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Case Report Open Access

Production and Operations Management Online Class: Some Experiences and Takeaways

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Abstract

This is a case study of making transition from a face-to-face teaching set up to teaching online, the undergraduate Production and Operations Management course. Despite my initial hesitation and reluctance to adopt online teaching for Production and Operations Management course, herein, I recount how I gradually adapted my face-to-face POM syllabus and pedagogy to an online environment and how students have come to benefit from my efforts and enjoy the course, as evidenced by their active participation in the discussion forum, their project reports, and their positive feedback.

Keywords: Production and operations management; Online teaching; Teaching technologies; Objectivist; Constructivist; Course design

Introduction

Despite one's level of training and education, most people almost involuntarily resist change as a first reaction. Particularly, when it comes to adopting new methods or processes at work, many resist such change for the reasons of ending up doing "more work" or out of their "skepticism" for the efficacy of new methods before they are fully familiar with the methods or processes. As a tenured associate professor who mostly taught in a traditional face-to-face environment, when I was assigned to teach undergraduate Production and Operations Management class "online" for the first time in the 2013 spring semester, I was no different. I was quite reluctant as I didn't believe that online delivery is a good fit for POM course content. Additionally, I had not formally been trained to teach an online course, the assignment was made rather late—about a couple of weeks before the start of the semester—and I had read and heard some unpleasant experiences of online teaching as well as the following words of caution: "Online classes can be unpredictable and potentially explosive" [1]. Also, I believed that online course instructional design needs careful consideration in regards to the time and effort required in developing the startup set of lecture notes, assignments, tests, projects, and so on.

My further reasons for my reluctance were: This course is not easily adaptable to online delivery because it is not merely a course dealing with simple concepts. Rather, it requires students to develop a class project report to demonstrate their understanding of the concepts in the context of a chosen product/service. In all of my face-to face POM classes, I require students to work in teams of 2 or 3 to develop such a project report and make presentations in class because such assignments support the team work requirement [2] and emphasize oral and written communication skills [2]. I wasn't sure if team projects work well in online environments.

As a seasoned management professors could very easily diagnose and summarize, I was exhibiting the typical "resistance to change" behavior of employees found in many an organization. It's well known amongst management scholars and readers that the main reasons for resisting organizational change include "uncertainty, habit, concern over personal loss, and the belief that the change is not in the organization's best interests" [3-6].

Nonetheless, some administrative coaxing and my desire to remain a responsible institutional citizen saw me undertake the assignment in spring of 2013. Ever since, I have been teaching at least one section of POM class each long semester, gradually improving my skills and capabilities of teaching this course online.

Having accepted to teach POM online, I had to implement my course design to a degree of perfection so as to satisfy my inner critic. So I went around looking for guidance and help. Our University's Office of Information Technology (OIT) and its Electronic learning group (e-learning) were most helpful in giving me a quick refresher in using our ANGEL platform. I downloaded and reviewed a few academic papers providing advice to online instructors and other relevant references that helped me gain a better understanding of what was required to be done in this context. I found guidance from a paper dealing with the development of an "online writing" course quite useful in determining what need not be done for a POM class and what should be implemented [7,8].

The rest of this paper is organized as follows. In section 2, I provide a brief outline of the POM course for undergraduate program at our university followed by section 3, which covers the adaptations I made for online delivery. Then, in section 4, I give details of technology tools and other resources I enlisted for course implementation followed by section 5, which deals with student assessment and feedback. And finally, in section 6, I list my conclusions and takeaways from this online teaching experience.

POM Course Design

Face-to-Face class format

As would be the case in most typical four year degree universities in Texas and across the nation, POM 3310: Production and Operations Management is part of the common body of knowledge (CBOK)

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required of all business majors in our BBA program at A.R. Sanchez Jr. School of Business (ARSSB) at Texas A&M International University (TAMIU) [9].

As per the University course catalog 2013-14 the description of POM 3310 is as follows:

"Introduces the student to planning, organizing, and controlling production and service systems. The impact of new product and process technologies will also be covered. Written and/or oral presentations are required. Prerequisite: DS 2310*" [9].

*DS2310: is a Business Statistics I course at our institution.

Further, as approved by the curriculum committee of our college, the course objectives are, "to develop student's basic understanding of production and operations management principles, [the course] will include both practical applications and integration of various management tools, techniques and skills."

Accordingly, the learning outcomes from the course were defined to be,

1. To understand and comprehend the operations management terminology and technological trends.

2. To develop certain quantitative skills, competencies, and points of view needed by organizations involved in the input, transformation and output process.

3. To be able to adequately produce basic written reports on operations management processes.

POM course design considerations: As Yadav SB [10] observes, "Design of a course should be dictated by the course objectives and learning outcomes." Yadav elaborates that if the objective is to teach the concepts (facts and theories), an objectivist approach would be most suitable. However, if the students are expected to apply the concept learnt to new contexts and be able to develop artifacts, then, the constructivist approach would be most suitable. However, in situations where the course objectives and learning outcomes so demand, a blend of objectivism philosophy and a constructivist approach would be more effective [10]. Having had the good fortune of being Dr. Yadav's student while pursuing my Master's degree and later working as a junior colleague under his mentorship at Texas Tech University for three years while Dr. Yadav served as the area-coordinator for Information Systems and Quantitative Sciences (ISQS area), my instructional design has been profoundly influence by Dr. Yadav's teachings and viewpoints.

Accordingly, in the POM course, so far as the discussion of the concepts, principles and historical facts are concerned, the instruction would follow predominantly the objectivist approach: the instructor leads the lecture and discussion while demonstrating the derivation of formulas and explanations for principles and practices. Obviously, the major portion of this is accomplished by classroom lectures and in-class quantitative problem solving sessions and the like. For example, discussions of various forecast methods, Break-even analysis, Little's law, waiting line models, just to name a few, are best delivered with an objectivist approach.

Upon completion of the above, students apply these concepts to different situations to derive actionable decision support; thus, the constructivist learning takes place. Students should also be able to apply these principles and practices to contexts that are not necessarily discussed in the classroom and be able to reach correct conclusions and make reasonably well informed decisions [11]. This part of the learning follows a constructivist approach; this will translate, partially, into homework assignments, quizzes, and class projects where students apply the concepts learnt in class to new contexts etc.

As much as 75% of the content of the POM course is principles and practice and fact-based learning where the instructor takes the lead and explains to students. The remaining 25% of content or learning is better imparted in a constructivist approach to ensure that students are, after all, able to spot the connections between theory and practice and use the appropriate principles and practices in solving problems/writing reports. In doing so, I also try to incorporate the AACSB learning outcome requirements of BBA students (communication skills, critical thinking, team work etc.).

Grades in POM 3310 are determined with the following weights for components:

3 Tests: 300 points,

3 Assignments: 100 points,

6 Quizzes: 30 points,

Class participation: 20 points,

Final Project Report: 25 points,

Final Presentation: 25 points,

Total: 500 points.

Tests are based on chapter material, lecture notes and quizzes, and homework assignments. However, I carefully select the test questions from publisher provided test banks and almost always, supplement them with questions I develop to ensure a blend of questions that require an understanding of basic concepts as well as analytical skills. This section is predominantly aligned with the objectivist approach even though there are a few application-oriented questions in each test.

My hope is that in solving homework assignment problems and developing the class project reports, students are learning in a constructivist methodology and, accordingly, tend to discover new knowledge on their own and be able to develop the necessary skills and competencies to be successful at work during and after the course.

Online delivery - some adaptation in course design

In light of the discussion in the foregoing section, when I was asked to teach POM online, I started to worry as to how I will manage the objectivist approach in an online format which is more eminently suitable for constructivist instruction design.

In a typical face to face class, the POM class either meets twice/thrice weekly. In my opinion, twice weekly is good, but others may hold contrary opinions. My rationale in leaning towards twice weekly is that the student is required to attend the class frequently enough to motivate him/her to read the course material and class notes for either of the two classes, thereby ensuring the student remains engaged in class. I carefully space in-class work (which mostly involves solving a few end-of-the-chapter quantitative problems), short quizzes (usually one for every two chapters) and homework assignments once every four chapters (usually due a week before the corresponding mid-term). In-class work and quizzes prepare students to tackle homework and mid-terms. Further, returning the graded homework provides the necessary feedback to students do well in midterms by clarifying any aspects that were not grasped during the initial discussions in the class.

Keeping in mind that online students are taking the online class for reasons of their busy schedule besides other reasons and requiring them to rigidly participate in fixed time online discussions/chats would be inconvenient and may turn them away from their educational pursuit, I had to rationalize how I would design the course requirements to ensure a reasonable level of engagement and yet leave a certain amount of flexibility for students in how and when they participate in class and take care of the assignments.

Although this was my first time ever to teach POM 3310 online, it was not my first ever online teaching experience. In fall 2012, I was assigned to teach MIS 3310. It was the second day of the fall 2012 semester, and I was assigned after one of my graduate course assignments didn't make. On that occasion, a very large MIS 3310 course section was split into two sections, and the second of the two sections was assigned to me. I didn't resist it that time because all the material was already developed by a colleague who was teaching the other MIS 3310 section. As such, I was able to use the same material. Fortunately, I had taught this course the previous summer using the same textbook my colleague adopted. I must admit that my colleague had designed the course fairly well (though I would have had a few things different if I had developed it from the scratch). That whole semester I had pretty much replicated the discussion posts and assignments, tests etc. using the material that was so, generously, made available.

Further, I had been using our ANGEL portal (or some variant) for posting Power Point lecture notes, homework assignments, and grades for Power Point my face-to-face classes, so I was rather familiar with the usage of online portals. Given my education and training in MIS for my master's study, I was fairly conversant with the mechanics of online hosting of material etc.

Armed with the above stated teaching philosophical outlook, IT credentials, some experience and associated exposure to the ANGEL platform, I set out to develop the syllabus and material for my POM 3310 online class in spring 2013. I came up with the following broad outline and components of grade.

First off, adopting the guidelines from our OIT, I provided a word of caution in the syllabus, this is an online course. A significant difference between online and more traditional lecture and face-to-face courses is that in an online course the student is much more responsible for carefully, thoroughly, and thoughtfully reading and reviewing the assigned material. Paying attention to detail is crucial. Furthermore, the style of communication in an online course is different than in a face-to-face class. While an online student can always use email to ask the instructor questions or request more information, this lacks the immediacy and richness of communication in a face-to-face class. (Excerpts from POM 3310-280, spring 2013 syllabus).

Grades will be determined with the following weights for components:

3 Tests: 300 points,

13 Assignments: 130 points,

Class participation: 20 points,

Final Project Report: 50 points,

Total: 500 points.

I retained the two mid-terms and the final as they were. Came up with weekly chapter assignments by combining the short quizzes and homework assignments into one. Likewise, I retained the class participation points, which will now be measured and awarded based on participation in the online discussion forum of the class web. And finally, I combined the team project report and presentation requirements and modified it to be an individual project report requirement instead of team work.

My rationale in coming up with above design is as follows:

I need to keep students coming back to the online course frequently and keep them engaged in class discussion and other interactions on a regular basis. What better way to require student participation than to link it with some grade component? So, the weekly chapter assignments requirement was reasonable to incorporate. Students need to review the chapter material—including the solved problems therein—review the end-of-chapter quiz questions, class notes posted under the Power Point presentations from the class in ANGEL, and submit the online assignment for each chapter on weekly basis. These weekly assignments encompass true/false questions, multiple choice questions, and fill-in the blanks quantitative problems. Typically, these assignments have about 20 questions to answer in 60 minutes (timed from the start). The assignments are open throughout the week and end on midnight of a specified week day, Wednesday for the spring semester. Since these weekly assignments count for a grade, students usually do not miss them (on an average 90-98% of students submit these weekly assignments- class size in spring 2013 was 60).

Tests are, obviously, open book but are timed. Students have 90 minutes to solve about 20 true/false questions, 20 (or more) multiple choices, and about 10 (or fewer) fill in the blanks type algorithmic questions. My expectation is that an average student will be able to answer the true/false questions in half a minute each, and multiple choice questions in 1-1.5 minutes each and require an average of 3 minutes for each of fill-in-the blanks type question by computing the answers based on formulas etc. This allows students to be able to complete, the exam in 70 minutes (10+30+30), and leaving about 20 minutes to review their responses. Tests are non-cumulative.

I require students to participate in the discussion forum by posting comments, questions, and observation about the class material or related issues. One common weekly requirement for all students is to post a brief note on the following:

You are required to participate in the discussion forum each week to ensure a better learning experience. Participation in the discussion forum counts towards the class participation points. Each of you after reading the chapter and submitting the assignment is required to post a brief note of 50 words or less on discussion forum to report, "What new knowledge did you gain from the chapter that you didn't know before reading the chapter" and "how may this new knowledge be useful to you in your studies/work/life or otherwise.

Example of weekly post on discussion forum: after reading chapter 1 one may post: "I now know that, all firms/businesses are engaged in producing products or providing services. Products are tangible while services are intangible" (OR Operations and Supply Chain management is the design, operation and improvement of the systems that create and deliver a firm's primary products and services/ OR While many of the Operations Management basic concepts have been around for years, their application in new and innovative ways is exciting). And knowing this will help me understand better the concepts and discussions in my other business courses" (OR relate what I see in daily life events to the products/services discussed in the chapter/ OR use this knowledge at work in writing my reports or planning for activities) (excerpts from POM 3310-280, spring 2013 syllabus).

As for the class project, since some of the students are distance learners and may not be able to attend and present reports, I dispensed with presentations. My rationale is that the course description doesn't mandate oral communication per se, and likewise, this is not the only course that is set to promote team work, so I converted the team project into an individual project report. I require each student to develop an individual report on a chosen product/service assuming the role of the promoter to explain the various production operations management aspects of the product/service. I provide elaborate details for the report requirement and grading rubric etc. For example, the project description includes the following.

In your project report you will first, outline the business and operations strategy, mission statement, core competencies, product and process design, and quality considerations in the manufacturing process for the product/service you have selected. Then you will proceed to analyze and select a production location or locations, forecast your production requirements, plan the capacity of your production facility, schedule considerations, and establish the necessary supply chain partnerships. Additionally, you will need to discuss what your inventory management policies will be, and your plans for implementing ERP and Lean management in your production facility. You will need to include the following sections in your Project Report: (excerpt from POM 3310-280, spring 2013 syllabus).

I advise students to start thinking about the project from around the third/fourth week and gradually develop their report over several weeks to be able to turn in the final report by end of 15th week (usually a week before the finals). I encourage them to communicate with me by email, by phone, in person by scheduling appointments during office hours or otherwise, to discuss any project-related issues and seek clarification if need be.

Considering the fact that the project report is a major component of the constructivist instruction design aspect of the course, I tried to provide as much detailed instructions as possible in respect to the project report. More specifically, I followed the user manual the OIT provided for developing rubrics for grading purposes and came up with the rubric for my class project. Such rubrics not only help students to not lose track of the requirements but also help the instructor in grading the reports by using consistently uniform metrics. This ensures fairness in grading and also allows students to know, beforehand, the requirements and upon grading where they missed some points and/or where they may have done better etc.

Technology Tools and Other Resources

I had the benefit of the following resources in developing the necessary assignments/tests and other components of the course.

Publisher provided resources

a) Instructor manual,

b) MS Excel spread sheets containing chapter problem solutions and templates for solving similar problems,

c) Basic set of power points,

d) Files of all figures/exhibits from textbook chapters,

e) Files and Power Point for appendices,

f) Test bank file in word format as well as in a format compatible with Angel,

g) Solution files for end-of-the-chapter problem sets,

There are many benefits of selecting an appropriate textbook authored by seasoned authors. For one, the authors would have incorporated their long years of teaching experience in selecting or developing the apt illustrations. Further, if the book is published by a well-established publisher with experienced editors, then the instructor's manual and supplemental material will provide ample opportunities for the instructors to pick and choose required resources that suit the design for content delivery.

I started with the Power Point sets and made suitable changes as I saw fir by adding new slides wherever felt necessary. I added sufficient notes under each slide capturing the transcript of lecture I would give in a face-to-face lecture.

I had the benefit of using the supplemental material from the publishers by suitably incorporating the same for this online class. In particular, the test bank and MS Excel spread sheets containing several quantitative illustrations of the book were immensely helpful. The templates provided in the MS Excel spread sheets allowed me to pose fairly advanced level of quantitative problems on chapter assignments as well as on tests.

Our Office of Information Technology (OIT) distance education group resources

a) Initial class shell set up with links to netiquette etc.

b) Assistance in uploading the test bank and other resources into web repositories,

c) Online tutorials for students to navigate the ANGEL environment,

d) Many other online videos and resources to assist students in their learning experience,

e) Technical support for test set up,

f) Technical support for linking assignments and test grade to grade book,

g) User manual and help in developing the grading rubric for online class projects,

h) And in general "on call" availability of technical support.

Needless to state, that I received helps and support from our OIT during the course of the entire semester in designing and delivering the course. Many ready to use templates and video clips were readily made available to provide necessary navigational orientation to students.

ANGEL environment

a) Options to set up assignments in many different formats choosing many different question formats such as true/false, multiple choice, match the following, fill in the blanks, algorithmic questions etc.

b) Options to choose required number of questions from a predetermined question pool,

c) Options to randomize the order of questions,

d) Options to randomize the order of answer choices (or leave certain questions as is while others are randomized),

e) Create and post algorithmic questions – with answers that are supported with a variety of options- numeric: equal, equal

subject to rounding up to required decimal precision, or answers with numerical tolerance etc.

f) Options to time the assignments/tests,

g) Many different options to track user/student activity, access and performance in class,

h) Options to show one question at a time (possibly, for tests) versus all at once (for chapter assignments),

i) Options to provide or withhold review options soon after an assignment or for a day or two after assignment as required,

j) Turn-it-in drop box that generates a similarity report of every student submission of reports/essays comparing it with huge database of all online material including all prior student submission at all educational institutions using turn-it-in.

Angle also provides a host of other user (instructor) friendly features to make online instruction experience effective and enjoyable. Personally, it was a very enriching learning experience for me in honing my online teaching skills.

Using the above features of ANGEL it is possible to create fairly distinctive questions sets/sequence for students taking quizzes and tests in this class, while at the same time ensuring that the questions are of same level of difficulty and test student's comprehension of same set of concepts and formulas. From a simple option to present the same set of questions in a randomly selected order to each student to posing distinctive questions based on same formula/algorithm but selecting one of the possible combinations of numerical data values, ANGEL provides the instructor with many possible options to ensure that each student reads and answers his question set carefully.

For example, consider the following algorithmic question:

Assume a fixed cost for a process of ${a}. The variable cost to produce each unit of product is ${b} and the selling price for the finished product is ${c}. What is the number of units that has to be produced and sold to break-even? Round up your answer to integers.

Where the variables a, b, and c can take a randomly picked value from the predefined list of values as below.

a={15000, 20000, 25000}

b={10, 15, 20}

c={25, 30, 35}

These set of values result in 27 ($3C_1 \times 3C_1 \times 3C_1$=3 × 3 × 3=27) possible distinctive questions of the same formula viz.,

Q_{BE}=FC/(SP-VC).

If I were to add one more possible value for each of the three variables then the number of possible distinct questions becomes 64 ($4C_1 \times 4C_1 \times 4C_1$=4 × 4 × 4=64). If an instructor were to create two similar questions and but with different value lists for the variables in a test and selected the option of "randomize the order of questions" in a test of 50 questions, no two students will have the same question in the same position on a given test. However, care must be taken to ensure that the value lists include realistic values guaranteed to result in valid responses. For example in our above case, the lowest of the sale prices must be ≥ to the highest of the variable costs. Otherwise, the denominator value turns negative resulting in a negative break even quantity signifying that there is no feasible solution for the given set of values.

Assessment and Evaluations

We had two sections in the discussion forum. The first section was exclusively for "meet and greet" to introduce oneself to others and to get to know your fellow class members. All students in class were required to post, in the very first week, their personal details and comment/respond to at least three posts of their fellow classmates to ensure they are participating in the class.

An indirect objective of this requirement was to ensure that all students are familiar about logging into the discussion forum and to post 'new' posts as well as to 'respond to 'existing posts.' Apparently, students enjoyed this quite a bit with near 100% participation in this section.

The second section of the discussion forum was used to posting any questions concerning the class material, assignments, tests etc. and also for making the weekly chapter learning notes that would count for class participation grade. I used this forum to provide feedback about weekly assignment grades/participation as well as test grades feedback and other class policies etc. This forum was also used for responding to student queries concerning correct answers for specific questions on an assignment or test as well as to remind them about due dates and requirements and other class related announcements. While not all students participated in the forum, participation was about 75 to 80% in most weeks. Over 50% of the students in class secured full grade on class participation requirements.

Student evaluation

Student evaluations for the course were reasonably good with an average aggregate score of 4.2 out of a possible 5. I think this was reasonable considering that I had been receiving comparable evaluations in the face-to-face class although I received much higher evaluations on occasions and lower evaluations as well on other occasions (semesters).

Student gave quite positive feedback and comments about the class conduct fairness of assignments and test format as well as the overall learning in the course. Some students made suggestions about extending test times and providing YouTube video clips and offering extra credit opportunities and so on.

Some of the aggregate scores as follows: In response to the question, "On an average how many hours have you spent on this course, including attending classes, readings, reviewing notes, writing papers any other course related work?" the average was 5.50 hours/week.

In response to the question, "Was this course intellectually stimulating, the response was 100% in affirmative.

There were many other students responses that seemed to corroborate the rationale of statistics course being a prerequisite, reading being an essential part of online classes, teachers notes, Power Points, spreadsheet, homework assignments contributing to the learning and so on.

Conclusions and Takeaways

What did I learn from this experience: I found myself checking my email more frequently and also checking the ANGEL course shell more frequently—at least twice or more a day? I was also posting short announcements from time to time, responding to student posts in the discussion form, and other such communication. In many ways, I was following the suggestions to teachers given by Hailey et al. listed below.

1. Visit the class often,

2. Learn to recognize warning signs and respond to them,

3. Post messages often,

4. Respond immediately to relevant posts and to all student emails,

5. Use the telephone to solve difficult problems and to reinforce support for frustrated students.

As may be noted, the implementation of suggestions 3 and 4 from above has yielded very good dividends in terms of student responses to the evaluation survey and contributed to a very positive learning experience for students.

What I now know, that I didn't know before, is that Publishers McGraw Hill provides excellent instructor material/supplemental material suitable for online teaching. As a matter of fact, I could teach this course using McGraw Hill's Connect Portal, if not for the privacy concerns we had at our institution for student data and student work, which, I too, shared to a reasonable extent. Through Connect Portal, it is easier to practice quizzes, grade quizzes and other assignments.

The ANGEL platform, too, has several teacher friendly features to design and post assignments and tests that help to design the course for a more effective delivery.

Grading in regards to assignments and tests can easily be automated, and maintenance of the grade book becomes easy and less time consuming than in a face-to-face class.

While it takes a lot of time and effort to create the initial set of lecture notes and assignments material etc., future/subsequent improvements/enhancements and modifications are very easily accomplished with less and less effort and finer refinements.

There is an excellent support network of publisher resources and our own TAMIU's OIT resources to help run the class, smoothly.

That most students are better prepared than I suspected to take an online class and succeed (if passing a course and receiving a decent grade is the criterion).

It's always a good policy to provide more time for chapter assignments since that activity is part of the learning process while it's advisable to give just about the correct amount of time for tests because tests form part of the assessment process and students are expected to have become familiar with the content by the time they are taking the midterms etc.

The instructor needs to determine the policy of providing or not providing the answer key and feedback soon after completing an assignment versus waiting until all students in class have submitted the assignments or the due date has passed. Whatever decision is made, this practice must be followed, consistently.

It's also not really necessary to record your lectures for an online class. Though, recording such lectures would make it easier on students who are accustomed to learning by hearing rather than by reading and doing.

What might I do differently?

a) I might give more weekly assignments based on chapter material, such as posting a news clip/video and requiring students to watch/study and share their observations with others in class on a discussion forum. Of concern, though, is the fact that students spent on average only 5.5 hours/week for a 3 credit hour course. I would like to have seen them spend anywhere between 8 to 10 hours/week. SACS COC's policy statement in regards to credit hours while adopting the applicable Federal regulations in this respect stipulate it to be as follows:

Not less than one hour of classroom or direct faculty instruction and a minimum of two hours out of class student work each week for approximately fifteen weeks for one semester or trimester hour of credit. Include more constructivist instruction by requiring students to search online for stories of interest concerning the concepts in class and post links on ANGEL along with their observations of how the report/story is relevant for the class and enhances the learning experience.

b) Include more algorithm-based questions and provide more time for submitting the weekly assignments and possibly increase the weight for weekly assignments.

c) Reduce the weight for tests down to possibly 40-50% of overall course grade (currently it is 60%).

d) In general, emphasize a constructivist approach to instructional design than at present given that the future of higher education appears to move in that direction.

e) I might use more variety of question formats to make the tests more challenging to promote constructivist learning.

f) Use available options in ANGEL to create more distinct, yet, comparable standard tests for each student in the class (where no student receives the same set of questions on tests and yet are essentially tested on same basic concepts.

g) Hold online office hours/chat sessions to promote interactive discussions and dialog to emulate face-to-face class discussion.

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