access to textbooks and other instructional materials (Hu, 2011; Rockinson-Szapkiw, 2011) and recently, the Los Angeles Unified District approved iPads for every child in the district's schools (Blume, 2013).

Given that electronic screens have become pervasive, it is important to examine how individuals process, comprehend, and utilize digital text compared with text on the traditional medium of paper. This paper describes two studies that examined the relative effectiveness and efficiency of screens versus paper for reading as well as synthesizing information and writing a research-based report under naturalistic conditions. Because so much reading and writing takes place in environments that include access to the Internet or to a cell phone, multitasking while reading or writing on the computer has also come into play. The effects of the resulting distraction on reading (Study 1) and report-writing (Study 2) are also explored in the present research. The results have potentially important implications for both formal as well as informal learning.

## ELECTRONIC SCREENS AS CULTURAL TOOLS

Why would we expect electronic screens or the particular reading medium to affect how learners process text? To answer this question, we turn to Vygotsky's proposal that cognitive development is mediated by the semiotic mechanisms or psychological tools provided by the culture such as language, counting systems, algebra, and writing (Vygotsky, 1978). Sociocultural theorists now recognize that tools such as the paint brush, computers, calendars, and symbol systems also play an important role in knowledge construction during development (John-Steiner & Mahn, 1996). Indeed mass media such as radio, film, and television, were considered to be early electronic tools and have been joined today by digital media such as tablet computers, video and computer games, and the Internet (Greenfield, 1994; Subrahmanyam & Greenfield, 2008). Greenfield (1993) has posited that cognitive socialization is the process by which cultural tools impact processing skills; on this view, different tools utilize and require different processing skills. As a widely used cultural artifact, media are important tools of cognitive socialization (Subrahmanyam & Greenfield, 2008). Different media use different symbol systems – radio uses auditory representations, television uses auditory, iconic, and visual representations, and computer games use auditory, iconic, visual, dynamic, and spatial representations. Consequently, repeated use of a particular media form will help to internalize the medium-specific representational skills that it uses.

Research has shown that different media forms do indeed help to foster and develop different cognitive skills (Subrahmanyam & Greenfield, 2008). For instance, several experimental studies have shown that repeated computer game playing enhances selected at-

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