INFORMATION SCIENCE PUBLISHING
701 E. Chocolate Avenue, Suite 200, Hershey PA 17033, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com
ITB10979

This chapter appears in the book, *Technology Literacy Applications in Learning Environments* edited by David D. Carbonara © 2005, Idea Group Inc.

Chapter II

The Role of Information Technology in Learning: A Meta-Analysis

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Abstract

This study provides an updated meta-analysis on the effects of information technology (IT) in education. Sixty-eight experimental studies conducted on the application of IT in the classrooms were integrated and analyzed. Positive effect sizes were found for learning outcomes, including academic achievement, knowledge retention, task performance, self-reported learning, and self-efficacy. Further analysis revealed the primary effects to be significantly moderated by several factors, categorized under learner and course characteristics. These findings have important implications for both research and practice.

Introduction

Emerging as a precious asset in pedagogy, technology is viewed as a potential element that can influence traditional education. Learning effectiveness has been a major issue in recent research, and the growing knowledge repository has implications on all levels of education with the advent of new technologies. The goals of using information technology (IT) in education are to enhance teaching and learning, and to increase the efficiency and effectiveness of the educational organization (Windschitl, 1998). This is readily reflected in the large amount of resources invested in IT spending (Volery & Lord, 2000). Concomitantly, calls for greater depth and breadth in the studies for technology-mediated learning (Alavi & Leidner, 2001; Owston, 1997) indicate growing interest in the pedagogical impacts of IT on education.

Since the first computer was introduced in education, many studies have been conducted to investigate the effects of educational technology. IT is increasingly used to complement or replace conventional teaching methods (Leidner & Jarvenpaa, 1995). Many researchers believe that the use of technology is inherently 'good' for learning (Niemiec, Sikorski, & Walberg, 1996). Yet, the application of old solutions to new problems in online learning usually leads to the 'no significant difference' phenomenon (Russell, 2002), in which IT applications tend to produce results similar to those in traditional pedagogy. Therefore, there is a need to understand the strengths and weaknesses, as well as the appropriateness of implementing IT in schools. Correspondingly, a number of studies were carried out to determine whether IT, in fact, has produced beneficial effects. In a typical study, learners are divided into experimental and control groups. Learners in the experimental group are taught educational content using some forms of technology, while those in the control group receive their instruction by traditional methods. But no individual study can conclude whether IT is generally effective. Conflicts in research findings (Kulik & Kulik, 1991; Niemiec et al., 1996) show that the conditions under which the use of IT is beneficial have ramifications not completely understood despite the plethora of research commentaries.

To reach general conclusions, reviewers must consider results from studies carried out in varied settings and under different conditions. Research syntheses are usually classified into narrative reviews, box score tabulations, and meta-analyses. Narrative reviewers give concise summaries of major studies and draw conclusions about overall impacts based on these studies reviewed. However, the early traditional reviews are inexplicit about their search procedures, inclusion criteria, and analytical procedures for synthesizing the studies. Box score reviews often report the proportion of studies favorable and unfavorable to an experimental treatment, and provide narrative comments about the studies (Kulik & Kulik, 1990). Meta-analyses, on the other hand, take a quantitative approach and have made increasing appearance in IS research (e.g., Benbasat & Lim, 1993). Hunter and Schmidt (1990) defined meta-analysis as a set of statistical procedures for accumulating experimental results across independent studies that address a related set of research questions. Meta-analysis is an integrative analysis that combines the findings from individual studies for the purpose of research synthesis. By aggregating results across studies, researchers can gain a more accurate represen-