

# Research on the Effects of Media and Pedagogy in Distance Education

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## INTRODUCTION

Do media influence learning? This is a historical debate in the field of educational technology, which started when Clark (1983, 1994) argued that media are “mere vehicles” and it is the content and pedagogical methods that are the “active ingredients” influencing student learning. Others (e.g., Kozma, 1994; Cobb, 1997) disagreed and argued that special media attributes can make certain types of learning more effective or cognitively efficient. In this chapter, I will first review the key arguments for and against media effects in distance education (DE). I will then review several meta-analyses that attempted to analyze the effects of media and pedagogy based on quantitative syntheses of the empirical research in DE. Finally, I will discuss directions for future research.

## BACKGROUND

### Arguments for and against Media Effects in Distance Education

The media effects debate has continued in the context of distance education (DE), especially regarding the need for comparative studies. Clark (2000) believes that comparing media-supported DE versus classroom instruction is similar to the old studies on computer-based instruction and that the research on the effects of DE has the same problem of media and method confound. Therefore, he calls for conducting multi-level evaluation studies on student perceptions of motivation using both quantitative and qualitative data such as questionnaires and cost-effective issues of DE programs instead of experimental studies.

Smith and Dillon (1999) argue for the continued need of comparative studies. They feel that the way to solve the media and method confounding problem is to describe not only the physical characteristics

of delivery media but also how media attributes are used to support student learning in the studies. Such features may include bandwidth of a delivery system, whether the communication is one-way or two-way, synchronous or asynchronous, and interface design. A media attribute associated with bandwidth is realism, which may be used to support the learning of concrete versus abstract symbols. Media attributes associated with one-way/two-way communication are interactivity and feedback, which can facilitate active engagement and adaptation to learners. A media attribute associated with interface is branching, which may support learner control and self-directed navigation. They believe that by describing these media attributes and how they are used to support student learning in DE should help researchers un-entangle the media and method confound, thereby, providing theory-based research evidence to direct effective design of distance education.

### Early Synthesis Effort

Regardless of Clark’s argument and repeated call against media and DE comparative research (1983, 1994, 2001), a considerable number of DE comparative studies have been and continue to be conducted, esp., after each wave of an emerging information communication technology. As is the case in most educational research, some studies found positive effects favoring DE, some found no significant or negative effects.

Russell (1999) compiled and annotated 335 studies published from 1928 to 1998 that reported no significant difference between mediated DE and classroom instruction. The collection does not include any studies that report significant findings, either positive or negative. Russell’s rationale for compiling no significant difference studies only was that these studies considerably outnumbered those that reported significant findings. Based on his collection, Russell concluded that the results support Clark’s theory of no media effects on student learning. Although the study was widely cited,

the selective vote-counting approach has been most criticized for its lack of rigor and incomplete picture of DE effects (Bernard et al., 2004; Layton, 1999).

## **Meta-Analysis**

Meta-analysis was first developed by Glass and his colleagues (Glass, McGaw, & Smith, 1981). It employs effect size as a standardized mean difference between an experimental and a control condition so that findings across studies can be statistically combined to estimate an overall average effect size. It also allows researchers to explore variability in the findings to identify potential moderating factors based on study features.

Hedges and Olkins (1985) further developed the meta-analysis techniques. The weighting by the inverse of a sampling variance procedure further reduces bias from studies of different sample sizes. The homogeneity analysis tests if the aggregated findings are consistent or heterogeneous.

## **MAIN FOCUS OF THE CHAPTER**

A total of 12 meta-analyses have been conducted and published from 2000 to 2007, attempting to synthesize the empirical DE research findings using a variety of different meta-analytic procedures (see Table 1). Some focused on one type of DE and others were more inclusive.

## **Video Conferencing or Telecourses**

Two meta-analyses focused on video-conferencing or tele-courses only. Machtmes and Asher (2000) synthesized 19 studies published in 1943-1997 comparing the effects of live and pre-produced telecourses with classroom instruction at the adult and high education levels. They found an overall mean effect size of -0.0093 and that the findings were significantly heterogeneous. Through univariate study features analyses, they found that studies that were published in the last decade had significantly more positive effect sizes favoring DE ( $ES = +0.23$ ,  $p < .05$ ) than earlier studies. They also found that studies where two-way interaction between students and instructor were available via either video or audio during live instruction produced significantly more positive effect sizes than one-way pre-produced telecourses.

Cavanaugh (2001) synthesized 19 studies published in 1980-1998 on the effects of telecommunication courses at k-12 levels on student achievement. The overall mean effect size was +0.15 favoring DE but not statistically significant. The findings across studies were significantly heterogeneous. Although Cavanaugh coded and analyzed a number of study features including use of delivery system, duration, frequency, and mode of DE, grade level, year of publication, outcome measure, test sequence, sample size, grade level, subject areas, and study sources, no significant moderators were identified.

## **Online Courses**

Four meta-analyses were conducted synthesizing studies on the effects of online learning compared with classroom instruction. Ungerleider and Burns (2003) synthesized a total of 12 studies published in 2000-2003 on the effects of online and networked learning (not exactly distance learning) on student achievement and satisfaction at the secondary schools and universities. The overall mean effect size was 0.000 ( $N=8$ ) on achievement and -0.509 ( $N=4$ ) on student satisfaction. The latter is significantly negative favoring classroom learning. Neither homogeneity analyses nor study features analyses were performed on either dataset.

Cavanaugh, Gillan, Kromrey, Hess, and Blomeyer (2004) synthesized 14 studies published in 1999-2004 that compared the effects of online courses at k-12 virtual schools with classroom instruction. The overall weighted mean effect size was -0.028, which is not significantly different from zero. The findings across studies were significantly heterogeneous. Similar to Cavanaugh (2001), they coded and analyzed a number of study features including grade level, content area, duration and frequency of the distance learning experience, instructional role of the distance education, pacing of the instruction, role of the instructor, timing of the interactions, and types of interactions, as well as various study quality and invalidity factors, but failed to identify any moderating features that account for the significant variability in the findings.

Williams (2006) synthesized 25 studies published in 1990-2003 that compared online courses with classroom instruction in applied health science at the undergraduate and graduate levels. The overall mean effect size was +0.15, which is significantly positive. Although the homogeneity analysis was not conducted, Williams

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