



Full length article

Engaging preservice teachers in integrated study and use of educational media and technology in teaching reading

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HIGHLIGHTS

- Preservice teachers in a technology-infused literacy methods course were studied.
- Survey data showed medium-large effects on technology knowledge and self-efficacy.
- Survey data showed medium effects on intent to use technology in teaching.
- PST planned sound literacy lessons with technology aimed at transformative learning.
- Findings underscore importance of addressing technology throughout PST education.

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ABSTRACT

This mixed-methods study explored effects of participation in a required course integrating educational media and technology with literacy instruction on preservice teachers' (PST) perceptions of their knowledge of technology, its usefulness in teaching and learning, and understanding of ways to use technology in teaching literacy. Survey findings showed moderate to large effects on PSTs' ($N = 29$) perception of their knowledge of and self-efficacy with technology, literacy content knowledge, and intent to integrate technology into future teaching. In lesson plans, PSTs integrated numerous technology devices and educational media while maintaining sound literacy instruction. Findings indicate a clear, positive trend in PSTs' outcomes.

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1. Introduction

Solving the problem of the reading achievement gap between students in high and low-poverty schools has long been at the heart of school improvement efforts. Although there are many factors underlying achievement gaps, differences in access to and use of technology represent a critical factor, particularly in our increasingly digitized society. Studies indicate that, in comparison to their peers living in poverty, economically-advantaged children have substantially greater access to a wide range of technology outside of school (e.g., Warschauer & Matuchniak, 2010). Moreover, international data indicate important differences in the ways teachers draw on tools and resources as they develop their students'

curricular knowledge (OECD, 2013). Children in high-poverty schools often use technology for purposes of knowledge acquisition and development (e.g., research papers), children in low-poverty schools are more likely to use computers for skill development (e.g., Judge, Puckett, & Cabuk, 2004).

These differences in technology access and use inadvertently maintain or even increase achievement gaps between high and low-poverty youngsters. Access to technology situated within transformative learning contexts (i.e., contexts emphasizing research and inquiry, knowledge acquisition, critical thinking, communication, and collaboration) not only provide children opportunities to acquire important conceptual knowledge that enables reading achievement (Leu et al., 2015); it also apprentices them into collaborative participation structures that are increasingly important in school and societal learning contexts (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006).

Evidence suggests that interplay between several factors—internal and external to teachers—contribute to transformative

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technology integration in schools and classrooms. Internal factors such as teachers' beliefs about the importance of technology in teaching and learning (Kanaya, Light, & McMillan-Culp, 2005; Windshitl & Sahl, 2002), technology knowledge (Mishra & Koehler, 2006), and self-efficacy with technology (Ertmer & Ottenbreit-Leftwich) play a role in technology integration; while external factors such as administrative support and professional development, "trouble shooting" support when technologies break down (Inan & Lowther, 2010) and access to high-quality technologies also contribute to effective technology integration. Given this interplay, it is evident that teacher knowledge, by itself, is unlikely to enable transformative technology use in classrooms; yet, absent sufficient teacher knowledge, external factors will not make a difference.

Although teacher education programs may have little or no impact on school-based external factors, they hold the potential to have substantial impact on internal factors: teacher beliefs, knowledge, and self-efficacy relative to transformative technology integration. As such, they have the opportunity, and in fact, the responsibility, to understand, shape, and implement a curriculum that will prepare preservice teachers (PSTs) for success in schools that are adequately resourced.

Yet, despite evidence and increased recognition that effective use of educational media and technology represents an important—perhaps even fundamental—component of students' learning, teacher education programs often fall short in sufficiently preparing preservice teachers to integrate technology into their future practice (e.g., Belland, 2008; Polly, Mims, Shepherd, & Inan, 2010). As a result, many (maybe even most) teachers enter their first classrooms with little understanding of efficacious uses of educational media and technology. As many new teachers enter high-poverty schools, the cycle of inadequate instruction—and unequal opportunities to learn both in and out of school—for children in such communities and schools continues, and, in turn, achievement gaps persist.

With this evidence as a backdrop, we set out to determine if preservice education teachers enrolled in a required methods course that integrated educational media and technology as a resource in teaching literacy in the elementary grades changed their perceptions of the usefulness of technology as a resource in teaching and learning, their knowledge about technology, their understanding of ways to use technology in teaching literacy, and their ability to plan lessons that meaningfully integrated technology within the context of sound literacy instruction.

2. Theoretical and empirical foundation

2.1. Technology and student learning

One explanation for a lack of emphasis on technology integration in PST education programs (particularly in kindergarten through second grade) is a widely-held belief that children's technology use in school does not yield positive effects on children's learning. A fine-grained examination of the evidence suggests understanding the effects of access to technology on children's academic achievement is complex. Individual studies (e.g., Campuzano, Dynarski, Agodini, Rall, 2009; Llosa & Slayton, 2009) and separate meta-analyses (Kulik, 2003; Torgerson & Zhu, 2003) have yielded evidence that technology use consistently results in only small effects on academic learning as compared to traditional instructional approaches. However, in a recent meta-analysis of 84 studies, Cheung and Slavin (2012) found that effects differ depending on *how* technology is used—that is, technology uses that largely supplanted the teacher and emphasized learning of low-level skills had little effect on reading achievement; on the other hand, technology uses that essentially enhanced the

role of the teacher (e.g., using multimedia content to build knowledge, using technology to illustrate key ideas) exerted small to moderate positive effects on children's learning. These findings are similar to those of other recent studies (e.g., Cviko, McKenney, & Voogt, 2012; 2013; Linebarger & Vaala, 2010; Lysenko & Abrami, 2014; Neuman, Neuman, & Dwyer, 2010; Yang, Yu, & Sun, 2013; Zheng, Warscheur, & Farkas, 2013) in which children whose teachers emphasized technology for transformative learning achieved significant growth in literacy achievement.

In addition to how technology is used, the extent to which technology-based and non-technology-based instruction are joined to support a coherent instructional curriculum matters. In a synthesis of 20 studies (7000 students in grades 1–6), Cheung and Slavin (2013) found greater effects on children's literacy outcomes when technology was integrated with instruction teachers offered in small reading groups ($ES = 0.32$) than technology use unrelated to other teacher-led instruction ($ES = 0.14$). These findings were consistent with evidence that linking non-technology, teacher led-instruction and computer-assisted instruction is beneficial (Cheung & Slavin, 2012).

Other studies (e.g., Nir-Gal & Klein, 2004; Segal-Drori, Korat, Shamir, & Klein, 2010; Valkenburg, Kromar, & de Roos, 1988) examined students' reasoning and literacy outcomes when educational media is used with and without teacher mediation. Across studies, outcomes consistently show that students demonstrate significantly greater outcomes on measures of abstract reasoning and vocabulary (Nir-Gal & Klein, 2004) and literacy (Segal-Drori et al., 2010; Valkenburg et al., 1988) when educational media use is teacher mediated. Mediation strategies included focusing children's attention on key aspects of the task; encouraging children through affirming verbal or nonverbal cues; regulating behavior by matching tasks to students' abilities and also by sequencing steps to support task completion; and expanding children's understanding by prompting them to make comparisons, to clarify, or to elaborate on an idea.

Although teacher-mediated use of technology has been found to lead to greater achievement, simply providing teachers with technology with the expectation that they will instantly leverage such resources to the advantage of their students' literacy development is unlikely to be sufficient. Rather, meaningful technology integration is substantially influenced by the training and support teachers receive. Archer et al. (2014) reported especially compelling evidence, with the effect of technology integration on children's literacy learning increasing from small ($ES = 0.18$) to substantial ($ES = 0.57$) when accounting for teacher support and training. Cheung and Slavin (2012), too, found a strong relationship between professional development and learning gains associated with technology integration. Such support may be particularly important for teachers in high-poverty settings as less efficacious integration of technology is substantially more prevalent in schools serving children living in high-poverty than schools serving children living in low-poverty (Atwell, 2001; Judge, Puckett, & Bell, 2006; Warschauer & Matuchniak, 2010; Wayne, Zucker, & Powell, 2002; Wengliński, 1998).

In sum, integrating technology as part of the literacy curriculum has positive learning outcomes when the instructional emphasis is on transformative learning, when technology use is integrated with other, teacher-led literacy instruction, and when teachers effectively guide and mediate technology use. Conversely, when technology emphasis is on low-level skills (Wengliński, 2005), on tasks that are not coherent with on-going classroom instruction (Cheung & Slavin, 2012), and on tasks for which the teacher is largely absent (Cheung & Slavin, 2012; Nir-Gal & Klein, 2004), there are few, if any, positive effects on students' literacy achievement. Finally, when professional development and instructional support are provided

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