Chapter 15

New Directions in the Research of Technology-Enhanced Education

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ABSTRACT

This chapter presents the results of a systematic review of literature in which the authors examined instructional technology integration in career and technical education, mathematics, language arts, social studies, and science. Three lenses were used to examine the literature: a research design framework, a teacher knowledge framework (CFTK), and a technology integration framework (TPACK). The research design framework revealed a low percentage of papers that were actually research studies (41.2%), favoring qualitative design (70% of the 41.2%). Consequently, educators may have difficulty

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sifting through high proportions of non-research to find the most informative, up-to-date instructional technology research. Three CFTK aspects of teacher knowledge were addressed less than others in the research studies: Individual Context (16%), Subject Matter (33%), and Discernment (29%). Pedagogical Knowledge was addressed the most (65%). The TPACK developmental framework revealed an emphasis on the lowest three levels of instructional technology integration (60%), indicating a gap in the research at the upper two levels. Mathematics studies accounted for almost half of all research addressing TPACK developmental stages (47%). From these findings, the authors conclude that pedagogical knowledge alone is not enough to ensure high levels of technology integration and offer recommendations for improving the disjointed nature of research on instructional technology.

INTRODUCTION

Teachers use instructional technology for online courses, video conferencing, electronic portfolios, and other exploratory projects. Literature reviews are important tools that teachers can use to evaluate instructional technology and develop strategies for its effective use. A systematic review of literature can make such evaluations far easier and more effective by synthesizing the results of the studies on a given topic using well-articulated methodological processes. The purpose of this chapter is to provide a systematic review of the impact of technology on teaching and learning and to propose a framework for looking at teacher knowledge from which gaps in the literature can be addressed. In this paper, the term "technology" refers to digital technology as opposed to other forms of instructional tools (e.g., overhead projectors, manipulatives).

Means, Wagner, Haertel, and Javitz (2003) identified two major issues regarding the use of technology for instruction: the pedagogical value of specific technology tools and the cumulative effects of technology exposure over time on student learning. In order to address these issues, educators need to assess specific sub-questions to gauge the effectiveness of technology as a teaching tool (e.g., What conditions foster learning with technology; what pedagogical strategies promote learning with technology; what teacher qualifications are related to content, technology, and implementation of pedagogical strategies; and to what internal and external classroom constraints must teachers attend when incorporating technology?). The complex nature of these questions requires multiple types of research and design.

Bell, Schrum, and Thompson (2009) suggested that the types of research needed to adequately address these issues include: (1) experimental or quasi-experimental studies, (2) large-scale studies, (3) studies with sufficient statistical information to be included in meta analysis and mixed-methodology studies, (4) studies with rich analysis of student content knowledge, and (5) studies that address the complexities of learners, classrooms, and schools. Recently, federal funding agencies such as the Institute of Education Sciences (IES; Whitehurst, 2003) have emphasized large scale experimental studies as the gold standard for scientific research. One such study, *Effectiveness of Reading and Mathematics Software Products: Findings from the First Student Cohort* (Dynarski et al., 2007), found that the technology programs used showed no significant improvement in student test scores in mathematics and reading. However, the results from a single study, even a large scale experimental study, are not conclusive in and of themselves. For example, Fitzer et al. (2007) challenged the generalizability of the Dynarski et al. (2007) study, noting that "this study oversimplifies the case by pushing aside these complicated relationships, and treating all the software programs as members of the same generic set of 'mathematics software' (or 'reading software')" (p. 3). Ronau et al. (2008) added

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