

Glen O'Grady
Director Academic and Student Services

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The argument for online teaching and learning has been around for many years. The claims about what online teaching and learning promises are well documented. These include: greater access to higher education, flexibility (students can study what, where and when they want), a cheaper alternative to studying on a campus, greater connectivity to world, and, enhanced digital literacy skills. The veracity of these claims are hotly debated. Data emerging from studies on the practice of online learning enable us to address a commonly asked question *does online really deliver on student learning?*

In this article I want to address this question by reviewing briefly the results of three meta-analyses that compare online (inclusive of blended and distance learning) with face to face instruction.

While the overall conclusions from these meta-analyses suggest online (technology enhanced) teaching does positively impact on student learning, there are lingering questions about how online learning should be done and the usefulness of comparing online with face to face for the purpose of asking which approach is better.

What are meta-analyses?

Meta-analysis is a systematic review of relevant studies undertaken in relation to a body of research, that aims to derive summary conclusions about this research. In some instances, the meta-analysis is a narrative driven review of research - often leading to a qualitative summation of common and different findings that emerge when collectively considering a body of research. In other instances, the analysis is more quantitative in that the review seeks to combine the results of multiple quasi-experiments to obtain a composite estimate of the size of an effect (difference) between a treatment group and a control group.

In this review I provide a narrative review of three quantitative meta-analysis. These three studies were selected because they examine the general question of does online deliver on student learning, but do so by employing different ways of undertaking the meta-analyses. They are all relatively current, use slightly different definitions of what counts as online learning, as well as use different intervening variables in their analyses while also drawing upon slightly different methodological approaches.

Study One:

Means, B., Toyama, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. [Teachers College Record](#), 115(3), 1-47.

This study addressed 4 questions:

1. How does the effectiveness of online learning compare with that of face-to-face instruction?
2. Does supplementing face-to-face instruction with online instruction enhance learning?
3. What practices are associated with more effective online learning?
4. What conditions influence the effectiveness of online learning?

The study analyses 176 studies published between 1996 and 2008 that met the following criteria:

- Web-based instruction (i.e., excluding video or audio-based telecourses or stand-alone, computer-based instruction);
- Used a random-assignment or controlled quasi-experimental designs when assessing the effectiveness;
- Examine effects only for objective measures of student learning – i.e. students learning gains or grades (e.g., discarding effects for student or teacher perceptions of learning or course quality.).

They compared face to face classes with:

- instruction that was delivered wholly online,
- as well as face to face classes that blended in an online component.

The study found 51 independent effects. These effects are measurable differences between students learning face to face with those studying online or in a blended mode. Of these differences 11 effects were (statistically) significantly positive, favoring online or blended learning over face to face. Only two effects, that were statistically significant, favored face-to-face over online.

So overall the meta-analysis found that, on average, students in online learning conditions performed better than those receiving face-to-face instruction. This was true across a wide range of academic subjects and for both undergraduate and post-graduate students.

The differences in learning were even more pronounced when comparing blended elements of online and face-to-face instruction with conditions taught entirely face-to-face. The study found there is little difference in learning outcomes when comparing blended with online

After examining the reasons for the positive effects of online and blended learning the authors concluded that differences could not be attributed to the media, or delivery mode per se. The effects were more a function of curriculum and pedagogy in particular the “additional learning time

and instructional elements.” Specifically, the analysis found that learners online spent more time on learning tasks than students in face to face settings. The authors noted *“online learning is much more conducive to the expansion of learning time than is face-to-face instruction.”*

The study did not find strong evidence showing that different approaches to online learning had significant impact on student learning. For example, the use of video or quizzes online did not have a major effect on differentiating student learning. However, one interesting finding was that if the curriculum and instructional design was identical between face to face and online the effect difference between the approaches was very small. Where the curriculum was different i.e. the activities, resources and group and individual work online, varied from what was done in a face to face setting, the positive effects of online were more evident. Suggesting that online classes that aim to replicate what is done in face to face is far less effective than if online is designed to be different.

Study Two

Shachar, M., & Neumann, Y. (2010). Twenty years of research on the academic performance differences between traditional and distance learning: Summative meta-analysis and trend examination. [*MERLOT Journal of Online Learning and Teaching*](#), 6(2).

This study investigated the question: Is there a difference in the final academic performance of students enrolled in distance-learning programs relative to those enrolled in traditional face to face programs for the period between 1990 to 2009. This period of time was further broken down into four distinct sub-periods (Period I: 1991-1998, Period II: 1999-2000, Period III: 2001-2002; and Period IV: 2003-2009)?

Distance learning (DL) refers to learning that occurs when students and teacher are physically distanced from each other. Historically DL was rooted in correspondence (Harting & Erthal 2005), but in more recent decades it has evolved to include Internet-online, one-way, two-way audio and video. This meta-review also wanted to examine the evolving nature of DL over the specified 20 year period and whether there was any difference between the four sub-periods and whether there is a change in the effect of DL in student achievement over time.

The study drew upon 125 studies that were relatively equally represented across the four distinct sub-periods.

The analysis found that overall, 70% of all the studies showed DL students statistically (significant) outperforming students who studied in traditional face to face classrooms. The analysis also revealed a clear upward trend of studies reporting higher positive student performance by DL students from period one (63%), to period two (67%) to period three (69%) to period four (84%). The study does not investigate in any details as to why there is an increase in performance over time but do suggests some possible explanations that warrant further investigation:

... this study did not differentiate between the educational delivery methods of time (synchronous and asynchronous) and place (same and different) dimensions, as categorized by O'Malley and McCraw (1999), or the various technological and telecommunication delivery systems, but rather remained with the general dichotomy of all distant (teacher-student geographically separated) courses, vs. all

traditional courses, the trend of the four periods' 'd+', when graphed together, depicting a clear U curve graph with an upward inflection point occurring in the 1999-2000 period (see Figure 4), demand an in-depth and insightful look at the possible educational and pedagogical factors affecting said periods, e.g., in the first period the 'classic' text-book was mostly just converted as-is to a CD or web based medium vs. the fourth period where new web software applications enhanced multi-level learning styles.

One of the interesting claims made in the paper is that online learning has proven to be more robust in times of economic hardship. The authors conclude from their analysis using time as a key variable that during the periods of economic downturns, notably the post dot com era in 2000-2002 and the major economic recession from 2007-2009, the levels of support and the quality of face-to face outcomes has eroded while the quality and support and outcomes of online programs has increased.

Study Three

Vo, H. M., Zhu, C., & Diep, N. A. (2017). The effect of blended learning on student performance at course-level in higher education: A meta-analysis. [Studies in Educational Evaluation](#), 53, 17-28.

This study compares blended learning with traditional methods of face to face teaching in higher education.

Blended learning (BL) is a combination of face-to-face instruction and computer-mediated instruction. The argument for BL is that student learning is augmented by technologies that enable greater scaffolding through the use of multi-format resources, online discussions (that can be archived) and reflective activities that can occur outside of the classroom. The goal of BL the authors argue is to not only to increase access and convenience, but to infuse a student-centered, facilitator based approach to teaching, by leveraging on frequent online interaction and feedback that goes well beyond just *using the online learning platform as a communication channel*.

This study instead of looking at the total number of effects when comparing BL with face to face they sought to investigate three possible effects:

1. The effect of BL on student performance in higher education.
2. The effect of BL on student performance across different disciplines, specifically STEM vs. non-STEM
3. The effect of BL on student performance when taking into account different approaches to assessment namely a single end-of-course assessment vs. multi-component assessment.

The study included in the meta-analysis 122 published articles that met the necessary criteria (focused on higher education, measured student learning using objective measures, studies were about BL implemented at a whole course level and the studies used an appropriate pretest and post-test design).

The study found that, BL, when compared with traditional face-to-face instruction, demonstrated a larger effect size on objective measures of student performance. However, one caveat to this finding was an indication that students who had higher grade point averages performed better in the BL than

in face to face conditions compared to students who had a lower grade point average. Those with a lower GPA performed better in traditional face to face classes.

BL was also found to be significantly more effective in facilitating student learning performance in STEM disciplines than non-STEM disciplines. The authors attribute this difference to the epistemological difference between STEM and non-STEM subjects. Suggesting the STEM disciplines' *instructional design can benefit more from the structuredness offered by learning management systems, allowing instructors to organize course content sequentially*. While non-STEM subjects are more dependent upon instructor facilitation and teaching presence.

The authors found that there was significant difference between the quality of learning between courses that used single assessment versus multiple assessments. However, there was no significant difference between BL and face to face courses when considering these different approaches to assessment. In other words when it came to assessment, the nature of assessment drove the quality of learning not the medium of instruction - BL or face to face.

Conclusions from these Studies

The three studies all show the positive impact of online instruction (inclusive of distance and blended learning) on student learning and achievement, however, there needs to be some caution when weighing up the findings of these meta-analyses. It should not be construed from the review of these meta-analyses that online learning is definitively superior to face to face.

First, this paper only reviews three meta-analyses. Bernard et al. (2014) has listed 13 different meta studies that compare online, blended and distance learning with face to face instruction (two out of the three studies I review are included in Bernard's list). While the three studies in this review, along with the other meta-analyses Bernard examines, all report a positive effect of online learning on student achievement (compared to face to face), Bernard suggest there was evidence of possible bias in 10 out of these 13 studies - biases that are common in many meta-analyses. One bias, for example, is that by focusing on a comparison between online and face to face, two quite different and distinct activities, it becomes difficult to disentangle the different "confounds" of each of the different approaches. Bernard suggests the confounds are problematic from both a philosophical and methodological perspective. The two instructional patterns invariably require different teaching methodologies, depending on the medium of communication used to bridge the distance. If an instructor is held constant (i.e., the same instructor in both conditions), is it likely that this teacher will have equal proficiency in each approach? Even if different instructors are selected based on qualifications relevant to the pattern used, there is a confound with levels of the treatment. Clark (e.g., 1983, 1994) has frequently exposed these flaws, many of which cannot be overcome, even with an impeccable research design. The question always remains, "What makes the difference?"—the distance, the medium, the instructional method, the teacher, or some factors or a complex combination of all or some of these? (Bernard et al. 2014)

So, what can we reliably draw from these studies? There is no doubt the results show that when technology is applied to teaching, either fully online or in a blended mode, this can be effective in fostering student learning. This seems especially the case when you look at different settings, disciplines and time. Over the period of the last 20 years with the expanding use of digital technologies, we have witnessed an increase in learning effectiveness. But is online teaching better than face to face? Well that depends upon what type of face to face instruction is used when the

comparison is made, and this is where the results of these meta-analyses are questionable. Bernard (2014) found that when studies on online learning attribute online as consisting of discussion and collaboration amongst students, and then contrast this with face to face teaching that is described as lecturing or independent work then it is perhaps not surprising that the effect size between online and face to face is quite large (and statistically significant). The findings by Borokhovski, et al. (2012) show collaborative interactions outperforming any use of technology (whether it was face to face or online), so we find that the explanatory factor may not be technology at all but rather, collaboration. The problem of confoundment is further evident from the first study reviewed (Means et al 2013) which showed there was no significant difference in learning outcomes between online and face to face courses that used multi-modal assessment (versus a single mode of assessment).

What Means' (2012) study (and supported by Bernard's critique of meta-analyses) reveals, is what we already know about teaching and learning, and that is it is highly complex and context specific. In particular, when curriculum is carefully and appropriately designed to engage students and encourage them to spend time on learning activities the results are better learning outcomes -whether it is online or face to face. Where online learning leverages on the idea of flexibility in how, when, where, and what students learn, as well as drawing upon the collaborative affordances certain technologies offer – it perhaps comes as no surprise that the impact on student learning is positive. The conclusion that good curriculum design and teaching is needed whether online or face to face seems obvious but can easily be lost in large scale general analyses or a fixation on trying to determine which delivery mode is better.

The generality of meta analyses also have limitations in unpacking how to improve online instruction. By choosing only experimental studies that focus on learning outcomes, at the expense of explaining the processes of online learning (and face to face) the qualitative experience that elaborates the online experience is glaringly absent. So while the meta-analyses provide some encouragement for online learning they are limited in their capacity to understand what and why online learning works. The comparison in many cases leads to an unnecessary denigration of face to face teaching, that when designed as well as what we hope online courses can be designed, can also result in effective learning.

Perhaps the lasting take-away for me is that the two approaches (online and face to face) are different, with each having their own strengths and weaknesses. It would be a mistake to think that one should replicate or replace the other. A more useful analysis instead of comparing which is a more effective means of instruction would be to study what makes each of these approaches in their unique contexts, more effective for student learning.

Additional References

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Saigon South

702 Nguyen Van Linh,
Tan Phong Ward, Dist. 7, HCMC

Hanoi City

Handi Resco Building,
521 Kim Ma, Ba Dinh Dist., Hanoi

www.rmit.edu.vn

P +84 28 3776 1300
E enquiries@rmit.edu.vn

P +84 24 3726 1460
E hanoi.enquiries@rmit.edu.vn