From Classroom to Online to Hybrid: The Evolution of an Operations Management Course

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Abstract

This paper discusses the evolution of an introductory operations management course at the University of Arkansas. The class is a required course in the Masters in Operations Management program in the Department of Industrial Engineering. The authors discuss their experience in creating an online version of this survey course and then reversing direction and converting the online course into a hybrid class, where class is held live one day a week and the remaining course content is delivered online. The paper discusses the evolution of course content and assignments and the impact on student interaction and participation. Throughout, we discuss student response to each of the course delivery modes.

Introduction/Background

Since its inception in 1974, the Operations Management (OM) program at the University of Arkansas has graduated over 4,500 students with a Master of Science in Operations Management (MSOM). Housed in the Department of Industrial Engineering, and originally developed for the U.S. military, the OM program today draws its students, primarily working professionals, from a broad range of industries and government agencies. The OM program currently operates live program sites at three military bases in the U.S. and three additional locations in the state of Arkansas. In addition, many students take the program online from remote locations not associated with any of the specific sites. Current enrollment in the program stands at just over 450 active students, with approximately 300 of those students affiliated with a one of our six sites and the remaining students classified as true distance students.

Although considered a distance program, OM courses are delivered both live and online (in an asynchronous mode). Courses are offered in eight-week accelerated terms, with five terms per academic year. Most OM courses are offered both online and in the traditional classroom setting, with live classes at six sites meeting in the evenings twice a week for three hours each. Classes are taught by a mix of tenured/tenure track faculty (6 of 12 industrial engineering faculty members are actively involved) and adjunct faculty (50+). Adjunct faculty members who teach classes at the various sites are typically practitioners with significant and relevant industrial experience. All have master's degrees and many have doctorates in relevant fields.

At present, about 60% of the course enrollments are accounted for by online asynchronous distance delivery. With a growing number of students coming from remote locations around the state and country, more military students taking course work while being deployed on active duty, and fewer live options available at the smaller civilian sites, this proportion of distance delivery coursework has become the norm in the program. More recently, the program has explored the format of hybrid or blended learning classes, which combine both online and face-to-face learning in the same course. These courses are designed for students who desire some live classroom interaction, but whose work and family commitments make it difficult to come to campus for three hours, two nights a week.

The OM program is designed for working professionals in such fields as manufacturing, construction, health care, banking, technology services, retail, nonprofit services, state and government services, and the military, who are seeking to enhance their skills in the management of capital, and technological and human resources. Although only approximately 20 percent of MSOM students have engineering bachelor's degrees, with others coming from a variety of fields, course content is delivered from an industrial engineering perspective, where the use of quantitative tools is emphasized.

Graduates of the program over the years have typically been engineers and managers who have gone on to build successful careers in their respective fields of employment. Many have been military officers who have attained senior ranks in the Air Force and the Navy, the two military branches primarily served by this program. Although our civilian graduates have been fewer in number until recently, they are no less successful in their chosen fields of endeavor. Among the latter are a former vice president of a Fortune 100 company, the chancellor of a state university, and numerous senior level managers in a variety of industrial sectors (transportation, retail, manufacturing, etc.). The program is designed to equip students with leadership and management skills, as well as analytical and problem solving skills that are aimed at making them better managers of both work processes and people.

Putting students first ensures all students of any ethnicity and gender have equal chances for educational success. Online, live and hybrid classroom options allow students the flexibility to learn at their convenience and in their own setting. The OM student body is one of the most diverse on campus. Table 1 highlights the race/ethnicity breakdown of our students by year for academic years 2009-2011. High minority and female percentages are due to the large percentage of students who are military members. The diversity of our students contributes to the overall diversity of the entire College of Engineering graduate population.

Table 1. Students Enrolled in Operations Management Program

Race	**Fall 2009**		**Fall 2010**		**Fall 2011**	
	Female	Male	Female	Male	Female	Male
African American	37	42	29	45	30	48
American Indian or Alaska Native	2	3	1	5	2	4
Asian	6	6	7	10	3	9
Caucasian	74	259	94	313	92	321
Hawaiian or Pacific Islander	0	0	1	0	1	0
Hispanic and any other race	3	10	3	11	3	15
Non-Resident Alien	5	12	5	11	12	13
Two or More Races	0	8	4	13	2	9
Unknown	0	6	0	10	1	11
Total by Gender	**127**	**346**	**144**	**418**	**146**	**430**
Total	**473**		**562**		**576**	
	27% Female	**30% Minority**	**26% Female**	**28% Minority**	**25% Female**	**28% Minority**

Although students are allowed to design a personalized plan of study, the MSOM degree requirements ensure that graduates receive both a breadth and depth of knowledge within the operations management field by requiring courses within four core competency areas and electives. The current course library contains 26 graduate courses, with new additions added when appropriate. Of the 26 courses, three are cross-listed with engineering courses, offering students a broad selection from which to choose. In an effort to keep courses current, recorded lectures and course material are updated every three years, at a minimum.

The OM program is directed by a senior tenured faculty member and administered by a team of faculty and educational professionals who manage curriculum changes, textbook selection and the program's admission process, while hiring faculty and overseeing the educational quality and academic rigor of the courses.

Developing an Online Class

One of the core courses in the OM program, and the one usually taken first by students entering the program, is the Introduction to Operations Management course. The Introduction to Operations Management course provides an overview of the functional activities necessary for the creation and delivery of goods and services. The goal of the course is to give the students a basic understanding of operations management and an appreciation for the many roles an operations manager can play in an organization. Specific attention is paid to how an operations manager impacts strategic and operational decisions across a variety of functional areas in an organization. Topics covered include: productivity; strategy in a global business environment; project management; quality management; location and layout strategies; human resources management; supply chain and inventory management; material requirements planning; just in time practices; and maintenance and reliability. This course is designed to provide students with a brief introduction to these topics so that they can better choose which areas they wish to pursue in more depth later in the program.

At program inception in the 1970's, all courses were taught in traditional classroom settings. In the l990's the program experimented with distance delivery through the use of VHS taped lectures, and the Introduction to Operations Management course was the first to be delivered in this format. Driven by improving educational technology, course content delivery moved from VHS tapes to CDs, and eventually to fully online courses. As the distance component of the OM program has evolved, the introductory course has often been used as the "guinea pig" to try out new instructional methods and delivery modes. The most recent effort, which is discussed later in this paper, has been to develop a hybrid course, which combines both online and face-to-face course components.

In 2001, the Introduction to Operations Management course was selected to be the first fully online course in the program. Since this course was designed to be the students' initial exposure to the operations management profession, the program director contacted practitioners in each of the major areas and asked them to discuss the role of operations management in their respective companies and industries. This resulted in a set of recorded presentations where the industry professionals discussed their fields of expertise and the unique challenges and opportunities that existed in each of these areas. Students were asked to watch these presentations and read the

corresponding chapters from an introductory operations management textbook. Students were assigned homework that emphasized conceptual understanding of key concepts from the text and they were graded based on performance on a midterm and final exam. There was no student-to-student interaction in the initial online offerings of the course. The only interaction was between individual students and the faculty member facilitating the course.

Even though the course was delivered using the learning management system (LMS) WebCT, most of the benefits that the LMS platform offered were not utilized. At this point in time, the introductory course was the only online course in the OM program and the course was offered only online. Over time, students began to complain about the course having little value in their educational experience. While many enjoyed listening to the practicing operations managers, most students felt the course was of minimal value in terms of preparing them for the more demanding courses they would encounter later in the program.

In 2006, a major overhaul of the course was undertaken. The goal was to better prepare the students for courses they would encounter later in the program, and at the same time, continue to provide them an introduction to the broad operations management career field. The learning objectives of the course were focused on understanding each of ten strategic areas of operations management (design of goods and services, quality management, process and capability design, location strategies, layout strategies, supply chain management, inventory management, scheduling, maintenance and human resources). In the new online course, an expert in each of the ten areas prepared a module in their area of expertise. The experts where drawn primarily from the tenured/tenure track faculty in the Department of Industrial Engineering. Each of the ten areas was covered with three hours of lecture content. In this format, the lectures focused on introducing the students to the functional area, how it impacts an organization's performance, and some of the quantitative tools an operations manager might use to help them make decisions.

One of the issues with this approach was that the three-hour modules varied in their treatment of the course material, resulting in a somewhat disjointed series of lectures. Some faculty members gave general overviews of their area and discussed quantitative tools, but did not provide much above the content already provided by the course textbook. Illustrations of how the tools are utilized in practice were limited. Other faculty members dove too deeply into a topic, formulating complex math programs for location decisions, for example, when the majority of students in the course had not yet been exposed to a basic math modeling course. Students complained that the lectures either did not provide enough meaningful content over reading the textbook, or did not correlate well enough with course content. Students quickly learned that they didn't need to watch the videos in order to succeed in the course. The recorded lectures would have been considered good quality if delivered in a live classroom setting; however, they were not effective in an online environment, particularly since they were 60-90 minutes in length. This is consistent with Bourne et al. (1997), who stated that recording live lectures and streaming them online just "moved the sage from the stage into a box."

This version of the course was less of an independent study than the original online course, however is failed to meet today's standards for quality online delivery. Students were required to read the assigned chapters, watch the videos, and complete assigned homework problems. Some instructors incorporated discussion boards, but they were not always used effectively. Students'

grades were based primarily on their performance on midterm and final exams. Feedback on the course from students was that while it provided them a good overview of operations management, the course covered too much material and the videos were too long and not effective.

Based on this feedback, another major revision of the course was performed in 2012. This time, the course was developed from the ground up, with valuable input from instructional designers available on campus. The goal was to meet the standards of quality online courses and exploit the capability of the current LMS, Blackboard, and other educational technology. Adjunct faculty members and tenured/tenure track faculty members who would be teaching the course worked together to define the specific learning objectives, assessment tools and desired outcomes for the course. An instructional designer developed the template for the course, which organized the content and provided elements consistent with the standards of the Quality Matters Rubric (Quality Matters).

One of the goals in the course redesign was to significantly reduce the length of the lecture videos and focus the lectures on key concepts in 10-15 minute segments. Working with instructional designers, we explored ways to reduce the *quantity* of online lecture content while increasing its *quality* and usefulness for the students. In the revised course, a greater emphasis was placed on the quantitative concepts in the course. This was done in order to better prepare the students for the more in-depth courses they would encounter later in the curriculum. The revised version of the introductory course was released in the fall of 2012.

The online course continues to evolve due to the creativity and innovation of individual instructors. Changes include more group assignments and collaboration among students using online collaborative tools, more effective assessments, and better use of educational technology to create instructional videos. There has also been more emphasis placed on introducing the use of analytical tools in platforms such as Microsoft Excel. The OM program encourages collaboration among instructors and sharing of innovative teaching methods by hosting a faculty meeting each fall and by facilitating online workshops throughout the year. A typical workshop will have instructors who teach the same course participating from six or seven locations around the country, sharing ideas and discussing better ways to deliver course content, enhance learning and assess student performance.

Developing a Hybrid Course

Student interest in a live version of this course led to the development of a hybrid course, where the class meets face-to-face for a portion of the scheduled class time (in this case, one versus two nights per week), and the remaining activities are conducted in an online environment. This format, also called blended learning, offers positives of both environments. The students have the flexibility of an online class, where much of the learning is on their time schedule and in a location of their choosing, but they also have the benefit of face-to-face interaction with the instructor and other students. Although the classroom time is reduced compared to a live course, the online component allows the instructor to emphasize active learning in the classroom time available. According to Vaughan (2007), a number of studies have shown improved student

performance and better student retention in hybrid courses, when compared to both live and pure online courses.

A related concept is the flipped classroom. Originally developed in 2007 by two high school chemistry teachers (Bergmann and Sams, 2012), the idea of a flipped classroom is to switch traditional classroom activities (lectures) with traditional outside-the-classroom activities (homework). A typical model has students watch recorded lectures before attending class, and then uses the classroom time for active learning activities such as class discussions and activities, working problems and conducting experiments. While there is some debate of the usefulness of recorded lectures, there seems to be much support for the idea that active engagement during class time between student and instructor and between students allows for more in-depth learning. As noted above, instructional videos, when used, should be no more than 20 minutes in length.

The transition of a live class to a purely online environment is labor-intensive. The instructor must translate the delivery of course material from primarily in-class to online, typically by creating or selecting lecture videos or other instructional material that can be accessed in an online setting. Considerable thought is required to take the positive aspects of student-teacher and student-student interaction in the classroom and reproduce it in the online environment. In contrast, we found that the transition of an online class to a live or hybrid environment has a different set of challenges. In developing the online course, much of the time-consuming process of developing unique online material, such as videos, had been accomplished, as had the effort to build and organize the full set of course material and assignments in the online environment. The challenge was to determine how to make the most valuable use of limited in-class time – should activities previously conducted online now be moved to the classroom, or should new activities be developed?

At the time of this writing, the hybrid course has been taught five times, by three instructors who are at three different locations (Fayetteville, Arkansas; Little Rock, Arkansas and Millington, Tennessee). The numbers of students who were enrolled in each section of the hybrid courses and the response rates to a recent student survey are indicated in Table 2. The survey results are discussed later in this paper.

Table 2. Student Enrollment and Survey Response Rates

Location	Term	Student Enrollment	Survey Responses	Response Rate
Fayetteville, AR	Jan-Mar 2013	15	7	45%
Fayetteville, AR	Jan-Mar 2014	10	4	40%
Little Rock, AR	Aug-Oct 2013	12	1	8%
Millington, TN	Aug-Oct 2013	15	5	33%
Millington, TN	Jan-Mar 2014	9	3	33%
Totals		**61**	**20**	**33%**

As with the evolution of the online course, the development of the hybrid course benefited from valuable collaboration between instructors and assistance from an instructional designer and academic technologist. After the hybrid course was taught for the first time in Fayetteville, the online instructors of this course collaborated in an online workshop, discussing methods for implementing the hybrid course and sharing ideas for class structure, content delivery, assignments and exams. All three instructors were experienced in teaching pure live classes and pure online classes, and all had previously taught the Introduction to Operations Management course online. None had taught a hybrid course. In the words of one instructor: "For me, the first challenge was one of personal mindset. Normally, my live classes use Blackboard as a tool to supplement content delivery such as posting assignments, discussions, and grades. However, my hybrid class is presented as a Blackboard class that uses an evening of live interaction to supplement content delivery." (Roy, R., personal communication, January 4, 2014)

Although the three instructors had three distinct approaches to the hybrid course implementation, many similarities existed:

Outside class activities

- Course readings – primarily from the course textbook
- Weekly assignments submitted to Blackboard
- Online lecture videos (2 of the 3)
- Online chapter quizzes (2 of the 3)
- Online discussion boards (2 of the 3)
- Group work on case studies (2 of the 3)
- Proctored, online midterm and final exams (2 of the 3)

Classroom activities

- Short lectures and demonstration of quantitative problems
- Case study discussion
- Student presentations based on group work (2 of the 3)
- Midterm and final exams (2 of the 3)
- Guest speakers (1 of the 3)
- Plant tour (1 of the 3)

Lectures

The online version of this course consisted of a collection of video lectures that were previously recorded by our own instructors. When moving to the hybrid course, the three instructors took slightly different approaches to these videos. One instructor removed them from the course and provided instead just a few instructional videos that focused only on some of the quantitative topics in the course. The other two instructors provided at least some of the recorded lectures as optional resources for the students.

Based on student feedback over several years, the perceived value of the recorded lectures seems to vary widely among students (and vary based on the quality of the videos). Some students do not find them useful, instead preferring to read the textbook and online readings. Other students stated they watched all of the optional videos, and liked having the option of watching them

multiple times to reinforce the content. An instructional approach that proved to be very useful was to provide the students with a written summary of the content of each video to help them determine if they wanted to watch the videos. For instance, it was noted when the video included the instructor working sample problems that related to homework problems.

Most class meetings consisted of some lecture time, where the goal was to focus the students on the main course topics and demonstrate quantitative problems. All of the instructors used a significant portion of in-class time for class discussions.

Classroom Discussions and Online Discussion Boards

Classroom discussion of course concepts results in a deeper understanding of the material, allows students to bring their own experiences into class and therefore learn from one another, makes the course more relevant, and generally makes class more enjoyable for both the students and the instructor. Discussion boards seek to reproduce the classroom discussion in an online environment and are an important component of most online courses.

Some contend that an online discussion can never be as effective as an in-class discussion, and based on the survey results discussed later, the students in these courses tended to agree. We feel, however, that both online and in-class discussions can have a place in hybrid course delivery. In-class discussions offer a synchronous flow of ideas and allow the students to react to extemporaneous questions. Online discussions allow the students to form thoughtful responses over time and supplement their comments with research. In addition, some students, particularly those whose first language is not English, often are more comfortable writing their thoughts than expressing them orally in front of a classroom of peers. The online discussion board draws out the student who might be reticent to offer their opinion in class.

The approach of one hybrid instructor was to post a discussion topic early each week on the online discussion board, and have each student respond only once, with at least one source cited in the response. During the live class that occurred later in the week, the class was divided into groups of 5-7, the topic discussed again (supplemented by each group member's individual responses) and then each group collaborated on a one-page summary of their main discussion points and presented them to the class. Discussion grades were based on both the individual and group contributions (Roy, R., personal communication, January 4, 2014).

Another instructor focused on cases studies that illustrated the topics covered each week. The class was divided in teams of three, and every week each *team* was assigned a case study to analyze and prepare to present in the live class. In this course, online discussion boards were reserved for discussion of course assignments, quizzes and team cases (Nethercutt, L., personal communication, January 4, 2014).

Online Quizzes

Two of the instructors used online chapter quizzes that were drawn from a test bank provided by the publisher. The "flipped" concept of the hybrid class depended on the students reading the assigned material and watching any relevant videos prior to the live class. The online quizzes,

which were due before class met, ensured that students were prepared to actively participate in the face-to-face activities. In both courses, students were allowed multiple attempts at the quizzes, with only the highest score contributing to their grades. Students from one course offering provided positive feedback on the effectiveness of the online quizzes in preparing them for class.

Online versus In-class Exams

Exams in all hybrid courses consisted of a midterm exam and a final exam; formats and content of these exams were individual to the instructors. One instructor held only in-class exams, one instructor required the students to take the exams online, and the third instructor used both models. In the OM program, online exams can be taken in any location of the student's choice, but are proctored by a live proctor who communicates with the student through the video and audio systems on their computer. An advantage of an online exam is that it frees up valuable classroom time. For instance, the last class period was available to be used for group project presentations, rather than a final exam. A potential disadvantage of an online exam that is available over a period of several days is that students can communicate about the content of the exam. This risk might be greater among students who know each other from the hybrid class and have participated in team work, as opposed to students who are in a strictly online environment.

Students who had never taken an online class are often intimidated by the online exam, and particularly by the online proctoring. In the course survey, several students commented on their dislike of online exams, and the preference was about 50/50 for online versus in-class exams. One service the hybrid course provides to students new to the OM program is an introduction to this concept of online proctored exams. Both types of exams have their advantages and disadvantages and should be evaluated on a case-by-case basis.

Guest Speakers and Plant Tour

One instructor chose to devote a portion of the in-class time to guest speakers from industry. For instance, when the students studied quality management, the guest speaker related his experiences working in quality control in both the poultry industry and an automotive parts manufacturing company. Another speaker from a large trucking company presented his use of integer programming in solving a manpower allocation problem and then discussed strategies used in implementing the solution. The hybrid class format seems to lend itself particularly well to having guest speakers, because a portion of the course content is delivered online, therefore less lecture time is needed in class. The live class time can then be used to reinforce the concepts learned with illustrations from practitioners. In a course such as this one, which covers a broad range of topics, it was also particularly beneficial to supplement the instructor's experiences in this way. Student response to the guest speakers was positive overall, but some students felt that the instructor's lecture material was not as thoroughly covered on the evenings when speakers were present.

Another use of live class time that is not possible in a purely online course was the plant tour. In this case, the tour was conducted at a local manufacturing company during one of the last weeks of class. Many of the concepts studied in the class were illustrated in the tour and these concepts

were reinforced when the students wrote summaries of the tour that described how it related to the course. The student review of the value of the tour was overwhelmingly positive.

Student Response to Course Delivery

The hybrid course has been offered five times by three different instructors, all of whom teach online sections of the course as well. The course sections do not give common midterm and final exams, therefore it is impossible to directly compare student performance between delivery modes. However, discussions with these instructors on student performance in the hybrid mode versus the online mode provided some interesting anecdotal information. All three instructors stated that the performance of their hybrid class as a whole was similar to their online classes in terms of exam scores and final grades. One main difference noted by an instructor was that in the hybrid mode the students could really engage each other when analyzing the case studies used to illustrate operations management concepts. Students were more receptive to sharing their experiences and seemed to do a better job critically evaluating alternatives in the classroom environment. The instructor stated that the hybrid mode "allowed students to see OM in action, think like managers, not consumers" (Nethercutt, L., personal communication, January 4, 2014).

Another instructor felt like the hybrid format enabled him to provide more attention to students who were struggling with some concepts. The instructor stated "I can say that some students made B's that I am quite certain would have made a C or below had they not had the attention given to them in the hybrid class" (Roy, R., personal communication, January 4, 2014). Students were receptive to the hybrid mode, and as one student pointed out, "The course covers a wide variety of topics and I feel it has prepared me for future OM classes. With it being a hybrid class, it definitely helped with the structure or mode of instruction transition to fully online classes."

Online course evaluations are made available to all University of Arkansas students during the last week of class. However, these general course evaluations do not focus on issues related to the course delivery mode, i.e., face-to-face, online, or hybrid, therefore an online survey was developed in March 2014 and the link emailed to the 61 students who were previously enrolled in the five sections of this hybrid course. As shown in Table 2, the overall student response rate was 20 students, or approximately 33%. Table 3 lists the 18 multiple choice questions asked of students. Questions 3-17 used a Likert scale of: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A) and Strongly Agree (SA). Empty cells in Table 3 indicate there were no responses in those particular categories. There were also two open-response questions in the survey and selected responses to those questions are included in Table 4.

As shown in Table 3, 85% of the respondents were participating in a hybrid course for the first time, however 60% of the students had taken a purely online course in the OM program. Student response was overwhelmingly positive, with 100% reporting that the course was a positive experience (question 3) and 90% indicating that they would enroll in another hybrid course (question 17). In question 18, 55% of respondents indicated that they would choose a hybrid course over either a face-to-face or online course offering. Of the 20 students responding, one in particular was negative about online education and was the only student who responded with "Disagree" to questions 4, 8, 13 and 17.

Table 3. Student Survey Results – Multiple Choice Questions

	Survey Questions	Survey Responses				
1	Was this your first experience with a hybrid class?	**Yes**			**No**	
		85%			15%	
2	Please indicate which of the other course delivery models you have taken in the MSOM program	**Face-to-Face**			**Online**	
		90%			60%	
		SD	**D**	**N**	**A**	**SA**
3	The hybrid class was a positive experience for me				40%	60%
4	I learned as well in a hybrid course as in traditional face-to-face courses		5%		35%	60%
5	The amount of communication and interaction between students and faculty in the hybrid course was sufficient for effective learning			5%	37%	58%
6	In my experience with the hybrid course, the course material was adequately distributed between the face-to-face portion and the online portion				45%	55%
7	Online assignments were helpful in understanding the course content			10%	45%	45%
8	The additional time I spent online (compared to a face-to-face class) was better than having to spend the same amount of time in class		5%	25%	45%	25%
9	The online course materials were easy to follow			10%	45%	45%
10	The in-class portion complemented the online material and the connection between them was clear			5%	37%	58%
11	I like the flexibility the hybrid course provided			11%	26%	63%
12	In the future, I would prefer to take a hybrid class to an online course			10%	25%	65%
13	In the future, I would prefer to take a hybrid class to a live class		5%	45%	30%	20%
14	I feel like the discussion that took place in the live classroom was superior to the interaction that took place in the virtual discussion board			11%	39%	50%
15	I prefer online exams so that in-class time can be used for learning through lecture and class discussions	16%	26%	16%	16%	26%
16	I feel that the hybrid class enabled me to network better with my classmates and establish more personal relationships than an online only class		11%	11%	21%	58%
17	I would enroll in another hybrid course		5%	5%	37%	53%
18	When selecting future courses, I will gravitate toward the following model based on my experience and personal needs (select one):	**Face-to-Face**		**Hybrid**		**Online**
		40%		55%		5%

Table 4. Student Survey Results – Open Response Questions

	Survey Questions and Selected Responses
19	List the three most significant advantages of taking a hybrid class based on your experience in this class.
	70% of respondents provided written comments. Representative comments: • Live discussions with classmates and instructor in class • Being able to solve problems and ask questions/clear doubts in class, which is difficult doing online • Group activities/ plant tour with the instructor and classmates • Stronger relationships with my classmates and professor • A lecture talk by professionals was a great way to link that particular day's coursework with current problems in reality • The interaction with other students and getting to know them personally helped me to work together for assignments to an extent apart from the professor's help • Able to rewind video lectures in case a concept was not understood; impossible to rewind a face-to-face lecture • Face-to-face and online learning complement each other • It wasn't as time consuming, sitting in a classroom going over stuff that was redundant, when I can use that same time studying at home • Hybrid classes provide more flexibility; only one day a week face-to-face meetings • Hybrid classes provide a good combination of in-class and online participation • More personal, you interact more with your peers • Questions are answered quickly • Students learn more about online resources and how to use them to their advantage • Able to follow up with online assignments during face to face class time • Instantaneous feedback from the professor and classmates • Direct feedback from oral presentations • More time to work on homework and submit anytime online • If you have a group project it allows you to work with your group in class and discuss similar issues one might have • Better schedule to work around for work
20	List the three most significant disadvantages associated with taking a hybrid class based on your experience in this class
	45% of respondents provided written comments. Representative comments: • Class time is sometimes rushed to fit it all in • Some online content, such as some quiz questions from the book, are not relevant to the overall learning concepts for the course • The lecture talk by the professionals was a great add to the class but by doing so sometimes we tend to miss out on covering the entire set of instructor slides • Lack of social interaction in class room due to less time in the classroom • Some of the class work is a little harder than in classroom learning • Hybrid classes provide less time in front of the professor in regard to clarification of subject matter • Hybrid classes provide less time for face to face interaction with classmates • Hybrid classes take away the option for students who prefer in-class sessions exclusively, especially in regard to certain courses • Some disconnection with other students when working on group projects • Don't really care to take an online exam • Online assignments are not as easy to follow as face to face class time assignments are • The online exam proctoring service

Conclusions

Through the evolution of this one course from a traditional live course, to various online versions, to finally a hybrid version, one can track the development of educational technology and its impact on pedagogy. While some will say that pedagogy should drive technology, not the other way around, it has been the authors' experiences that the ready availability of and excitement surrounding new technology has certainly been one of the drivers in the evolution of the Operations Management course offerings at the University of Arkansas. The other, probably more important factor is the students' desire for online course offerings. Online education is here to stay, and the institutions that are dedicated to delivering high quality online courses are positioning themselves for the future.

The recent development of a hybrid course from the existing online course has motivated our instructors to develop new methods for delivering content, new assessment techniques and new ways to enhance student collaboration and learning. Ideas that were generated during the development of the hybrid class have contributed to making the existing online classes better. It has also been our experience that having highly-talented instructional designers on staff to support course development has greatly added to the quality of both online and hybrid course offerings. Student and instructor evaluation of the new format has been positive, and we look forward to future innovation in teaching methods and technology improvements.

References

Bergmann, J. and Sams, A. (2012). *Flip Your Classroom: Reach Every Student in Every Class Every Day*. ISTE 9781564843159.

Bourne, J. McMaster, E., Rieger, J., and Campbell, J., (1997). Paradigms for On-Line Learning: A Case Study in the Design and Implementation of an Asynchronous Learning Network Course. *Journal of Asynchronous Learning Networks*, 1(2). Retrieved from http://fie2012.org/sites/fie2012.org/history/fie97/papers/1039.pdf.

Pierce, R. (2013). Student Performance in a Flipped Class Module. In R. McBride & M. Searson (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2013*, 942-954. Chesapeake, VA: AACE.

Quality Matters Program, Higher Education Program Rubric. Retrieved from https://www.qualitymatters.org/rubric, January 5, 2014.

Vaughan, N. (2007). Perspectives on Blended Learning in Higher Education. *International Journal on E-Learning*, 6(1), 81-94.