Multimedia Management Teaching Case Impacts on Student Learning

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Abstract

This paper reports on two field trials that compare the impact of a traditional written teaching case and a multimedia enhanced case in public affairs classrooms on general student learning outcomes. Because of their contextual richness and decision-making format, teaching cases have become a signature pedagogy within public affairs. However, little empirical research has explored the use of them in the public affairs classroom or considered how different forms influence students' reported learning. By engaging with the larger body of literature in teaching and learning, describing the development and use of a new teaching tool, and providing results from two field trials, this paper moves us towards more research-based teaching innovation in public affairs.

Preparing public affairs students to lead in today's political and economic climate is no simple feat. Professionals must analyze emergent phenomenon with often limited information, assess the perspectives of various stakeholders, build coalitions across sectors or fields, and develop, implement, and adjust action plans as events unfold. They do so with significantly limited resources and often significant public scrutiny. While public affairs education is critically important, many instructors are not aware of advances in the scholarship of teaching and learning relevant to professional education. Nor do they apply this knowledge in classroom. However, there are positive developments that suggest ways to rectify this situation; in the last generation, many public affairs instructors have moved away from textbooks and didactic lectures as the primary means of teaching (Ginn & Hammond 2012, Silvia 2012, Witesman 2012). An array of pedagogical techniques, including team assignments, workshop projects, and analytical teaching cases are used to broaden learning and improve student engagement.

Yet, today's students also interact with an array of digital content. Accessible videos, blogs, other forms of social media form the backdrop for any professional experience and are necessary organizational where they will work in the future (Mergel 2012). This new technological environment also provides more opportunities for altering *how* we teach, moving us closer to creating and reinforcing the professional competencies the field now requires of our graduates (Blomgren, et al. 2008, Schweick, et al. 2011).

While videos and podcasts of current events abound, content focused on the daily operations of public organizations, policy making processes, or management decision-making is not easily found in the public domain. The rise of the open educational resource movement points to a strategy for overcoming this limitation and creating a means by which public affairs scholars can create and share this type of content (Seely Brown & Adler 2008, Atkins et al. 2007,

Carey & Hanley 2010); in the last ten years, national foundations have seeded and supported a new culture of contribution within higher education (Hess & Ostrom 2007) . One central part was the growth of teaching and learning resources within the public domain where free use or repurposing by others is permitted (Lessig 2001). In this paper, we present research relevant to public affairs education's participation in this new direction. We analyze results of implementation of a digital learning material, specifically e-cases, held in our field's first collection of open educational resources.

Within public affairs, there is a long tradition of creating written teaching cases to enhance classroom instruction, particularly in topics such as management strategy, ethics, and policy implementation (Rosenbloom 1995, Gibson 2008, Jain 2005, Thacher 2006, Robyn 1998, Harney & Krauskopf 2003). In our project, we have built a new generation of e-cases using multimedia content which helps to bring the content to life through videos of key actors, hyper-linking to web resources, and presentation of relevant documents. By sharing the story through source materials, the case can be experience without the simplification required by the traditional, written format (Spicer & Husock 2000). Our empirical evidence in this paper comes from two field studies. In both, we started by considering how a well regarded taxonomy of learning outcomes (Fink 2003) applies to learning in the public affairs classroom. In both trials, we used a quasi-experimental design. However, the results of both studies are inconclusive and raise additional questions about outcome specification and larger replication. We share them because of our commitment to rigorous research about teaching and learning within our field and to invite others to engage with us in this endeavor. Before turning to the study designs and results, we would like to provide the intellectual context for this study. Lessons from both the use of cases in public affairs and evolving research about technology enhanced learning

informed our efforts. Additionally, we will briefly describe the larger, open educational resource platform, the Hubert project, which provides a robust container for the development and refinement of effective public affairs teaching materials.

RELEVANT RESEARCH

In public affairs classrooms, instructors often want students to develop both analytical abilities for investigating problems and social skills for navigating nuanced social and political settings. This is complex learning, as it demands they integrate knowledge, skills and attitudes, and transfer this integration to problem solving (van Merrienboer, et al. 2003). A number of potential pedagogies do support this development – problem-based exercises, interactive lecturing, discussion-based teaching, and case studies. Rather than instruction focused on the mastery of an academic field, this approach to professional education is shaped by inquiry-guided learning (Lee 2004). Teaching through inquiry methods involves active exploration and investigation of complex questions and problems by students and is historically tied to the pioneering work of American educational philosopher John Dewey (1910). In other fields, such as medicine (Gallagher-Lepak, et al. 2009, Hawiuns, et al. 2004, Sandars & Langlois 2006, Kumta, et al. 2003) and education (Bruce & Reynolds 2009, McCrary & Mazur 2010), instructors have used multimedia content to bolster this type of learning because it is documented to improve professional skill and performance.

Case-Based Education in Public Affairs. There is a long tradition within public affairs of using teaching cases for inquiry-guided learning (Gibson, 2008; Gilmore & Schall, 1996; Rosenbloom, 1995; Yeung, 2007). Teaching cases often tell a story of a knotty 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. They are focused on uncovering the art of strategic action rather than scientific

exploration of causation.

As Yeung (2007) describes, Harvard began to first use cases in 1919 and, during the

interwar years, the Inter-University Case Program became an important venue for management

training of all type. Instead of presenting idealized public organizations or idealizing scientific

management, the cases left the blemishes intact and presented situations that were political,

irrational, and deeply contextual. The goal of the cases was explicitly to teach decision-making

skills, or, as Yeung (2007: 555) concludes from his close analysis of that point in history, "The

case study offered the public administration student a chance to vicariously live the life of an

actual public administrator." Throughout the 1960s and 70s, case books continued to proliferate

(Rosenbloom 1995). Yet, the use of cases also was challenged with the advent of public policy

schools that replaced many public administration programs at leading universities until a focus

on public and nonprofit management could be established (Lynn 1996). In fact, teaching cases

now are regarded as a "signature pedagogy" of public affairs professional education because of

the wide recognition that, as a technique, they prepare students for professional work. As

Shulman (2005: 55) who as president of the Carnegie Foundation for the Advancement of

Teaching expressed, "signature pedagogies simplify the dauntingly complex challenges of

professional education because once they are learned and internalized, we don't have to think

about them; we can think with them." In public affairs, case studies are used for teaching because

they orient students to engaged learning about significant issues. While case books continued to

be published, the advent of internet enabled these curricular tools to be archived and shared for a fee.[1]

Proponents claim cases and other active learning methods used in public affairs improve professionals' learning (Gibson 2008, Rivenbark 2007, Harney & Krauskopf 2003, Kenney 2001, Robyn 1998, Gilmore & Schall 1996, Spicer & Husock 2000), enabling them to integrate, apply, and test general knowledge in ways other pedagogies – such as didactic lectures – do not. However, empirical investigations of such claims in public affairs continue to be virtually non-existent. The project reported on t his paper is one small step towards another practice, using and contributing to research about the processes of professional teaching and learning.

Scholarship of Technology Enhanced Learning. Over the last thirty years, a large body of scholarship has developed exploring the means and results of technology enhanced learning. While significant portions of this research focuses in K-12 education (Means, et al 2009; National Research Council 2000) and the mechanics of instructional design (Hokanson & Miller 2009), increasing scholarship also considers technology enhanced learning in higher education. Scholars have spent considerable time asking the fundamental question – how do learning outcomes in fully online or blended courses compare to face-to-face traditional classrooms? (Means, et al. 2009, Bernard, et al. 2009, Machtmes & Asher 2000). While the results of these studies and meta-studies point to modest, positive effects of technology enhanced learning, the proliferation of technology and widespread use of information communication technologies in all aspects of life, are making such a macro-question less relevant. Experts are increasingly

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[1] See the Electronic Hallway (http://www.hallway.org) at the University of Washington's Evans School, the case program at the Kennedy School of Government (http://www.case.hks.harvard.edu/), The Syracuse University's Maxwell Schools' e-PARCC (http://www.maxwell.syr.edu/parc/eparc/) sponsors case competitions and shares winning contributions for free.

encouraging future research to consider how to improve technology enhanced learning, regardless of the format of the course (Bernard, et al. 2009, Means, et al. 2009, Tamim et al. 2011). They also point out that initial conceptions in these studies may have been incorrect by emphasizing transmission of content and cognitive gains instead of a more recent understanding that technology enhanced learning is better suited to supporting active learning and connection between ideas (Cognition and Technology Group at Vanderbilt, 1996)

The research we have pursued in this paper explicitly takes a *design based research* approach (Wang & Hannafin 2005, Collins 1990, Miller & Miller 2000). In the scientific study of teaching and learning, this approach has gained prominence because it helps to improve understanding of conditions in classrooms, with all their complexity, rather than isolated lab conditions. This work is like others in that our efforts are focused on improving how learning environments that encourage collaboration, problem solving, and reflective practice can be fostered (Brown 1992, Thomas & Brown 2011, Conner & Clawson 2004). While digitally enhanced learning tools like e-cases can be designed, the social dimensions of course-based learning are also important. Learner-learner interaction, faculty facilitation of classroom discussion, and emotional engagement are all important dimensions that shape learning processes and results (Lee & Gibson 2003, Gibson 2005). While students may well be enthusiastic about use of more dynamic and interactive tools, this scholarship suggests faculty must create structures that incentivize engagement, for example by tying assignments to the multimedia content, and encourage time to be invested. Without these basic elements – social interaction, appropriate incentives, and adequate time – even the most artfully crafted multimedia learning object will have little impact (Salmon & Jones 2004, Fink 2003, National Research Council

2000). While the tools might change, the basic parameters of teaching to promote learning remain the same.

A NEW PLATFORM FOR DEVELOPING AND SHARING E-CASES

In 2011, the Hubert project was started as a pilot program of the Humphrey School of Public Affairs at the University of Minnesota; it is focused on building professional effectiveness in public affairs by connecting educators through the creation and exchange of engaging teaching materials that enhance student learning. The pilot initial phase focused on establishing the proof of concept; the development team and other authors created 25 learning materials and built out the technical functionality of an open access repository which allows them to be shared. Beyond e-cases, the repository also includes other materials, including video briefs and curated cases, all of which can be incorporated in traditional classrooms, as well as blended or fully on-line courses (see: http://www.hubertproject.org). The materials are held in an indexed database which allows users to find and access products for their own courses and training programs; each is accompanied by the usage note and can be downloaded and used in any course management software program. The portability of these materials and the ability of faculty to use them to teach whatever content in relevant in their own curriculum points to their potential significance for public affairs education

A new concept in the public affairs education space just eighteen months ago, the Hubert Project's multimedia learning tools – e-Cases in particular – have been strongly received by educators and trainers the community. To ensure the long-term success and use of learning materials, Hubert has mapped it's growth to academic standards of the three major accrediting boards of public affairs educational institutions: the National Association of Schools of Public

Affairs and Administration (NASPAA), the Association of Professional Schools of International

Affairs (APSIA), and the Association of Collegiate Schools of Planning (ACSP). Such an

alignment ensures that the potential audience for these materials are students at 280 different

schools of public affairs. The Project's theory of change is built upon a few assumptions. First,

that public affairs students and professionals deserve and now expect engaging, relevant and

rigorous learning materials to be used in their education. Secondly, that considerable untapped

knowledge about effective public affairs practice exists in the field which should be captured in

the materials and used to enhance traditional academic content. Finally, that by building an open

access repository, the collection is able to scale more quickly and affordably.

The research reported on here was undertaken to inform the development of this

collection. Using protocols and open-source templates, contributors can develop their products in

significantly less time, thereby overcoming a limitation created by too little structure in the

material development process (Roschelle & Kaput 1996).   In our development process, we have

drawn significantly from research, including studies examining content design (Hokanson &

Hooper 2004) and scaffolding (van Merrienboer, et al. 2003), media format (Greenfield 1984,

McCrary & Mazur 2010), and the potential pitfalls of cognitive overload (Mayer & Moreno

2003, Mayer 1997, Paas, et al. 2003). While others have noted the potential benefit of the

information availability in presenting multimedia cases (Spicer & Husock 2000, O'Connell, et al.

2004), many specific design choices need to be considered. Materials that support the complex

learning needed in public affairs must be research based. Further refinements also need to be

grounded in design based research such as that undertaken in this study.

FIRST FIELD TEST

As mentioned earlier, to date, we have conducted two field studies examining the impact of e-cases on student learning. In the first iteration, we employed a quasi-experimental design in four undergraduate and four graduate sections of two management courses (N = 183, see Appendix A for demographic information). We considered the exploratory question of how learning outcomes generated by a traditional written teaching case compared to a multimedia enhanced teaching case. To explore this question, we surveyed students enrolled in the fall sections of an under-graduate course in nonprofit management and a graduate general management course, both in the public affairs program at the same university.

Our theoretically-grounded survey instrument 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 each, we created four to five survey items to capture the construct and did factor analysis to assure construct validity. This focus on general learning outcomes followed a cognitive approach (Bloom 1956) and resembled a study conducted by Bocker (1987) that explored whether or not case-based teaching (traditional written cases) develops abilities to reproduce knowledge and skills better than lecture-based teaching in business administration. Our survey also taped other relevant descriptive factors including age, ethnicity, gender, years of experience, familiarity to content, and motivation to engage (Böcker 1987, Finney & Pyke 2008). Surveys were also completed by each of the instructors to investigate their professional experience, opinions, and facilitation

practices because of the essential role they play in using these teaching tools in the classroom (Argyris 1980).

We deployed a multimedia, e-case in all sections of the courses. The particular e-case used in this study focuses on a nonprofit organization's response to the emergence of predatory lending practices around federal and state tax returns disproportionately targeting low-income citizens. In the case, the agency develops an alternative financial product to provide convenient tax refunds without predatory interest rates. There are a number of reasons why this particular case is interesting: it mirrors an institutional reality in which many public affairs students will be employed, namely a small nonprofit organizations; it highlights programmatic innovation that responds to an unfair, market practice; it focuses on issues related to poverty and market exploitation; and successful navigation of the situation requires both management and leadership skills focusing within the organization and on the external relationships. Overall, research has suggested that case relevance is particularly important in student motivation (Finney & Pyke 2008).

The e-case assembles multimedia assets – video, audio, photographs, hyper-links to live web-sites, pdfs – in a story-line with particular decision points. After learning about the policy challenge, students assumes the perspective of the nonprofit executive director and makes decisions about how to best develop a program to respond to it, given a series of constraints experienced in actual practice. The students navigate through four modules that describe different dimensions of the management and leadership challenges: defining the problem; assembling resources to solve it; building political will with board and staff; implementing initial program ideas; evaluating and refining the pilot program. Throughout, students interact with media showcasing different stakeholders, such as funders, financial partners, staff, board

members, and clients. They confront choices about what actions to pursue and capture

qualitative ideas in text boxes before moving down one of the possible decision-tree branches

where different media is highlighted depending on their choice. While this structure simulates

actual decision-making, where there are consequences of actions, this first case was developed

without much visual appeal. It was a proof of concept e-case developed within Moodle course

management software because of its ability to allow for the branching.

For this first field test, we identified a comparison written case in each course which

generally aligned with learning objectives of the multimedia case. These objectives included:

appreciating the role of nonprofits in public policy implementation, increasing one's abilities to

define and analyze problems in complex fields, and sponsoring program development and

expansion. As part of the course assignments, students wrote course analytical memo

assignments about the material in both the multimedia and traditional case helping to assure

comparable student motivation for understanding the content of each.

Although this first test was very exploratory, we did establish a number of propositions to

guide our inquiry. We looked at each dimension of learning outcomes – foundational

knowledge, application & integration, human dimension, interest, and learning how to learn –

and posited that the multimedia form would more effectively influence each. We thought e-

cases would be particularly impactful for indicators of human dimension and interest because

prior research suggested that multimedia format made material more immediate for students

(Spicer & Husock 2000). However, we were very conscious that the rough format of this initial

e-case might prompt cognitive overload or frustration among students.

Initial Results. For our initial analysis, we tested the null hypotheses that there was no

significant difference after exposure to the written and multimedia case for each learning

dimension with simple comparison of means. The results of our tests were mixed (see Table 1).

For the foundational knowledge questions, we rejected the null for three of the four items, with

exposure to the multimedia case producing significantly larger results. For the application and

integration questions, however, exposure to the paper case was more significant than the

multimedia case for half of the items, with no difference 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 cases formats in 20% of the increased interest items; the

remaining 80% was distributed evenly between paper and multimedia having the larger impact.

And, we failed to reject the null hypothesis of no difference for all questions in the learning how

to learn category.

Table 1: Categorical Distribution of Results of Difference of Means Tests in Initial Field test			
	Paper > multimedia	Paper = Multimedia	Digital > multimedia
Foundational Knowledge	0.0%	25.0%	75.0%
Application and Integration	50.0%	50.0%	0.0%
Human Dimensions	33.3%	33.3%	33.3%
Increased Interest	40.0%	20.0%	40.0%
Learning How to Learn	0.0%	100.0%	0.0%
TOTAL	26.1%	39.1%	34.8%

There were a number of potential reasons for these initial mixed results. For one, the multimedia

case itself was a prototype in which navigation challenges and content overload could have

easily created more barriers to learning than the comparison, traditional cases presented in

familiar written format. Additionally, there were also 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 these factors revealed no systematic patterns. These results did suggest to us, however, that we would benefit from continuing to improve the multimedia case, itself, and explore a new research design to control for potential confounding factors.

MODIFICATION OF RESEARCH DESIGN AND SECOND FIELD TEST

After the initial prototype, the e-case was streamlined and rebuilt, as part of the development of a larger Hubert portfolio. We began to conceptualize our efforts as part of the movement to design based research and grounded the work more directly in the scholarship of teaching and learning. Using a new development process and standardized templates, we streamlined the case considerably and improved navigability, more consciously scaffolding content to mitigate cognitive overload (Mayer & Moreno 2003, Mayer 1997, Paas, et al. 2003). We also improved visual appeal and reduced the number of decision-choices.

We then considered how to rigorously test our central research question comparing student learning outcomes between traditional written cases and multimedia e-cases. We decided to focus our investigation in graduate courses and included three sections of a management course in our study (N=60, see Appendix A for demographic information). In an attempt to correct for some confounding factors in the previous trial, we did not use a implemented a nonequivalent control groups research design: 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. The instructors across these sections were all experienced and employed similar, facilitative styles in the classroom. Again, all students in these sections wrote a course analytical memo assignment related to case material and faculty evaluation was done with a standard grading rubric. We hoped such an approach afforded the opportunity to isolate more carefully the impact of media format, as the content was consistent across the treatment (O'Connell, et al. 2004).

In this field test, we used the same survey where learning outcomes are reflected by six constructs. Have dealt with a number of design and implementation issues, we felt more confident in our propositions that the multimedia format would be more effective at influencing most dimensions. However, the construct of foundational knowledge really taps students abilities' to recall facts; in this design, we were unsure if the multimedia format would have a positive effect, since many graduate students are highly skilled at recalling written details and the audio and video multimedia content is more fleeting. However, we did continue to support the proposition that the e-case would be particularly impactful for indicators of application & integration, human dimensions, and interest because of the realistic and nuanced content.

Initial Results. Using a comparison of means, we again tested the null hypotheses that there are no significant differences in item responses based on case format. Yet, in this trial, we failed to reject the null for 97.2% of the items; for only one item (from the learning how to learn construct) did we reject the null in favor of the superiority of the multimedia case (see Table 2). This result was surprising, particularly because we had not developed a well-formed proposition of how the media format would impact the learning to learn construct. After utilizing various controls and testing for other potentially biases, we realized that no clear pattern in our results

could be identified. While these findings suggested the multimedia case at least "does no harm" compared to written cases, they clearly defied our expectations that the digital or blended case treatments should enhance student learning across the five theoretical constructs representing student learning in our survey.

Table 2: Categorical Distribution of Results of Difference of Means Tests for Second Field test			
	Paper > multimedia	Paper = multimedia	Paper < multimedia
Foundational Knowledge	0.0%	100.0%	0.0%
Application and Integration	0.0%	100.0%	0.0%
Human Dimensions	0.0%	100.0%	0.0%
Increased Interest	0.0%	100.0%	0.0%
Learning How to Learn	0.0%	75.0%	25.0%
TOTAL	0.0%	97.2%	2.8%

These results led us to consider whether or not our null findings resulted not from the intervention, but instead from our conceptualization of the desired results. Our constructs were well-grounded in cognitive outcomes (Fink 2003, Bloom 1956), the conception of realizing changes in these outcomes came through repeat exposure to materials throughout a whole course. Our assumption that we could use this concept of course-level learning outcome to identify the effects of one learning object now seemed misguided. For one, students were being asked to report on their learning experiences from a fairly modest intervention. Students reasonably may have considered prior aspects of the course learning experiences, thereby introducing additional, confounding pieces of information and cloud their responses. Secondly, it is quite likely the survey may be operating at a level of analysis that is insensitive to the impact of the learning

object (e.g. case) treatment. Because of these factors, we focused again on ways to specify outcomes germane to our research question and intent.

Reconceptualizing our Model. As we thought more systematically, we realized other outcome specification might yield more accurate understanding of the differences between written and multimedia cases influence student learning. For one, we realized that we had student grade information that might overcome many of the limitations of the survey data. In the course where our research was carried out, sequencing of the cases and written memoranda assignments lent itself to isolating the impact of the multimedia case treatments. Specifically, three memo assignments were given in all sections, the second one of which was based on information from 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. Additionally, we obtained official demographic and aptitude data that enabled us to control for a host of additional factors in our model.

We first began to examine grades on the interim assignments connected to the learning objects. We pooled comparisons of all the sections using multimedia cases[2] versus the written, paper case and uncovered three interesting patterns (see Figure 1). First, for students in the class experiencing the traditional written case, their average memo grades improved steadily over time. In

Figure 1: Differences of Means Tests of Student Grades, Paper versus Digital

	Memo 1***	Memo 2***	Memo 3
Paper	80.77%	85.70%	90.07%
Digital	88.54%	91.24%	92.00%

■ Paper ■ Digital

***p < .001

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[2] e.g. full multimedia case *and* treatment where students read the first segment and experienced multimedia content for two additional segments.
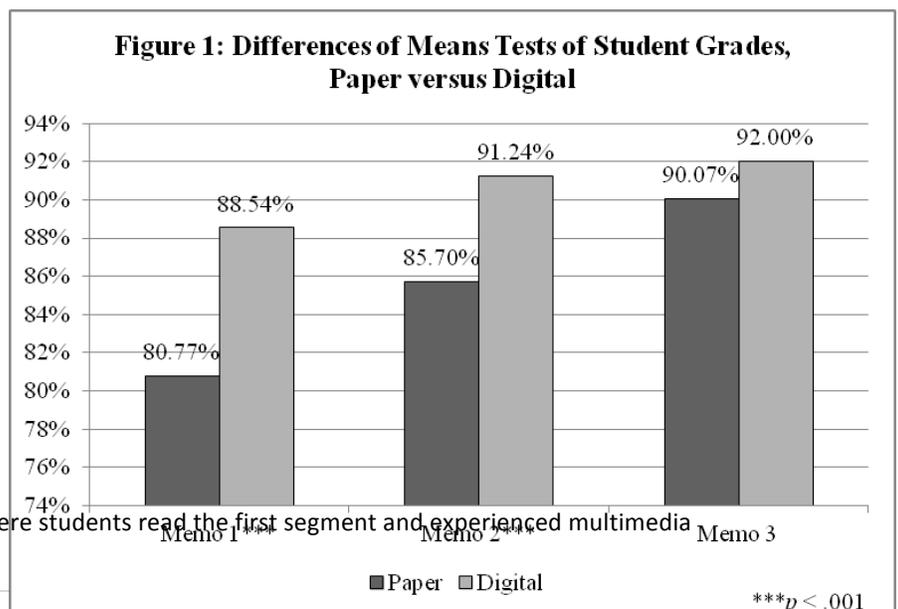
contrast, students exposed to the multimedia case saw their average memo grades improve substantially between Memo 1 and Memo 2 before plateauing on Memo3. Additionally, there was a significant, but absolute, difference between the treatment sections, with students' average grades differences decreasing 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. While these results were not unexpected in that students were learning how to do the memos better with repeated attempts, they suggested to us differences in learning processes depending on the particular form of the learning object.

To examine this process in more detail, we employed a structural equation model (SEM) for the paper and multimedia cases using students' Verbal GRE scores as a measure of *a priori* aptitude that could be regressed onto the memo grades in the order in which they the assigned (see Table 3).[3] The first model uses data from the course section where students only experienced the written case. 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, what students learned from their experience and feedback on Memo 1 is about thirty times greater than the impact of their measured aptitude. Yet, grades earned on the first two memos did not have a statistically significant impact on the third memo grade; only Verbal GRE scores remains a significant, but consistently weak, predictor of student grades.

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[3] We also had tested the standard demographic data gathered on the survey and found no discernible pattern.

A different pattern emerges, however, when we use the same SEM to examine data from sections in which student experience the multimedia case treatment. In these sections, students' aptitude does not predict significantly their grades for the first baseline memo. On Memo 2, we obtain a similar result to that of the paper-based one analysis: both students' Verbal GRE scores

Structural Model	Variables	Model 1: Paper	Model 2: Multimedia
Memo1	Verbal GRE	0.023* (0.010)	0.010 (0.012)
	Constant	69.535*** (5.617)	82.775*** (6.707)
Memo 2	Verbal GRE	0.019* (0.009)	0.021*** (0.006)
	Memo1	0.562*** (0.154)	0.259*** (0.074)
	Constant	31.572** (11.538)	56.298*** (7.029)
Memo 3	Verbal GRE	0.025*** (0.006)	-0.003 (0.006)
	Memo 1	0.052 (0.122)	0.236** (0.081)
	Memo2	0.097 (0.129)	0.615*** (0.142)
	Constant	64.973*** (8.380)	16.613 (10.526)
Variance	Error Memo 1	35.801 (10.335)	45.714 (9.430)
	Error Memo 2	20.454 (5.905)	11.839 (2.442)
	Error Memo 3	8.224 (2.374)	11.226 (2.316)
Log Likelihood		-355.409	-680.639
N		24	47

Table 3. Structural Equation Model of Verbal GRE Scores and Prior Memo Grades as Predictors of Memo Grades

NOTE: Cell entries are regression coefficients with standard errors (in parentheses).
*$p < .05$; **$p < .01$; ***$p < .001$

and Memo 1 grades predict significantly their grades on the second memo, although the effect of the first memo is less than 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 appear not only to have an enduring, positive impact on student learning but a disruptive one that allows students to transcend their abilities and outperform our expectations.

Certainly, our attempt to model the relationships between student aptitude and learning outcomes in relation to written teaching cases and multimedia e-cases cases is anything but definitive. While this 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 at this point.

IMPLICATIONS & NEXT STEPS

Our account of this research project suggests some implications for scholars committed using research to shape ongoing development of teaching innovation. First, while the field has moved from laboratory studies of cognitive impact, research about live courses introduces more challenges in controlling for confounding factors. While scholars may initially land on appropriate research designs, proper levels of analysis, and effective instrumentation to capture variables of interest, it is more likely that research teams must approach these efforts with a more exploratory mindset. Researchers must follow the lead of instructors, instructional designers, and content creators who know that learning about blending learning is iterative. As researchers, we must be able to design approaches, implement quickly, assess initial results, and adjust, in a way more akin to ethnographers or action researchers. We must be willing to consider the strengths and limitations of previous attempts and respond creatively with tighter controls, better

designs, and measures. Such persistence improves our understanding of the consequence of technology enhanced learning materials on student learning and helps assure that further iterations are informed by scientific inquiry.

Secondly, while technology enhanced learning can impact student outcomes, it is also transforming how and what instructors teach. In an initiative like the Hubert project, research should inform the design of learning materials (Miller & Miller 2000, Collins 1990, Wang & Hannafin 2005). But it should also help to illuminate teaching and learning processes so that instructors can maximize the impact of technology-enhanced content with their own actions and choices.

We are grounding Hubert e-cases development in what we have learned from the emerging scholarship, these field trials, and our ongoing usability studies on individual projects. We are establishing practical goals for theory development in our field bereft of empirical investigations of teaching and learning processes. We have also created the technological and collaborative platform to support the share of these materials in the tradition of other open educational resource collections (Caren & Hanley 2010, David 2010). Most significantly, we are committed to continuing to conduct research about e-case use, to inform our process of learning material development and our support of instructors who are using these materials to improve learning results among public affairs students. We are building future examinations to consider student learning in the context of a larger initiative also focused on supporting faculty development, as they work to learn and share knowledge about technology enhanced education in public affairs (Gibson 2005). Our research team is currently developing a more comprehensive research design to further explore these issues and seeking funding from the Cyberlearning initiative at the National Science Foundation. With this approach, we hope to

continue to bolster our understanding of the learning process and outcomes associated with

digitally enhanced learning materials in public affairs.

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Appendix A

Table A1: Demographics of students surveyed in first trial

	PA 4101~	PA 5011	Min	Max
Sex (Female = 1)	0.68 (0.47)	0.61 (0.49)	0	1
Age (Years)	23.15 (5.10)	26.69 (3.03)	19	51
Ethnicity (White = 1)	0.86 (0.35)	0.80 (0.40)	0	1
Experience	1.96 (1.31)	2.21 (0.90)	1	5
Familiarity	3.03 (0.96)	2.87 (0.82)	1	4
N	78	105		
NOTE: Cell entries are means with standard deviations in parentheses.				

~undergraduate management course

Table A2: Demographics of students surveyed in second trial

	Paper	Blended	E-Case
Sex (Female = 1)	0.47 (0.51)	0.77 (0.43)	0.37 (0.50)
Age (Years)	27.63 (4.67)	26.43 (4.43)	28.26 (3.56)
Ethnicity (White = 1)	0.74 (0.45)	0.73 (0.46)	0.58 (0.51)
Experience	2.47 (1.12)	2.36 (0.90)	2.95 (1.08)
Familiarity	2.11 (0.81)	2.41 (0.85)	2.32 (0.95)
N	19	22	19
NOTE: Cell entries are means with standard deviations in parentheses.			