
Technology in the Face-to-Face Classroom: Evidence from Four Decades of Research

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The Accumulating Data about TEL

Since 1980, thousands of studies have compared computing and non-computing classrooms to see what impact technology had in a face-to-face setting. To make sense of these disparate investigations, many researchers performed meta-analyses on these studies to gain a wider perspective on the impact of technology on student learning. Eventually, the number of meta-analyses themselves rose to over 60, and Rana Tamim and her collaborators performed a second-order meta-analysis—a meta-analysis of a carefully selected set of 25 meta-analyses—in order to measure the combined effect of 1,055 primary studies.¹

Their investigation focused specifically on computer technology as a supplement for in-class instruction, and included only studies which compared two face-to-face conditions, one of which was enhanced by online or in-class digital technology and the other of which was not. Studies comparing a face-to-face condition with a fully online condition — included in the Means Department of Education (2010)² and Bernard (2004)³ meta-analyses—were excluded from this examination. The studies were drawn from a pool that were 1) conducted since 1985, 2) reported an average effect size, 3) focused on student achievement outcomes, and 4) included elementary, secondary, and post-secondary grade levels. In all, the pool of primary studies included approximately 109,700 participants.

The Findings

The researchers sought to answer the question, “What is the effect of using computer technology in classrooms, as compared to no technology, to support teaching and learning.” They found a small to moderate effect size (+0.35) favoring the use of technology in the classroom over traditional (technology absent) instruction.

Their analysis also revealed two interesting moderating variables. The first displayed a small but significantly higher average effect size for technology that supports instruction over applications that deliver direct instruction, such as computer-assisted instruction. The second suggested a larger effect size for computer applications in the K-12 classroom over those in postsecondary settings. To be clear, technology in both the traditional K-12 *and* postsecondary

¹ Tamim, R. M., Bernard, R. M., Brookhovski, E., Abrami, P.C., Schmid, R. F. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research*. 81(1), pp. 4-28. doi: 10.3102/0034654310393361. Retrieved May 24, 2011 from <http://rer.sagepub.com/content/81/1/4.short>.

² Means, B., Toyama, Y., Murphy, R., Bakia, M., Jones, K. (2010). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning. Center for Technology in Learning, U.S. Department of Education. Retrieved May 10, 2010 from <http://www.ed.gov/about/offices/list/oepd/ppss/reports.html>.

³ Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., Bethel, E. C. (2009). A Meta-Analysis of Three Types of Interaction Treatments in Distance Education. *Review of Educational Research*. 79(3), pp. 1243-1289. doi: 10.3102/0034654309333844. Retrieved May 24, 2011 from <http://rer.sagepub.com/content/79/3/1243.abstract>

classrooms was shown to have an effect, but the effects in K-12 were greater. This result distinguishes it from the recent Means meta-analysis that found that the learning effects of technology were independent of grade level.

The recent DOE study provided a rigorous meta-analysis of recent (1998-2008) investigations in technology enhanced learning and found a (+0.20) effect size in courses with an online component. In this widely-discussed examination, Means identified several moderating variables and also qualified her conclusion by suggesting TEL courses were associated with positive instructional practices, including overall increased learning time and a greater number of learning materials, etc. The DOE study refrained from suggesting that learning gains came exclusively from the adaptation of technology and almost certainly from the combined effect of technology and the pedagogical framework that enables it. The same logic would apply to the Tamim study, and thus we might want to view the reported positive gain scores with a lens that would interpret some of this gain as resulting from novelty effects, additional time-on-task, or other instructional practices that are conditioned by the introduction of technology.

Discussion

The Tamim second-order meta-analysis surveys a broader landscape both in time (1985-2010) and in the number of studies it includes (1,055 studies as compared to 45 studies) than the DOE analysis. As a result, Tamim can logically claim to summarize the history of the computer/non-computer classroom divide, though understandably in less detail and perhaps sacrificing the important particularity that context imparts to this analysis. Taken together, the Means and Tamim approaches give us both a wide-angle and close-up look at the long and growing history of these investigations. Interestingly, Means, Bernard (a co-author in this study), and Tamim suggest that studies framed across the technology/no technology divide are growing less useful than studies that differentiate among different types of technology adaptation.