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Piloting a Networked Curriculum

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EXECUTIVE SUMMARY

This pilot study examined student learning outcomes and potential instructional cost savings in an undergraduate Principles of Marketing course that combined online delivery of content, flipped classroom and experiential application for on-campus classes, referred to as a networked curriculum. This model separated the traditional 3-credit course into a common online content section and a smaller application section. Student learning and engagement outcomes in the networked curriculum were compared with a traditional lecture format, and no significant differences were found. Potential savings in classroom space utilization and faculty compensation encourage further research of this model.

Keywords: Flipped Classroom, Hybrid Learning, Curriculum, Faculty Compensation

BACKGROUND

Over the last few decades the landscape of higher education in the United States has changed dramatically. As pointed out by Bowen (2012), costs and tuition at both public and private universities have risen faster than inflation. Students and their parents are forced to finance college education through greater and greater amounts of debt. Simultaneously the financial position of many universities has eroded. Despite this new environment, university curricula are still typically designed around a model in which courses are delivered to students with a single faculty member teaching all of the content for each course. Multiple faculty members within a department, or across several departments, frequently teach multiple sections of the same subject each semester, creating expensive redundancies in the use of faculty resources and campus classrooms.

Technology has made great strides in the classroom and researchers seek to find the optimal class format to benefit student learning and engagement. Hybrid, blended, online, active learning, as well as the flipped classroom models have been widely discussed and researched.

 Hybrid classrooms, sometimes called blended classrooms, combine online learning with face-to-face learning. This model may supplement or replace some of the traditional face-to-face class time with online course requirements. Recent studies done at Carnegie Mellon University (Bowen, Chingos, Lack, & Nygren, 2012) and the University System of Maryland (Griffiths, Chingos, Mulhern, & Spies, 2014) have demonstrated that hybrid course formats can result in student learning outcomes that are equally as good as those achieved in traditional courses, but at a substantial cost savings. Re-organizing courses so that content is delivered to large groups of students either online or in person, coupled with smaller face-to-face classes reserved for high-impact pedagogical techniques, could dramatically lower the cost of instruction while preserving student learning.

 A meta-analysis of research on online and hybrid, or blended, classrooms by SRI International for the U.S. Department of Education assessed research completed between 1996-2006 with mostly college and adult learners. This meta-analysis suggested that students in blended, or hybrid, classrooms perform better than students in fully online or fully in-class formats (Means, Toyama, Murphy, Bakia, and Jones, 2010). Further research on the hybrid classroom model supports the Department of Education study, but continues to better distinguish hybrid and online learning environments (Shea and Bidjerano, 2013) as well define the optimal blending of online and face-to-face interaction, appropriateness by class level, as well as instructor roles (Arbaugh, 2014) . Sauers and Walker (2004) compared eight sections of business communications classes, 3 in the face-to-

face format and the others in hybrid half-time online format, and found that students in the hybrid half-time online format demonstrated increased active learning practices while all students benefited from improved writing skills.

There is a great deal of research on the flipped classroom. Although identified under different names, such as the inverted classroom (Lage, Platt, and Treglia, 2000) or peer instruction (Crouch and Mazur, 2001), this research has been critical in shaping the flipped classroom of today. Common themes of encouraging students to gain their first exposure to course content prior to attending class and using class time to apply this content are threaded throughout the research including in the book *Effective Grading* (Walvoord and Anderson, 1998).

Brame (2013) indicates that, "…'flipping the classroom' means that students gain first exposure to new material outside of class, usually via reading or lecture videos, and then use class time to do the harder work of assimilating that knowledge, perhaps through problem-solving, discussion, or debates." This differs from the traditional lecture model where first exposure is typically delivered via lecture and assimilation occurs outside of class. Brame also notes that the key elements of the a flipped classroom include "1. Provide opportunities for students to gain first exposure prior to class….2. Provide an incentive for students to prepare for class…3. Provide a mechanism to assess student understanding…4. Provide in-class activities that focus on higher level cognitive activities."

Crouch and Mazur (2001) found that a modified version of the flipped classroom, peer instruction, supported an increase in student learning when compared to traditional lecture. Lage, Platt, and Treglia (2000) experimented with an inverted model in an economics classroom which also included exposure to content prior to class, and economics applications in the classroom.

Meyer (2013) compared the traditional lecture format with the flipped classroom format using a course in a doctor of pharmacy program. He found that scores on an identical final exam for the same course increased 5.1% between 2011 and 2013 when using the flipped classroom over the lecture model. Additionally, Meyer reported that, "almost 90% of students said they preferred the flipped model after the class."

NETWORKED CURRICULUM PILOT STUDY

This pilot study examined student learning and engagement outcomes, as well as potential instructional cost savings in an undergraduate Principles of Marketing course. Principles of Marketing was chosen for the experiment in part because it is representative of undergraduate instruction at this university and in American higher education generally. Principles of Marketing is a required course for students in the university's various business majors, which compose the largest academic program on campus, drawing hundreds of students. Business also comprises the most popular area of study for U.S. college students generally. Of the 1,791,000 undergraduate degrees conferred in the 2011–2012 academic year in the USA, the greatest numbers were conferred in fields of business—367,000, or twenty percent (National Center for Education Statistics, 2015).

The course combined online delivery of content with a flipped classroom environment and student application of content for two sections of the on-campus class, a model that is herein identified as the networked curriculum. The networked curriculum separated the traditional 3-credit course into two separate components—a common online content-delivery section and a smaller face-to-face application section. Different instructors were responsible for teaching the different components of the course. This paper focuses on the potential for instructional costs and classroom space savings using the networked curriculum model in a university where course capacity does not typically exceed 35 students, and most courses are capped at 25 students or less to maintain low teacher-student ratios.

The pilot version of Principles of Marketing was organized as a series of weekly modules. The online content for these modules included readings, fourteen lecture-captured videos that corresponded to the textbook chapters, weekly machine-graded quizzes, and weekly team-based writing assignments that applied the course content to an existed company. The online content also included a series of nine "From the Field" video interviews that linked course topics to the experiences of leading figures in the marketing industry. These videos were captured using Skype and Camtasia and edited for video production, including a script for all interviews. All of this material was stored in the university's learning management system and was available to all students enrolled in the course. Common course content was developed with contributions from multiple participants from academia and the business industry, and organized in a modular format using the online learning management system. The

common content was delivered via online course to all students for half of the contact hours, while the other half of the contact hours were spent in the classroom applying the content.

In each online common content section, the instructor supervised 50 students. Two sections of the online content course were needed. This instructor's duties included working through the content with students, provided tutoring when needed, and performing assessments related to the content throughout the semester. The online common course component replaced one day of class meetings per week, with the exception of meetings for in-class exams. Creating common content standardizes the content delivery (all students receive the same online content) which guarantees delivery of key concepts and aids in crafting standardized course assessments across instructors.

Each common content section was split into two application sections of 25 students each. In the application sections, students applied course content in class in experiential learning activities organized and supervised by the instructor. Students' interaction with online content was scheduled to correspond with what occurred in the once-weekly meetings of the application section. By keeping the application sections capped at 25, the faculty were able to maintain a low teacher-student ratio in the classroom.

The idea of a "networked" curriculum model refers to the need to carefully coordinate the online content covered during a specific week to the experiential learning piece taught during the weekly in-class application section meeting for instructors involved in teaching in this model. For example, during week 4, the online content covered consumer behavior, so the two faculty members teaching the four application sections during week 4 had to coordinate the experiential lesson to relate to the consumer behavior topic.

AN ALTERNATIVE FACULTY COMPENSATION MODEL

Faculty compensation was changed to reflect the new course format. Instead of using the traditional method of compensating each instructor 3 credits for each course taught, instructors were compensated 1.5 credits per online common content section, and 1.5 credits per application section. Faculty members teaching the face-to-face application sections met with students once per week compared to twice per week for the traditional lecture-style course. These faculty members were also "freed" from delivering content as the course content was delivered online through video captured prepared prior to the course offering. Faculty members teaching the face-to-face application sections created weekly experiential assignments related to the weekly online course content and guided students through the application process.

The networked curriculum version of the Principles of Marketing course had a total of one hundred students. These students were split into two online common course sections of fifty students each, and four application sections of twenty-five students each. Two full-time faculty members taught in the networked curriculum pilot. One faculty member oversaw the two sections of the online common content course for a total of three credits and taught two application sections for an additional three credits. The second faculty member taught two application sections for a total of three credits. In sum, two instructors were paid a total of nine credits to teach one hundred students divided into six sections, at 1.5 credits of compensation per section.

FINDINGS

Student learning and engagement outcomes in the networked curriculum course were compared against those from students in a traditional lecture version of the course where there was no online content delivery and students met more frequently in the classroom. Content knowledge was assessed in both groups using an identical final exam as a post-test, and students completed a sixteen-item survey to measure their perceived engagement with course content.

Findings related to student content knowledge and student engagement with the course content were measured in the lecture style sections and during the networked curriculum pilot sections of Principles of Marketing. Data collected in the traditional lecture style course sections of Principles of Marketing was compared to data collected in the networked curriculum pilot sections.

Results of the post-test for content knowledge suggests no appreciable loss in student learning when course content was moved online and time spent in the physical classroom was reduced. For the engagement survey, in all but one item, there were no statistically significant differences at the .05 level of significance between responses from students in the traditional version of the course and the networked curriculum version. For the one survey question where a difference at the $p < .05$ level did occur, students indicated that they were *more engaged* with content in the networked curriculum course than they were in the lecture style course.

Sixty-two students in the lecture course and eighty-nine students in the networked curriculum course completed the post-test for content knowledge. The average post-test score for the lecture class was 81.48 points. The average post-test score for the networked curriculum class was 81.62 points. With equal variances assumed, $t=-.08$ and $p \geq .05$. Research indicates that there is no significant difference between these scores. This data suggests that students completed the course (in both lecture and networked curriculum formats) with the same level of content knowledge.

The Classroom Engagement Survey consisted of 16 questions, and was based on a research instrument developed by Schreiner and Louis (2006). Questions were modified to fit this research project. Students in the lecture class and the networked curriculum class completed the survey at the final class meeting. Fifty-seven students in the lecture class and ninety-eight students in the networked curriculum class completed the survey. Students were asked to read the sixteen statements and indicate their level of agreement with the statement (Strongly Agree, Strongly Disagree, Uncertain, Disagree, and Strongly Disagree).

A T-Test compared the mean scores of all sixteen statements between the lecture class and the networked curriculum class. There was no significant difference (at the .05 level of significance) between the mean scores in fifteen of the sixteen statements. This indicates that student engagement with the course content remained the same in the networked curriculum course, even as the content moved online and the students met with the instructor fewer times. Student engagement with the course content was not lost as a result of the newer pedagogy. There was a significant difference in the mean scores for Question 15. Question 15 asked students to indicate their level of agreement with the following statement:

> *Sometimes I get so interested in something I'm studying in this class that I spend extra time outside of class trying to learn more about it.*

In terms of faculty compensation and classroom space utilization, it appears that the networked curriculum model provides an opportunity to simultaneously decrease both classroom space utilization and instructional costs while maintaining the integrity of content knowledge and student engagement with content, though the model's actual impact depends upon typical course enrollments and the number of sections taught. For example, if the capacity of the Principles of Marketing course were 25 students, then four sections of the traditional face-to-face lecture style course would be required to teach 100 students, and faculty members would be compensated for 12 credits (assuming each section is worth 3 credits). In the networked curriculum model as used in the pilot study, faculty members were compensated for teaching 6 sections (2 online common course sections and 4 application sections) at 1.5 credits each for a total of 9 credits in instructional costs.

Table 1 illustrates how the networked curriculum model could result in a fifty percent (50%) reduction in the use of physical classroom space and a twenty-five percent (25%) savings in instructor compensation with enrollment of 250 students under the following conditions:
1. Sections of the course in a given semester typically enroll a total of two hundred fifty students.
2. Each traditional lecture-style section has a capacity of twenty-five students and meets twice per week in physical classrooms.
3. The student capacity in the networked curriculum model is fifty students for the online common content section and twenty-five students for the application sections, with the latter meeting once per week.

TABLE 1: PROJECTED SPACE UTILIZATION AND INSTRUCTIONAL COST REDUCTIONS FOR 250 STUDENTS IN A NETWORKED CURRICULUM MODEL

	Sections Needed	Students per Section	Classroom Meetings per Week	Total Classroom Meetings per week	Instructor Compensation per Section (Credits)	Total Instructor Compensation per Semester (Credits)
Traditional Lecture Model	10	25	2	20	3	30
Networked Curriculum Model	5(common course sections)	50	0	0	1.5	7.5
	10 (application sections)	25	1	10	1.5	15
Total Reduction				**10 Classes (-50%)**		**7.5 Credits (-25%)**

 Opportunities to expand the pilot within and between departments on campus could significantly reduce operational costs across campus. Possibilities for expanding the networked curriculum model include identifying opportunities for common content to be developed and shared within and across departments. For example, an online common content course in Child Psychology could be developed for students across several majors, while the application sections would be taught by faculty from the specific majors such as nursing, psychology, and education as shown in Illustration 1 below. Students of different majors would be exposed to different perspectives on the subject in the online common course section, and apply this knowledge directly in the context of their specific majors when meeting in the physical classroom for the application sections. The collaboration over content of the online class may reduce redundancies in teaching content and provide potential instructional cost savings.

FIGURE 1: NETWORKED CURRICULUM ACROSS DEPARTMENTS

CHILD PSYCHOLOGY
Online Common Content

Applications in Nursing	Applications in Psychology	Applications in Education

 In this example, disaggregating the online common content class into smaller groups allows for students with specific majors or specific interests to explore the application of the content to their major or area of interest. These smaller groups would be led by a different faculty member in the major or interest area. This disaggregation allows the student to see the relevancy of the content, and become more engaged in its role and application to the major or area of interest while reducing instructional costs and space utilization for the university.
 Given that the post-test findings indicated no differences in student learning or engagement between the traditional and networked curriculum course formats, and the potential for instructional cost savings and more efficient classroom utilization, the researchers recommend further exploration of the networked curriculum model. Course capacities, number of classroom meetings per week to optimize learning, student engagement with the online learning management system, student interest, and faculty interest in disaggregating the learning and perceived fairness of compensation should be further explored. Additionally, it should be noted that one faculty member was compensated to develop of the online common course prior to the beginning of the pilot. Online course development is an area of increased costs when using the networked curriculum model.

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