

Trial and Error: Iteratively Improving Research on Blended Learning

D. Christopher Brooks

Jodi R. Sandfort

University of Minnesota

Chapter 9

Research Perspectives in Blended Learning

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As scholars interested in technology enhanced learning, we think it is essential to bring our empirical skills to help us assess and improve teaching innovations. In this chapter, we share our experience developing and studying portable learning objects used in teaching professionals about public policy and management. Specifically, we describe our development of a new generation of learning materials to refresh written teaching cases, a signature pedagogy in public affairs education (Rosenbloom, 1995; Shulman, 2005). Our research examines the impact of using new, multimedia teaching cases rather than traditional, written cases in public and nonprofit management courses. This chapter recounts our conceptualization of the research, our multiple rounds of research with a rigorous design, and results. We illustrate how using appropriate research designs, identifying the proper levels of analysis, and specifying dependent and independent variables often is iterative in blended learning studies.

Teaching and Learning in Public Affairs

The field of public affairs encompasses professional schools of public policy, public administration, and nonprofit management (Lynn 1996) as well as courses focusing on these topics in undergraduate programs in sociology, political science, and social work. In public affairs classrooms, students develop both the analytical abilities to investigate problems and the social skills to navigate nuanced social and political settings to develop or implement solutions.

A number of pedagogies support this multi-faceted learning -- problem-based learning, interactive lecturing, discussion-based teaching, problem-based exercises, and case studies. In contrast to instruction that focuses on the mastery of an academic field, this pedagogical approach often is shaped by inquiry-guided learning (Lee, 2004).

Within this field, there is a long tradition of using teaching cases to deepen classroom learning (Gibson, 2008; Gilmore and Schall, 1996; Rosenbloom, 1995; Yeung, 2007). Teaching

cases often tell a story of a difficult problem, providing written accounts of context-rich settings that enable students to actively grapple with specific organizational settings, complex field relationships, and the ambiguity inherent in public problem solving. Students read the case before class and teachers ask a series of questions about underlying dynamics of the case to stimulate new ideas and connect to other course concepts. These case studies can also provide context for additional course assignments. For example, in the research applications described below, students wrote one-page management memos analyzing a case situation with recommendations about strategic actions to leaders described in the case.

The increasingly low-cost of multimedia content and sharing power of the Internet allows for the enhancement of this traditional pedagogical tool. We began our research by exploring a prototype of that idea focused on creating a decision-forcing teaching case with new media. The particular case assembled multimedia assets--video, audio, hyper-links to live web-sites, PDFs--in a story-line in which students needed to assume the perspective of a nonprofit leader and decide how to best develop a program to combat predatory lending targeting low-income people. After the initial prototype, the e-case was streamlined and rebuilt as part of the Hubert portfolio, a growing collection of multimedia public affairs learning objects. The repository also includes other portable learning objects, including video briefs and curated cases that can be incorporated in face-to-face, blended, or fully on-line courses (see: <http://www.hubertproject.org>). The portability of these materials points to their potential significance for public affairs education and why we conduct research on their impact on student learning.

Initial Research Deployment

When initially exploring the e-case prototype, we employed a quasi-experimental design comparing the relative impact of exposure to the multimedia case with a paper-based case in four

undergraduate and four graduate sections of two management courses ($N = 183$). We gathered data after students experienced both cases through a theoretically-grounded survey instrument that captured key demographic variables and measured five constructs based on Fink's (2003) typology of significant learning experiences: 1) foundational, content recall; 2) application of knowledge and integration of creative & practical problem solving; 3) human dimension of learning about oneself and others; 4) increased interests and new opinions; and 5) learning to learn through inquiry.

For our initial analysis, we tested the null hypotheses that there is no significant difference in responses between students after exposure to written cases and multimedia cases for each construct with simple comparison of means. Failing to reject the null hypotheses would mean that there are no significant differences between our comparison groups; rejecting the null hypotheses would mean there are significant differences observed. From these tests, we have three possible sets of findings: 1) paper and multimedia cases have the same effect on student learning, 2) paper cases have a greater impact than multimedia ones on student learning, and 3) multimedia cases have a greater impact than paper cases on student learning. Our test results were mixed (see Table 1). For the foundational knowledge questions, we rejected the null hypothesis for three of the four items, with exposure to the multimedia case producing the significantly larger results. For the application and integration questions, exposure to the paper case was more significant than the multimedia case for half of the items, with no difference observed for the other half. The results for the human dimension tests were evenly distributed across all three possible outcomes. No significant difference was found between the two case formats in 20% of the increased interest items; the remaining 80% was distributed evenly between paper and multimedia having the larger impact. We failed to reject the null hypothesis

of no difference for any of the questions in the learning how to learn category.

[INSERT TABLE 9.1 HERE]

We have a number of potential explanations for these initial mixed results. First, the multimedia case itself was a prototype in which navigation challenges and content overload could have created easily more barriers to learning than the traditional cases presented in familiar written format. Additionally, there also were other confounding factors including treatment sequencing, instructor experience, and course levels. While we explored the possibility that demographic variation might be responsible for the disruption of a clear pattern of results, the analysis of sex, age, ethnicity, professional experience, and familiarity with using cases studies revealed no systematic patterns. These results did suggest to us, however, that we needed to improve the multimedia case and explore a new research design to control for potential confounding factors.

Modification of Research Design

We rebuilt the prototype multimedia case, streamlining it by presenting content around learning objectives to reduce cognitive overload and to improve visual appeal and navigability. We also reconsidered how to test rigorously our central research question regarding the impact of case modality on student learning. We again employed a quasi-experimental design in three sections of a management course ($N = 60$) using the same instrumentation. This time, however, we used a new research design to correct for the confounding factors identified in the previous trial: students in one section received a written version of the same case content, students in another section received a blended content (written for part A and multimedia for parts B & C), and students in the third section only experienced the multimedia case. This approach afforded the opportunity for us to isolate more carefully the impact of the media, since the content was

consistent across the treatment.

Using a comparison of means, we again tested the null hypotheses that there are no significant differences in item responses based on case format. We failed to reject the null for 97.2% of the items; we rejected the null hypothesis for only one item (from the learning how to learn construct) in favor of the superiority of the multimedia case (see Table 2). We again made comparisons across the aforementioned demographic categories, none of which revealed any systematic patterns in the data. While these results suggest that the multimedia case at least “does no harm” compared to written cases, the results defy our expectations that the digital or blended case treatments should enhance student learning across the five theoretical constructs representing student learning in our instrument.

[INSERT TABLE 9.2 HERE]

Unlike the first trial where implementation challenges of a prototype could likely explain some of the non-findings, our second design controlled some of the confounding factors. We initially considered whether or not our null outcomes resulted not from the intervention, but from our conceptualization of the desired results. While our constructs were well grounded in Fink’s (2003) model of significant learning experience and the model was based on course-level interventions, our assumption that we could use a general idea of course-level learning outcomes to measure precisely the effects of using one learning object now seemed misguided. We asked students to report their learning experiences from a fairly modest intervention, yet the reflective nature of many items may have induced students to consider other or prior aspects of learning experiences in the courses, thereby introducing additional, confounding pieces of information that clouded their responses. Moreover, self-reports about learning tend to be questionable when compared to more evidentiary proxies for learning (e.g. grades). Finally, the instrumentation we

developed simply may be operating at a level of analysis that is insensitive to the impact of the learning object (e.g. case) treatment on student learning. Because of these factors, we focused again on ways to specify outcomes germane to our research question and intent.

Reconceptualizing our Model

We realized other data sources and specification of outcomes might yield more accurate understanding of the differences between how traditional cases and multimedia influence student learning. First, we had student grade information that might overcome many of the limitations of the survey data. Second, by sequencing the cases and written memoranda assignments systematically, we were able to isolate of the impact of the multimedia case treatments: three memo assignments were given in all sections, the second of which included our focal case. Thus, in each section using the multimedia case, the first memo served as the baseline, the second as the treatment, and the third as a posttest; the section using only the paper case was our control. Third, we obtained official demographic and aptitude data from the University's Office of Institutional Research that we matched to student identification numbers. This afforded the opportunity to control for a number of additional factors ignored previously.

We examined grades on the interim assignments connected to the learning objects and tested for differences between men and women, international and domestic students, traditional and non-traditional students, and ethnic divisions. None of these tests revealed a consistent pattern in differences between the various sections in which students used the multimedia case treatment and written paper case control. However, pooled comparisons of all the sections using multimedia cases (e.g. full multimedia case *and* blended content) versus paper cases revealed three interesting patterns (see Figure 1): 1) students receiving the paper controls saw their average memo grades improve steadily in each iteration; 2) students receiving the multimedia

digital treatments saw their average memo grades improve substantially between Memo 1 and Memo 2 before a plateau between Memo 2 and Memo 3; and 3) the significant, but absolute, differences between multimedia and paper students' average grades decreased from 7.77% for Memo 1 to 5.54% for Memo 2 and, finally, to a statistically insignificant difference of 1.93% for Memo 3. These results suggested to us that students were learning how to do the memos better with repeated attempts, but that there may be differences in how they are learning to do the memos depending on the particular form of the learning object.

[INSERT FIGURE 9.1 HERE]

Since our data included measures of *a priori* aptitude (Verbal GRE scores) and sequential grade data (Memo 1 followed by Memo2 followed by Memo3), we employed a structural equation model (SEM) to better understand this process. We hypothesized that a student's memo grade would be predicted significantly by a student's aptitude *and* any memo grades that precede it. The grades for Memo 1 would be partially determined by Verbal GRE scores; the grades for Memo 2 would be influenced by Verbal GRE scores *and* grades for Memo 1; Memo 3 grades would be predicted by Verbal GRE scores *and* the grades for Memos 1 and 2. The first model uses data from the course section where students only experienced the written case (see Table 3). In that section, students' Verbal GRE scores predict significantly all three of their memo grades at approximately the same levels ($b = 0.023$, $b = 0.019$, and $b = 0.025$, respectively). For the second memo, however, the grade for the first memo predicts considerably better than Verbal GRE scores; holding all other factors constant, for every one point increase in the grade for Memo 1, students earn a corresponding increase of 0.562 points on the grade for Memo 2 ($p < .001$). This suggests that while Verbal GRE scores remains a good predictor of performance, the effect of what students learned from their experience and feedback on Memo 1

is about thirty times greater than the impact of their measured aptitude. However, the grades earned on the first two memos do not have a statistically significant impact on the grade students receive on the third memo. Instead, only Verbal GRE scores remains a significant, but consistently weak, predictor of student grades while the student experience of writing case memos fails to inform students' subsequent efforts.

[INSERT TABLE 9.3 HERE]

A different pattern emerges when we use the same SEM to examine data from sections in which students experience the multimedia case treatment. In these sections, students' aptitude does not predict significantly their grades for the first baseline memo. This initial disruption may be attributed to any one of the aforementioned confounding factors, but there is no clear pattern in the data that explains why students in the sections receiving the digital treatments outperformed their paper-case peers on Memo 1. On Memo 2, we obtain a similar result to that of the paper-based case analysis: both students' Verbal GRE scores and Memo 1 grades predict significantly their grades on the second memo, although the effect of the first memo is less than half of its counterpart in the first model. The similarities, however, stop there. Both the first *and* second memos predict significantly student grades for Memo 3, while the impact of student aptitude is reduced both in magnitude and significance. Thus, compared to the model results for the students reading the written case, exposure to multimedia case appears not only to have an enduring, positive impact on student learning as measured by memo grades, but also a disruptive one that allows students to transcend their abilities and outperform our expectations.

Certainly, our attempts to model the relationships between student aptitude and performance with written teaching cases and multimedia cases are anything but definitive. While our evidence suggests that something about using multimedia cases changes the manner in which

students learn, we cannot say anything about whether or not those changes are for the better, how they happen, or why they happen without better measures and more rigorous research designs.

They do allow, however, these types of questions to come into clearer focus for our ongoing for research.

Implications for Blended Learning Research

This account also suggests some implications for other scholars committed to using research to shape ongoing development of blended learning. It highlights that conducting research on the consequences of blended learning treatments is difficult, especially when under the field-conditions of live courses where the ability to control for confounding factors is limited. While some researchers may initially realize appropriate research designs, proper levels of analysis, and effective instrumentation to capture variables of interest, it is more likely that research teams will confront numerous obstacles. We should follow the lead of instructors, instructional designers, and learning object creators who know that knowledge about blending learning is gleaned iteratively and cumulatively. As researchers, we must be able to begin, implement quickly, evaluate, and adjust. We must be willing to consider the strengths and limitations of previous attempts and respond creatively with tighter controls, better designs, and more precise measures. Such persistence improves our understanding of the impact of blended approaches on student learning and helps assure that further iterations of tools are informed by scientific inquiry.

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