A TALE OF THREE CLASSES: CASE STUDIES IN COURSE COMPLEXITY

T. Grandon Gill and Joni Jones, IS&DS Dept., University of South Florida, Tampa FL 33620
ggill@cobal.usf.edu, jjones@coba.usf.edu, 813-974-6749

INTRODUCTION

Pedagogical research is unusual within business academic research areas in that nearly all the researchers are also practitioners, which is to say we teach as well as research teaching. For this reason, our interest in the answers to our research questions is personal as well as professional. Will our distance learning teaching be as effective as face-to-face techniques? Is the case method really more effective than lecture? Should we allow laptops in the classroom? The number of questions we might pose knows no bounds.

No one would dispute that our research on teaching and learning will be challenging. After all, there are many variables that must be considered. Who would dare argue, for example, that factors such as the experience of the instructor, the nature of the students, the form of content being presented, the method of delivery and the setting of the class are irrelevant to learning? Nonetheless, we often find that in causal relationships that involve many variables, the individual effects of specific factors can be teased out using techniques such as regression or structural equation modeling (SEM). In such cases, the underlying process can be described as nearly decomposable [4]. On the other hand, sometimes the interrelationship between variables is so great that such decomposition is impossible. In such cases, we term the relationship complex. Where such complexity exists, we may need to rethink our research strategy, since how a particular variable impacts effectiveness will be situation dependent.

The present paper considers the question of decomposability of teaching situations by presenting three case studies of MIS courses. We believe the cases themselves to be intrinsically interesting—all three illustrate innovative teaching techniques (2 of the 3 were first place winners of DSI's Innovative Curriculum Competition) and all demonstrated substantial evidence of learning and student satisfaction. We also find, however, that by comparing the three cases side-by-side we gain considerable insight into the complexity of the relationship between teaching approach and outcome; a relationship that we find to be quite complex.

ISM3232.A

Ism3232.A (Business Application Development) was an introductory programming course that was taught at a large U.S. research institution by Instructor A. The students in the course were generally undergraduate MIS majors and minors, although some graduate students took the course each year to meet the programming prerequisites of the department's MS-MIS degree. The course's innovative design (winning DSI's Innovative Curriculum Competition in 2007 as well as the university's excellence in undergraduate teach award that same year) included:

- A fully self-paced design with all assignments being due on the last Friday of the semester.
- Optional class attendance.
- Online content that included lectures, readings and assignments, all with embedded self-tests that fed into Blackboard, the university's course management system.

- A progress monitoring system allowing students to submit weekly status reports (check-ins) for credit that were then consolidated into weekly reports sent to each student by email.
- A grading system based entirely upon weekly check-ins and assignment scores, using a validation approach originally patterned after submarine training [2].

When these were instituted, in Fall 2006, a dramatic improvement in virtually every aspect of course performance was observed, as shown in Table 1. These benefits persisted through the year that followed. In Summer 2007, for example, retention was 100%--a first in the history of the course. In Fall 2007, overall course evaluation scores reached 4.89—also a course record.

Table 1: Results of Fall 2006 change to Ism3232.A

	Fall 2006	Spring 2006	Fall 2005	Spring 2005	Fall 2004	Spring 2004
Overall Evaluation (1=Poor, 5=Excellent)	**4.53**	3.94	4.13	3.38	3.88	4.00
Students Enrolled	**71**	70	77	86	82	91
Students Surveyed	**41**	28	34	39	36	34
Retention (% of A, B and C grades for combined sections)	**72%**	63%	61%	52%	61%	56%
Missing student % – Percent of students accumulating no points	**1%**	11%	13%	9%	10%	11%
Average grades of retained students (not DWF)	**3.27**	3.32	2.90	3.06	3.14	2.50
Average points accumulated (out of 1000) of students surveyed	**703**	725	640	713	681	585
Satisfaction with type of assignments (1=very dissatisfied, 5=very satisfied)	**4.00**	3.85	3.50	3.38	3.30	3.37
Satisfaction with multimedia content (1=very dissatisfied, 5=very satisfied)	**4.63**	4.25	3.78	3.75	3.75	3.66
Self-paced format (1=not helpful at all, 3=moderate help, 5=extremely helpful)	**3.78**	N/A (survey inst. error)	3.20	2.53	3.00	2.80

ISM3232.B

As Ism3232.A evolved and MIS enrollments plummeted, Instructor A had become the only faculty member teaching the course. By Fall 2006, it had become a high priority of the incoming department chair to ensure faculty redundancy for all required classes. Thus, he had requested that Instructor B teach a section of Ism3232 in Fall 2007. The two instructors presented a strong contrast. Whereas Instructor A was a tenured associate professor who had taught programming for nearly 20 years and had also programmed commercially, Instructor B was an untenured assistant professor with a strong research record who had joined the department in 2003. Although she had a substantial breadth of experience in teaching MIS-related classes, both at the university and prior to receiving her doctorate, Ism3232 was to be her first programming class. Also, she had never programmed commercially, although she had created a large application using the C++ programming language as part of her dissertation. To help her prepare for the course, she sat in on Ism3232.A during the Spring 2007 semester. Although Instructor A encouraged her to use all the materials that he had created, she felt uncomfortable doing so. In an email to Instructor A, she stated:

> I discovered that the current structure was not in line with my teaching style and philosophy…My teaching style is active and interactive. Although, the current course was active, I needed a more structured set of interactions with the students.

As a consequence of these feelings, she decided that she would redesign her section of the course to fit her own personal style.

Ims3232.B Course Design

In developing her own version of Ism3232, Instructor B incorporated a mixture of elements, some quite traditional, some quite innovative. On the traditional side, she chose to use an established textbook [1], administer both midterm and final examinations (accounting for 40% of each student's grade), and enforce a strict set of deadlines for student work. On the innovative side, nearly all instruction was conducted in a lab setting. Lab sessions would begin with a short lecture, followed by a programming activity. During the programming activity phase, students would individually complete problems provided at the end of each chapter of the textbook. Although the students knew in advance what chapter would be discussed, they did not know what problems would be assigned. Moreover, by about the third week of class—according to Instructor B—students determined that they needed to study the assigned chapter in advance of coming to class if they were to have any chance of completing the activity. Each lab was graded and the student's top 10 grades from the 12 sessions represented 60% of their final grade.

For purposes of comparison, the lab exercises in Ism3232.B were very different from the programming projects employed in Ism3232.A. Whereas a typical Ism3232.A project could take 3-6 weeks for a student to complete and involve the student writing several hundred lines of code (in addition to the hundreds or, in one case, thousands of lines provided by Instructor A), a typical Ism3232.B lab assignment—which normally needed to be completed in under 2 hours—would rarely exceed a hundred lines of student-authored code. While Ism3232.A focused on completing 3-4 projects the Ism3232.B labs required students to complete 19 applications during the course of the semester. The core objectives of the two courses also differed slightly. Since this was an introductory programming course Instructor B's primary objective was to teach the core constructs of object-oriented programming. Namely, variables, memory concepts, algorithms, various visual controls, event handling, repetition constructs, choice constructs, collections and arrays, methods, and class concepts. Similar to Ism3232.A, the Ism3232.B labs reflected applications that could be encountered in a business environment, albeit on a smaller scale.

Ism3232.B Outcomes

In assessing the outcomes of Ism3232.B, there is only a single data point—the Fall 2007 semester. Based on those results, however, the course design would have to be characterized as a spectacular success. Among the indicators considered:

- Instructor B's course evaluation of 4.79 was the second highest in the history of the course (with Instructor A's evaluation during the same semester being the highest). The numerical result was supported by highly positive student comments. It was also above Instructor B's average for other courses, although that was also very high.
- The DWF rate of 21% (4W, 1F out of 24) was well below the historical course average.
- Student performance on examinations indicated a high level of comprehension.

ISM6155.A

The final case to be considered is that of Ism6155.A, Enterprise Information Systems, the capstone course for the department's MS-MIS program. The course was introduced in Fall 2002

and its basic design remains unchanged to the present day. Combining many innovative aspects, in 2005 it won the DSI Innovative Curriculum Competition. Because the class was taught by Instructor A, including it in the analysis allows us to explore the relationship between course design and learning outcomes with the instructor being controlled.

Ism6155.A Course Design

Ism6155.A was organized around three activity streams: case discussions, debates, and a multi-semester research project. Although use of the case method in business education could hardly be described as ground breaking, the course introduced a number of new variations. These include: a) an instructor-developed case detailing a classroom uprising to introduce the case method to students, b) incorporating a classroom response system into case discussions, and c) experimenting with three different modes of discussion: classroom, asynchronous online, and synchronous online.

The debate pedagogy, nearly absent from the business education literature, facilitated focused discussions on topics of current interest. Topics were loosely synchronized with the cases being discussed, and each week about one third of the class is assigned to the panel—presenting the pro and con sides prior to opening the debate to general class discussion. Although students were given some choice regarding what topics they would prefer to present as panelists, they are given no choice of side—often forcing them to look at issues from new perspectives. A research project required each student to trace the evolution of two strategic information systems, chosen from an instructor-developed list, that were introduced somewhere between the late 1970s and early 1990s.

The project activity was intended to build research skills and foster an appreciation for how MIS has evolved. Over a scheduled three year period, each system was researched at least three times (using a data gathering instrument designed by the instructor). The ultimate goal of the project was to establish system histories sufficiently rigorous so as to be useful to the MIS community. A more complete description of the course can be found in Gill [3].

Ism6155.A Outcomes

The case for the effectiveness of Ism6155.A was presented in the 2005 DSI competition entry, which stated:

- *Student evaluations* of the course and instructor are far above college averages.
- *High quality of student-prepared work*, with both debate preparation and research papers far exceeding the instructor's original expectations.
- *High levels of effort*, with students reporting spending more time on the course than on their average MS course.
- *End-of-semester survey items relating to course design* not only show students are satisfied with each course activity, but also show complete lack of consensus regarding any alternative design direction.

Table 2: Multi-Case Experimental Design

	Instructor A	**Instructor B**
Content: Undergraduate Introductory Programming	Ism3232.A	Ism3232.B
Content: Graduate MIS Capstone Course	Ism6155.A	

DISCUSSION

Conceptually, the three class treatments can be viewed as a quasi-experiment in which instructor is controlled for two classes, and content is controlled for two classes, as shown in Table 2. Presented in Table 3 is a cross sectional analysis of the three courses in their final form. For the purposes of this analysis, decomposability would be suggested by the presence of common factors that appear to contribute to the success of all of the cases being examined. Complexity, as will be explained shortly, would be suggested by the presence of exclusive-OR relationships, in which a factor that appears to contribute to the success of one situation appears irrelevant—or even detrimental—to success in another.

Table 3: Cross-Course Comparison

	Ism3232.A	**Ism3232.B**	**Ism6155.A**
Classroom Lectures	No	Yes	Minimal
Multimedia Lectures	Yes	No	No
Moderated Classroom Discussions	Optional	No	Yes
Paired Student Problem-solving	No	Yes	No
Student Presentations	No	No	Yes
Deadline Flexibility	Yes	No	No
Mandatory Attendance	No	Yes	Yes
Examinations	No	Yes	No
Outside Class Projects	Yes	No	Yes
Level of Performance Feedback	High	High	Low
Grade Subjectivity	Low	Low	High
Student Level	Undergraduate	Undergraduate	Graduate
Source	Evolved	Designed	Designed
Instructor	Instructor A	Instructor B	Instructor A
Instructor Experience with Course Subject Matter	High	Low	High
Evaluations	Outstanding	Outstanding	Outstanding

The analysis of Table 3 suggests a clear lack of consistent patterns across the three cases. Indeed, with the exception of his apparent aversion to lectures and formal examinations, Instructor A's two courses appear to be almost pure opposites. (Furthermore, in the highly successful pre-2001 version of Ism3232, both lectures and examinations were employed, so by adding that to the table we could eliminate even that apparent consistency across his courses.) Naturally, a case could be made that graduate and undergraduate courses are inherently different, so including Ism6155.A is inappropriate. On an informal basis, this particular objection does not seem to be well supported. Over the course of 5 years teaching the two courses in parallel, Instructor A encountered roughly 20 students who took both courses. In some cases, this situation was as a result of the student completing undergraduate studies and moving directly into the department's MS-MIS program. In others, it was the result of the student with a bachelor's degree needing to meet the programming prerequisite of the MS-MIS program. In both cases, though, enthusiasm for Ism6155.A was unanimous (unsurprising, given the course's popularity) and, for the most part, these students also reported positively about their Ism3232.A experience. This informal observation is further supported by evidence from the Ism3232.A survey conducted each

semester, finding no significant correlation between students taking the course as a prerequisite and course outcomes, including grades and satisfaction with the course.

The foregoing analysis should not be taken as meaning that students don't matter when considering course fitness—only that such characteristics are not adequately captured by the crude graduate/undergraduate distinction. To the contrary, both Instructor A and B felt that their respective approaches were better suited to some students than others. As a result of this feeling, in Fall 2007 Instructor A urged students seeking a more structured environment to switch to Ism3232.B. Instructor B, in turn, urged those seeking flexibility to change to Ism3232.A. While the specific flow of students between sections could not be captured during the (always tumultuous) registration week, both instructors felt that their evaluations likely benefited through having fewer students who were uncomfortable with their particular pedagogy.

CONCLUSIONS

The three cases that we have presented suggest a simple conclusion: that teaching effectiveness derives from a complex process. We would like to believe that this conclusion is more profound than it may, at first glance, appear. The real danger of assuming decomposability is that we will interpret lack of observed significance in our variables with lack of importance. Evolutionary processes tend to generate many local fitness peaks. For each of these peaks, nearly all the variables involved are likely to play an important role. If we accidentally combine observations from different peaks—or even combine observations from different sides of the same fitness peak—the temptation to conclude that important factors are unimportant is likely to be irresistible. Naturally, data from a given instance may help us navigate among the peaks—witness Instructor A's apparently insatiable appetite for Ism3232.A survey results. We just need to be careful what conclusions we draw and, particularly, what questions we ask. Questions such as those used to introduce this paper—Will our distance learning teaching be as effective as face-to-face techniques? Is the case method really more effective than lecture? Should we allow laptops in the classroom?—sound eminently sensible. If the attributes of teaching and learning fit are non-decomposable, however, such questions will always have the same answer: *it depends on the situation*. Where statistical analysis techniques such as multiple regression suggest otherwise, either the sample is skewed or we have come across an attribute whose effect is felt independently. Unfortunately, such decomposable attributes tend to be quickly discovered and, as a result, when the audience for the research is practitioners (as it often is for education-related research within a discipline), they rarely come as a surprise to the reader.

So, what type of research should we be conducting? In the context of teaching and learning, we believe that the most beneficial research strategy would be one that emphasizes acquiring deep understanding of individual instructional situations. We believe such a need is particularly pressing in today's environment, where technology has vastly increased the number of possible instructional designs that are feasible. In a world where a single instructional paradigm—such as the mass lecture—dominates and both student and instructor diversity is low, statistical analysis across many classes may be highly informative. But such a world exists only in the past, if it ever existed at all.

References available upon request to the authors