# Development of online principles of economics courses: twenty years of reflection

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ABSTRACT

The use of online courses has expanded dramatically at institutions of higher education over the last several decades. Appropriate design of an online course is instrumental in determining the quality of the student experience and the amount of material students retain from the class. However, the instructor has a tremendous amount of freedom when it comes to course design. This paper contains the lessons learned from teaching face-to-face and online Principles of Microeconomics and Principles of Macroeconomics courses for twenty years. Topics discussed include general considerations such as overall course design and the appropriate vehicle for communicating the course information as well as specific design decisions such as grouping of material within the course, video design, assignment design, accessibility issues, and testing procedures.

Keywords: Distance Education, Teaching Strategies, Pedagogical Issues, Online Learning, Lightboard
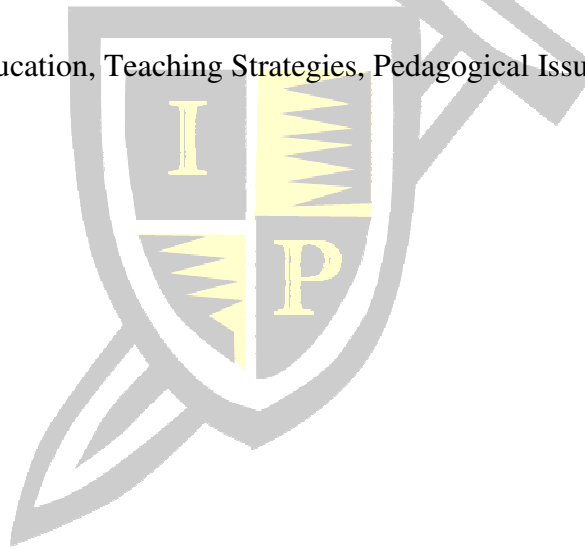
INTRODUCTION

While online classes have been in use since the creation of the World Wide Web, the emergence of the Covid-19 pandemic increased their usage dramatically. The pandemic resulted in a switch to online instruction at all education levels. While the end of the pandemic largely brought a return to face-to-face instruction, use of online instruction is still higher than pre-pandemic levels. Tight university budgets, improved technology, and decreases in the size of the pool of students attending college will likely continue to push higher education institutions toward more online instruction in the future. Online courses allow universities to draw from a larger group of potential students (Allen and Seaman, 2014; Limperos et al., 2015). However, it also exposes institutions to a greater degree of competition with other institutions than traditional face-to-face courses as there is no need for the student to be located in proximity to the institution. At the same time, opportunities for students to cheat in an online environment are expanding.

The obvious question is whether or not this expansion in the use of online course is beneficial for student learning. Additionally, the expansion in the use of online courses impacts the satisfaction of students taking online classes as well as the satisfaction of the instructors that teach them. It has never been more important to examine the characteristics of high-quality, online instruction.

Not surprisingly, evidence on student learning in online courses is mixed. Clearly, the amount of student learning done in any class is a complex function of the characteristics of the student, the instructor, the material being taught, and the organization of the online class itself. It is not possible to make a general statement about the overall effectiveness of the online learning environment. However, there is an abundance of work in this area. Early work by Bray et al. (2007) emphasized that institutions must gather data on the effectiveness, or lack thereof, of online courses in order to better allocate resources toward faculty who do a good job of developing courses that foster student learning. Brown and Liedholm (2002) look specifically at the teaching of microeconomics online and find that students in the online sections perform worse on exams than students in the face-to-face section. The effect was especially pronounced for test questions that required complex thought. A very similar result is found by Figlio et al. (2010), also in the area of economics instruction. Soffer and Nihmias (2017) find evidence that online courses are at least as effective as face-to-face instruction in terms of several measures of effectiveness. Their results must be used cautiously as the authors do not control for student selection bias or instructor differences between the two forms of instruction. Means et al. (2009) also find evidence that online instruction can be effective. They use meta-analysis to find that learning outcomes for students in online classes exceeded those of students in equivalent face-to-face classes. Bernard et al. (2004) use meta-analysis to conclude that, in terms of synchronous learning, classroom learning results in more learning than online education. They conclude that, in general, research into the efficacy of distance education is of low quality. Overall, the evidence indicates that online instruction has value if time and effort is spent designing an effective course.

Bolliger (2004) finds that the instructor is the most important determinant of student satisfaction in an online course. Other important factors include the technology used as well as the interactivity of the course. Herbert (2006) examines the factors that determine student satisfaction and retention in online courses and finds that faculty responsiveness to the needs of students is of primary importance. Bolliger et al. (2014) develops a self-reported measure of the

satisfaction that instructors get from teaching online courses, and recommends that administrators monitor levels of satisfaction as it is related to the quality of instruction that students receive. Hampton et al. (2020) explores instructor satisfaction with online courses and finds that the development of self-efficacy, often acquired over time, leads to higher levels of satisfaction.

The purpose of this paper is to discuss the issues addressed by the author from 20 years of teaching Principles of Economics in both face-to-face and online formats. Though the discussion will concern instruction in the area of economics, the issues discussed are relevant to the development of online classes in other disciplines.

The specific courses that will be discussed in this paper are Principles of Macroeconomics and Principles of Microeconomics. The author has taught both of these classes at the college level in a face-to-face environment for two decades. In order to understand the development of the online courses, it will be instructive to first discuss the structure of these face-to-face courses. For these courses, the method used to communicate information to students is through lecture with students taking notes. The author prefers not to use Powerpoint slides, instead opting to write information on a whiteboard. Teaching of economics involves the presentation of basic principles of logic, principles of human behavior, factual information, mathematical calculation, and graphical analysis. Student learning is enhanced by active student participation with the material during class. The knowledge retention benefits of student note-taking during class are well-documented (Aiken et al., 1975; Einstein et al., 1985; Mueller and Oppenheimer, 2014). There is also evidence that the use of Powerpoint slides as a means of providing information to students reduces student note-taking and knowledge retention in college courses (Worthington and Levasseur, 2015; Baker et al., 2015). The author has found that students are much more willing to take notes when the note-taking process is modelled for them by presenting the information on a whiteboard. Additionally, many of the graphs that are used in an economics class are complicated enough that students need to draw them many times before they understand them enough to answer exam questions correctly. The author's goal in drawing them on the board (rather than showing Powerpoint pictures of them), is to encourage students to interact with the material by drawing them repeatedly.

Students are incentivized to attend lectures through the use of attendance points. Students begin the semester with a set of attendance points and lose points for each unexcused absence. Homework is handled through an online homework program. Though the bulk of the course material is communicated through lecture, it is not the case that the entire class period consists of lecture. Other information is provided through the use of short videos, online visualizations of data, and online articles. The field of economics is also very conducive to short classroom discussions. These allow both the students and instructor to have a short break from the mental rigor of note taking and lecturing. Student evaluations indicate high levels of satisfaction with the design of the face-to-face courses. Typical comments include, "I liked how we actually took notes rather than using Powerpoint. I found I learned so much more through taking notes. Very interesting class" and "The notes and lecture together really improved my learning. I like how you didn't use Powerpoint! I tend to pay more attention when I am forced to use my own notes. You really made this class interesting! The use of life examples and how the topics related really held my attention and helped me learn the material."

The author developed the online principles courses 15 years ago. The success of the face-to-face versions of the classes drove many of the decisions made in the development of the online versions. The Principles of Macroeconomics and Principles of Microeconomics classes

were designed to be as similar to the face-to-face experience as possible. As a result, video was chosen as the main method of communicating the material to the online classes. Of all the options available, the use of video is the best at simulating the in-class experience. Homework is conducted through the same online platform as that used in the face-to-face sections of the course. Supplemental short videos, data visualizations, and articles are also presented to online students as links within the course. There are a number of issues that one must consider when designing an effective online class.

GENERAL CONSIDERATIONS

There are some general principles that can guide the creation of a good online class. For example, Quality Matters (qualitymatters.org) and Online Learning Consortium (onlinelearningconsortium.org) are excellent resources. Both provide research and resources that can be used in course development. However, instructors still have a tremendous amount of leeway in the process, and the choices that an instructor makes will be dependent on the type of material that is being taught, the characteristics of the students they will be teaching, and the instructor's strengths and weaknesses.

Synchronous vs. Asynchronous

One of the most important decisions that has to be made in the development of an online course is whether to design the course to be synchronous or asynchronous. Synchronous courses operate in real time, with the students and the instructor participating together from different locations. In many ways, this is very close to a traditional classroom. The interaction is typically done on a set schedule. Asynchronous courses do not depend on a set schedule. Students typically have more flexibility in terms of when they interact with the material.

Each approach has its own particular advantages and disadvantages. Many students who choose online classes do so because of the flexibility that it provides. This can be a downside of setting a class up to operate synchronously, which requires students to participate at set times. Asynchronous classes provide flexibility to the student, but may lead to feeling of isolation for students. Schoenfeld-Tacher and Dorman (2021) find that students may feel a lack of instructor interaction, but found no significant difference in student learning between synchronous and asynchronous classes. Kunin et al. (2013) compared student preferences for face-to-face, synchronous, and asynchronous classes and found that students preferred the asynchronous format to the synchronous format.

One important consideration when making this decision is the nature of material. As noted by Parslow (2012), subjects that lend themselves to speculation and points of opinion are more conducive to the synchronous format. Subjects of a more technical nature are often best handled with an asynchronous format. It is also the case that the two formats can be combined. Some material may be provided in a format that can be accessed at the student's leisure, while other course activities can be scheduled for students and instructor to participate in together.

Though the use of an asynchronous format may be a factor in increasing student isolation, there are tools for increasing students' feeling of participation. One option is through the use of video to present the material. This will be discussed below. Another option for providing interaction between students and instructor can be developed through discussion boards. It can be challenging to create discussion board assignments that allow each student to

participate in a meaningful way. In the field of economics. opportunities exist for students to discuss the economic impact of a policy or situations where a student has experienced a topic being discussed in class. However, many contributions take the form of "I agree with this post." The creation of artificial intelligence (AI) platforms such as Chat GPT increases the challenge of incorporating discussion board assignments into a course as it can aid in student cheating. The power of AI can also be used to assess student writing assignments. Tools such as Packback (packback.co) are available to both coach students toward better writing as well as aid instructors in evaluating writing assignments. Covelli (2017) contains a thorough discussion of the use of discussion boards as a way of fostering communication and community in an online class.

An additional option for reducing the feeling of isolation is the use of Zoom (or a similar tool) for question/answer sessions and discussion sessions. These types of activities allow students to interact with other members of the class without the added pressure of being graded on the quality of their contribution.

Delivery of Material

Another important decision that has to be made is how the material is to be communicated to the student. Common options include but are not limited to assigned readings, video, voice-over slide presentations, and synchronous streamed lecture. One way to overcome the impersonal nature of an asynchronous class is through the use of videos for delivery of the material. Choe et al. (2019) explore the use of different styles of video presentation by measuring student satisfaction as well as student learning, and find that many of the formats considered produce similar student learning outcomes, but that student satisfaction depended on the format, with the lightboard (learning glass) format performing the best.

The lightboard is one of the most innovative tools ever developed for the production of educational videos. The lightboard allows the presenter to maintain facial contact with the camera while seeming to write in midair. Figure 1 (Appendix) shows a frame from a typical lightboard video. The technology was developed in 2013 and involves a large panel of glass with LED lights surrounding the outer edge. The lights cause the writing to fluoresce on the board. The instructor stands on one side of the board while the camera films from the other. The image is then reversed for the final video so that the viewer can read the writing. The fact that the instructor is able to maintain visual contact with the viewer while writing increases visual interest for the viewer. Lubrick et al. (2019) discusses a variety of issues related to use of lightboard technology in the classroom and for video production, pointing out that including an instructor on the screen significantly increases the attention that students devote to the video. Another important issue is whether including an instructor on screen increases or decreases the cognitive load of the viewer. They conclude that cognitive load is not increased.

One surprising outcome of the use of video in the author's classes is the often-expressed view of past students that they felt as if the class was produced specifically for them. The use of the lightboard video format, with the instructor presenting to the camera (as opposed to a video of the instructor presenting a lecture to a face-to-face class) creates a more intimate experience for the viewer. This is one of the main advantages of the lightboard format over other formats such as voice-over slide videos that do not include the instructor on screen.

Though many universities have created lightboard studios for the production of videos using the technology, it is relatively cheap to create a home studio (Birdwell and Peshkin, 2015). The technology can also be used in a face-to-face format to replace a traditional whiteboard

(Skibinski et al., 2015). For a review of the literature on the use of lightboards in various educational settings, see Aslanidou (2022).

An obvious consideration with any educational video is length. There is a wealth of research on the relationship between video length, cognitive load, student interest, and student learning (Manasrah et al., 2021; Slemmons et al., 2018; Zhu et al., 2022; Yu and Gao, 2022). The general consensus is that shorter videos are better at reducing cognitive load and maintaining interest. This may be appropriate if the amount of information that needs to be communicated is small. However, a typical chapter of economics material often has dozens of interrelated concepts that need to be communicated. This creates a dilemma: create one (or a few) long videos or many short videos. A student who chooses not to watch past the 30th minute of a single video is not going to begin watching the 7th five-minute video. Because of the asynchronous nature of the class, students are not required to watch a video in one sitting. Students can self-regulate their watching to suit their learning style and state of mind at the time. The decision was made to go with fewer, longer videos rather than many, shorter videos. A single video was developed for each chapter covered in the class. Videos range from 50 minutes to 100 minutes depending on the amount of material covered in each chapter.

Another important consideration in the development of any educational video is the ease with which new material can be incorporated into the videos. Videos that cover current topics become outdated quickly, so it is important to consider what material to include in the video. Because the basic economic theory that is covered in a Principles of Macroeconomics and Principles of Microeconomics class changes relatively little over time, care was taken to not mention current events during the lecture video for each chapter. This allows for the videos to be used without revision over a longer period of time. Current topics are presented to the classes in the form of shorter videos.

Delivery of the class

Multiple learning management systems (LMS) exist for course management and delivery of online course materials, including Blackboard, Canvas, Moodle, and others. Many possibilities exist for the organization of the material with the LMS. However, care must be taken to make sure that the overall organization of the class is simple and intuitive for the student to navigate. A "Start Here" page is a good way to get students oriented to how things will work at the beginning of the course. The Start Here page for the Principles of Macroeconomics and Microeconomics courses contains the course syllabus, a welcome video in which the basic details of the class are discussed, the instructor contact information, a link to the discussion board for the students to introduce themselves to the other students in the class, and a link to the area of the LMS that contains the course content (lecture videos).

Course content can be grouped according to time (e.g. by the week) or according to subject (e.g. by the chapter). How the course content is organized depends in large part on the decision of how to assess student learning in the course. A variety of options exist for testing including tests and quizzes, homework assignments, projects, participation in discussion boards, performance tasks, and observation. The field of economics lends itself to assessment using tests, homework assignments, and discussion board posts. As a result, course content in the author's Principles of Macroeconomics and Microeconomics classes is organized by chapter. For each chapter, students view the lecture video, complete a homework assignment, and take an exam. Another testing option is to have fewer exams, each covering multiple chapters. Though this

approach tends to work well in a face-to-face class, it is not as effective in an online class. Students sometimes tend to procrastinate until just prior to the exam. Breaking up the material into smaller segments reduces the impact of procrastination.

Homework is often best handled through an online homework program. There are several options in the field of economics including Macmillan's Achieve, Cengage's MindTap, Pearson's MyLab, and McGraw Hill's Connect. These programs all have similar features and the choice is often driven by the instructor's choice of textbook. The author uses one homework assignment per chapter. An additional assignment given twice during the course is for the student to listen to a relevant podcast and write a short synopsis.

Hosting of the instructional videos is an important issue to consider. The most common approach is to upload videos to a hosting platform and then embed them in the LMS. Increasingly, instructors are opting to make lecture videos publicly available through platforms such as YouTube. One advantage of this approach is YouTube's automatic closed captioning generator. Accuracy of the captions depends on the clarity of the speaker's voice and the quality of the microphone used to capture the audio. Tisdell and Loch (2017) examine the issue of closed captioning in mathematics educational videos and emphasize the importance of providing accurate captions for accessibility purposes. This is made more challenging when considering translations of captions for international students. Dallas et al. (2016) find that college students who use closed captioning while watching educational video scored high on information recall exams. Accessibility issues are also an important consideration of documents that are provided within the course. Dell et al. (2015) contains a discussion of the provision of accessible materials for students with physical and/or learning disabilities.

Another advantage of publicly hosting educational videos on a platform such as YouTube is that public availability can increase the reach of the videos, resulting in increased exposure for the instructor and/or the university. The author makes videos for both Principles of Macroeconomics as well as Principles of Microeconomics publicly available on YouTube. This has resulted in more than 1,000,000 views and 180,000 watch hours by students in economics classes around the world.

One of the most important considerations with the development of an online course is the evaluation of student learning. Unfortunately, student cheating is common in higher education (Fendler et al., 2023). Evidence indicates that cheating is more common with online classes than with traditional face-to-face classes (Lanier, 2006). The creation of language processing models driven by artificial intelligence technology (e.g., Chat GPT) has made cheating in an online environment easier than ever before. Moten et al. (2013) provides a variety of suggestions for curtailing cheating, including placing a strict time limit on tests, randomizing exam questions and responses, using a proctoring service, and using statistical analysis to detect cheating. Testing in the author's online classes is conducted through the LMS' testing function. Many of the suggestions from Moten et al. (2013) are incorporated. All students take the test for a particular chapter on the same day. However, the student has flexibility as to the time of day they take the exam. The exam becomes available in the morning and closes as midnight. Students get 45 minutes to take the exam, with the clock beginning when the exam is opened by the student. Question order is randomized for each student and the order of the question answers is randomized. Questions are presented one at a time. Once an answer is submitted by the student, they may not go back and change the answer. As the student takes the exam, they know how much time they have left as well as how many questions they have yet to complete, but they do

not see the upcoming questions. Once the student has completed their exam, they may not view the exam again until all students have taken it.

An additional precaution mentioned in Moten et al. (2013) is to perform a Google search for each question on an exam prior to making the exam available to students. The growth of academic resource sharing sites such as Quizlet, Chegg, and Course Hero has increased the ease with which students can find answers to exam questions online. A remedy is to search each question on the exam and make changes to any question for which the solution is available online. Often, minor changes are all that is required to keep a Google search from leading the student to the answer. Other options are discussed in Fendler et al. (2023).

The author has found that this testing procedure results in a distribution of test grades for the online class that is very similar to the distribution of test grades for equivalent face-to-face classes. Figure 2 (Appendix) shows a comparison of the distribution of test grades between an online section and face-to-face section of Principles of Macroeconomics. Both sections are from the Spring 2023 semester, and each was of 16-week duration. Tests in the author's face-to-face sections are given in a proctored environment. Results indicate relatively little variation in the distribution of test scores across the online and face-to-face mediums, even without the use of an online proctoring service for the online section.

Other Considerations

Student internet connectivity is an important consideration in the development of an online class. Katz et al. (2021) find that students with better internet connectivity experience better learning outcomes in an online experience, but finds that connectivity does not have as large of an impact on learning as effective communication with the course instructor. Ohuh et al. (2022) explores the relationship between internet service reliability and the incidence of missed assignments, and find, not surprisingly, that students with more reliable internet service tend to miss fewer assignments in online classes. Successful online classes require institutional guidelines that take into consideration the underlying factors that affect students, but also requires that the instructor keep open the lines of communication with students. Connectivity is clearly a more important issue if the class is set up to operate synchronously.

Organization of the course within the LMS is also an important consideration. The author has found that the best approach is to keep the structure of the course relatively simple. The main LMS page for the course has links to the following sections: Start Here, Discussion Board, Course Content, Class Announcements, Course Calendar, and My Grades.

At the beginning of the course, students are directed to go to the Start Here page. As noted above, this is the location of the course syllabus, a welcome video, instructor contact information, a link to the discussion board for students to introduce themselves, and a link to the first folder of course content. The Discussion Board is the location for the student introductions as well as the discussion prompts assigned throughout the course. A thread is also created for students to ask questions of each other.

The Course Content section is the location of the lecture videos, links to the homework assignments, and the exam for each chapter. The lecture video and homework assignment for a chapter become available to a student when they complete the exam for the previous chapter. Each chapter exam is pre-scheduled, with all students taking the exam on the same day. This obviously prevents students from working ahead on material. The author has found that this prevents students from attempting to complete all the material at the end of the course and also

lessens the likelihood that students are able to cheat by viewing material early and providing information to other students. Subjects other than economics may be more conducive to allowing a greater deal of flexibility for student to choose when to complete assignments and exams.

In a course with pre-scheduled exams, it is important to make sure that students are aware of the schedule at the beginning of the course as well as throughout the course. Reminders are sent to students throughout the semester through the Class Announcements page. Announcements are stored on the page as well as emailed to students. This allows students to go back and view past announcements. The Course Calendar is also available for students to view upcoming events. Finally, the My Grades section allows students to view the grades they have received on assignments and exams.

This is a relatively simple structure that allows students to quickly find what they need. A majority of the student's time is spent in the Course Content section, so it is important to make the organization of the material inside that portion of the LMS logical and obvious.

Finally, it is very important to be available to students. Responding to emails quickly and sending reminders before important deadlines increases the student's feeling of interactivity.

CONCLUSIONS

The author has found that the structure discussed above results in a well-functioning course that generates high levels of student satisfaction. Final grade distributions are very similar across the face-to-face and online formats for both the Principles of Macroeconomics and Principles of Microeconomics courses. Clearly, the most important aspect of any online course is the choice of how the material is communicated to the student. The use of lecture videos is a good choice for subjects that contain a large amount of objective information that the student must learn, with lightboard technology emerging as the best choice for creating videos that maintain student interest. Other options, such as synchronous streaming, exist for subjects that are more conducive to a discussion format.

It is also important to preserve the academic integrity of the online course. Cheating is certainly not a new activity for students. However, the development of AI technology has made it easier to cheat than ever before. Ensuring that steps are taken to reduce opportunities for students to cheat is a necessary step in preserving the value of online education.

Above all, it is important to critically evaluate the performance of the course on a regular basis. Though student satisfaction is an important consideration, the satisfaction of the instructor is also important. Fortunately, there is no single combination of characteristics that form a good online course. The instructor has a tremendous amount of freedom in choosing how the course will be structured, how the material will be communicated, and how student learning will be assessed. By carefully evaluating the good (and not-so-good) aspects of the course over time, the instructor can develop a course that is conducive to student learning as well as satisfying to teach.

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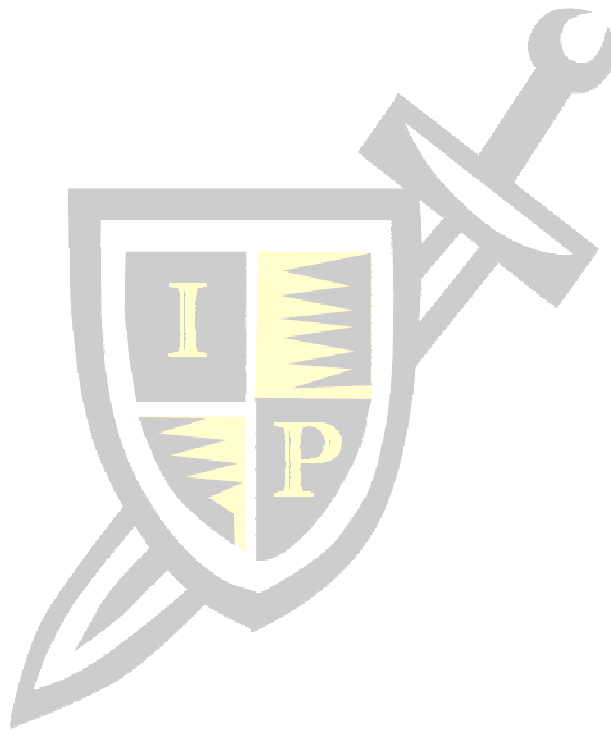
APPENDIX

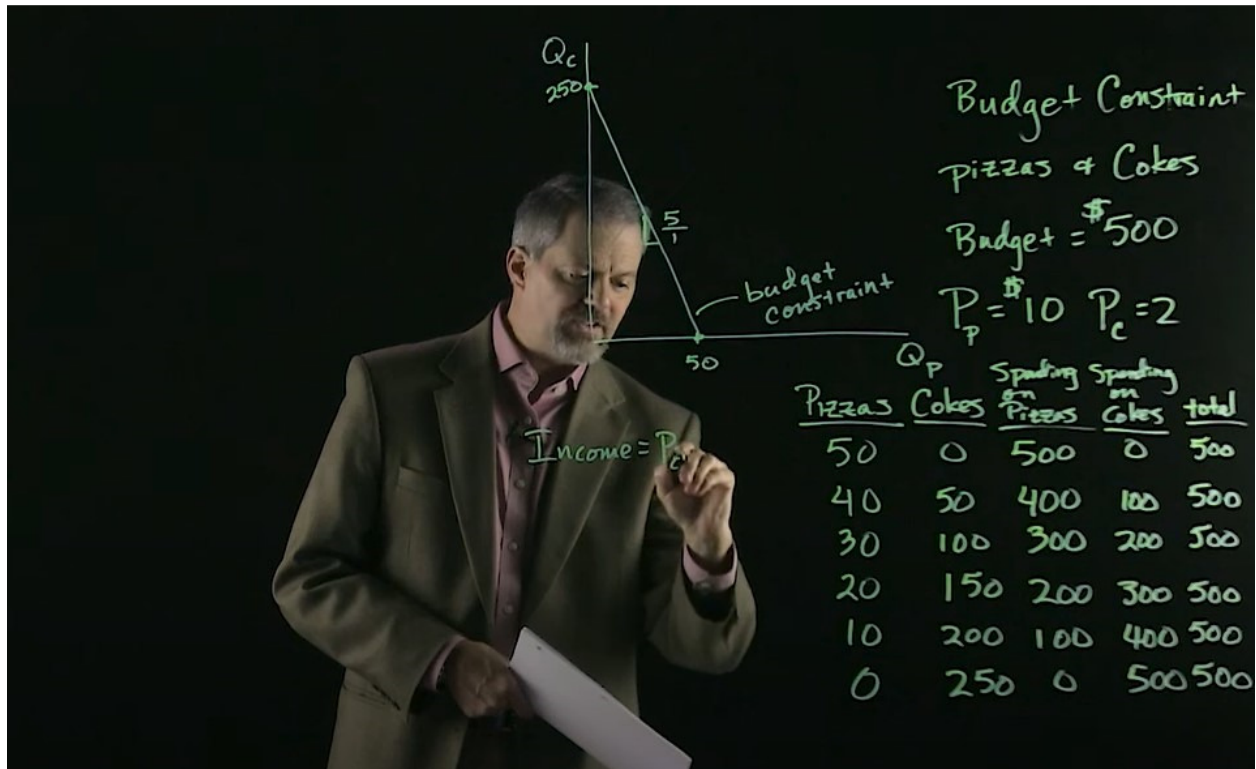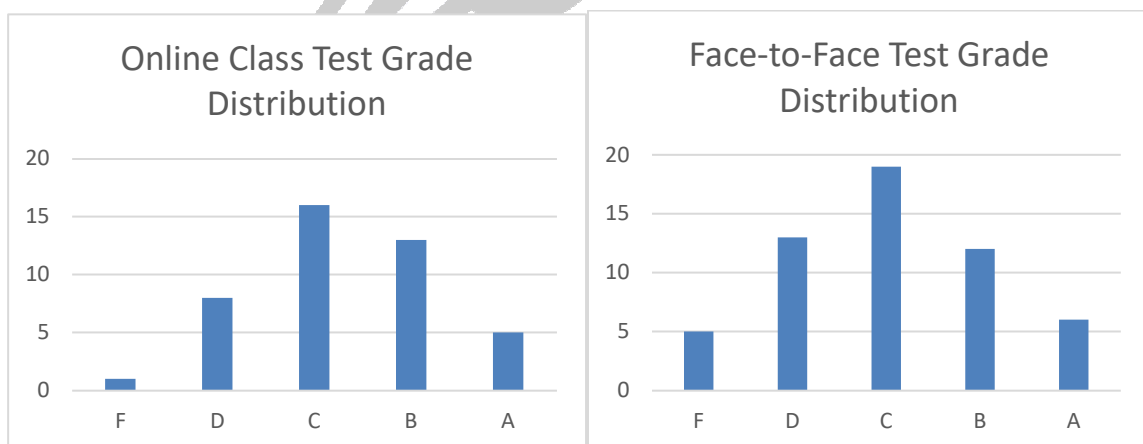Figure 1: Frame from lightboard video

Figure 2: Comparison of test grade distributions for online and face-to-face classes

Notes: These do not represent final course grades. Test grades were averaged across all tests taken during the semester. Both courses were for the spring semester, 16-week duration, with coverage of the same chapters. Online class students took one test for each chapter (11 total), while face-to-face students took a total of four tests in a proctored environment.