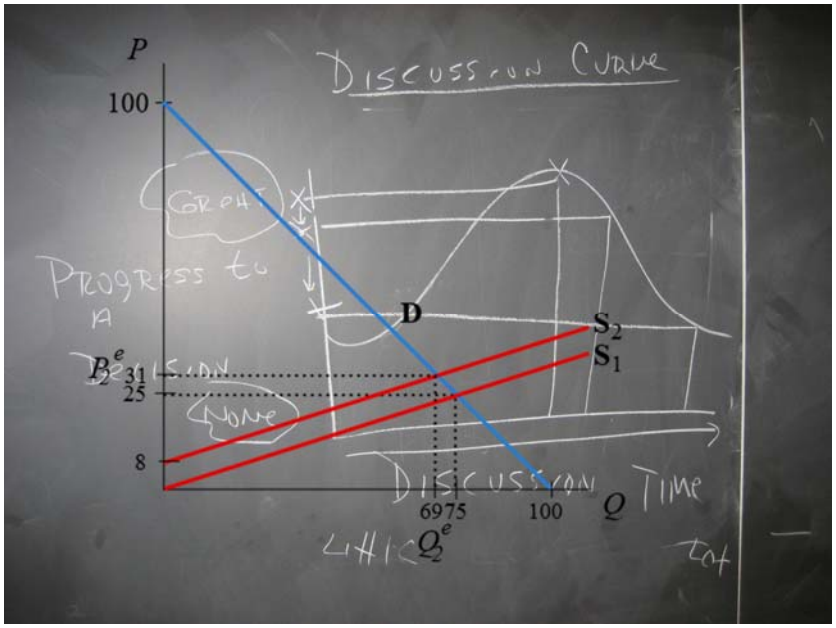
2014b Departmental Impact Grant Final Report

Economics

Using Hybrid Technology to Improve Student Learning Experiences in a Large Course



The Department of Economics converted a large lecture (600-plus students) section of Econ 2001.01: Principles of Microeconomics into a hybrid offering, with the goal of improving student learning experiences by increasing interaction.

Lectures were delivered in HyFlex mode, so that students could attend in-person or from any location with internet access. A back-channel was provided so that students could pose questions wherever they were. Lectures were also recorded and made available for later review. Three of the 15 recitation sections were presented in hybrid format. Quizzes and homeworks were made available online. The online support structures of the course were revised with guidance to minimize effort required for course logistics.

Executive Summary

Goals

We gave students in a large-section (600+) Introduction to Microeconomics more control over their education and enabled instructors to shift time from course logistics to subject education by making more effective use of learning technology, including hybrid-flexible (HyFlex) lecture delivery and Quality Matters-based course design.

Outcomes

Students consistently preferred the technology-enhanced version of the course and made use of new opportunities with no statistically significant impact on grades. Attendance – but not the mode of attendance – predicted performance.

Process Analysis

ODEE and Economics team members collaborated smoothly to meet and exceed the original project goals in a timely manner. The course redesign required much more time and effort than normal course preparation.

What We Learned, in a Sentence

A mega-lecture course can provide active and individualized learning when learning technology is used intelligently, while online quizzes and practices increase students' engagements with the course, availability of information online free instructor's time of answering frequently asked questions via emails.

5 Talking Points

- Students made use of online lectures, both live HyFlex and recorded.
- Students valued and made use of online assessments.
- Attendance predicts performance, regardless whether online or in-person, but mode of attendance does not predict performance.
- HyFlex delivery in recitation was not as effective.
- Efficient course logistics reduce student direct contacts gradually as students learn how to use online resources.

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Project Committee

Economics

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Project Goals and Objectives

Background

Principles of Microeconomics (Econ 2001.01) is a basic course for all students selecting to major (BA and BS) or minor in economics, as well as a General Education (GE) course in the College of Arts and Sciences. As a result, Econ 2001.01 has very large enrollments, up to [department total] students per [semester/year]. To accommodate this multitude of students, the department offers several "mega-lectures" per term, ranging from 600-700+ students.

These mega-lecture sections serve as the first encounter with the Department and College for a wide range of students from throughout the university. Improving the student experience thus has great potential to improve general perceptions of both, as well as recruiting additional enrollment in Economics courses.

The student experience in large lecture is limited. A sense of community is lacking. There is minimal one-on-one interaction with the instructor. The one-way communication structure, as well as the theater-style architecture required to seat so many students at once, allows for very little communication between students. The natural formation of student study groups is absent, and learning as a shared experience is limited. The logistical difficulty of providing basic instruction and assessment leaves little room for individualization: one size must fit all, because the cost of providing alternatives is prohibitive.

Solutions

This project addressed these problems by using elearning technology to provide a more flexible student experience. Specifically, we introduced the HyFlex teaching model for lecture and some recitation sections, so that students could choose how they attend and encounter course materials. We also improved the presentation of non-lecture and non-recitation elements of the course to provide better support for learners and to enable instructors to devote more time and attention to non-logistical aspects of the course. This involved a fundamental redesign of the Carmen course using best practices for distance education and adopting a new textbook and elearning platform supported by the publisher.

Goals achieved

- **HyFlex Lecture:** The project team will implement the Hybrid-Flexible (HyFlex) teaching model, which features the use of synchronous streaming of lectures to enable both flexible attendance and active participation. Those activities will also be recorded and made available. A student-response system or other online tool will be used to provide a back-channel that can be used for polling questions to test student comprehension and also to encourage and capture student questions.

    - This goal was successfully achieved. All lectures following week three were streamed online for synchronous attendance and recorded for make-up and review, except [two], which were missing sound due to technical problems.
    - Re-design of all PowerPoint materials to optimize for online delivery (larger images, less text, e.g.) contributed greatly to the success of this goal. Nicole King (ODEE)'s guidance in this work was crucial.
    - There were significant technical problems capturing sound for HyFlex during the first few weeks of the course, despite thorough testing during the weeks before the course. The

podium computer had been re-imaged in the final week before the semester started, which introduced an incompatibility. Andy Kuhar and Tate Donovan worked diligently to diagnose and resolve these problems in time to deliver HyFlex lecture as scheduled.
    - While successfully implemented in the pilot, it will be possible to improve the delivery of this teaching method, as the instructor continues to get familiar with how to optimize materials for online delivery. For example, there is more work left to be done in order to have more efficient use of tools like "Poll Everywhere."

- **Online assessment:** The current system of in-class quizzes during recitation sessions will be replaced with online quizzes.

    - Using online quizzes worked well overall. We created a question bank of 50 questions per quiz, and configured Carmen to provide students a random selection of five questions per quiz, including at least one from a set number of topics for each quiz. Students were given the option to re-take quizzes, so that they could test their understanding, and they did so in large numbers.
    - However, using Carmen for non-credit homework problems did not work well since Carmen Quizzes was a more suitable tool for multiple choice questions rather than open ended questions.

- **Improved Online Course Information:** In order to minimize instructor time spent on the logistics of the course and replying to e-mail, delivery of course information will be streamlined using Quality Matters standards as a guideline, and an online Q&A system will be provided as the primary means for posing questions.

    - We added an FAQ section to the content page that included a thorough digest of previously asked and answered questions from previous semesters and used a jQuery script to provide students with an accordion menu for accessing it.
    - We also utilized discussion section of Carmen for Q & A. Students were encouraged to post questions and seek and provide answers to questions in a designated forum, which the instructor and TAs monitored on a daily basis.
    - While students used and liked these resources, the flow of emails continued. It seems students' expectations for quick answers to their questions are much higher this semester compared to previous semesters. Subjectively, it seemed that more questions than usual concerned the subject of the course than course logistics.

Additional goals pursued

- **Adoption of eTextbook and Publisher Learning Platform:** A new textbook was adopted for the course, which was available in both printed and electronic versions. In addition, students had the option to pay for access to a publisher-provided website which provided practice questions and additional learning material.

    - Students who used publisher's digital resources had access to more practices found it helpful based on several students' comments.
    - We coordinated a thorough accessibility of this platform and shared the results with the publisher, who has already begun the process of incorporating the suggested improvements.

- **Revised Course Materials for Better Online Delivery:**

- The content page and PowerPoint presentation slides were completely redesigned in order to apply "Quality Matters" principles. The support of Tim Lombardo and Nicole King were crucial for identifying opportunities and developing efficient processes to implement wide-spread improvements.

Goals partially achieved

- **Pilot Hybrid Recitations:** Use technology to improve consistency and student experience in recitations by standardizing student experience around engaged activities. Develop an online/hybrid format for three of the 15 course recitation sections, probably HyFlex, but other formats will be considered.

    - What was achieved: Apoorva successfully developed and implemented a HyFlex format for three of the recitations. She configured a CarmenConnect space to enable student small-group work, as well as to stream Q&A. She developed online-deliverable versions of recitation handouts and other materials. Altogether, she enabled students to attend and participate in recitation synchronously online or to attend in person.
    - What was not achieved: CarmenConnect does not fully support interactive online recitation activities. Collaborative whiteboard composition, for example, cannot always be shared with the full class, and annotation of PDFs in small groups is problematic. The quality of audio and occasional difficulty setting up audio also results in a substantially diminished experience. As a result, few students made use of HyFlex recitation, so that the effort to provide the option was not justified.
    - A more detailed assessment of HyFlex recitation is attached as Appendix A.

Goals not achieved

- Building study group via Carmen Connect and integrating into recitations were not successful.

Goals not actively pursued

- **Virtual Office Hours:** Students will be able to interact with the instructor in-person or via online means. (2 hours per week).
    - It was decided that in-person office hours and availability of recitation leaders at all class sessions would be more effective ways to address students' needs with available resources. Low participation rates in HyFlex recitation indicate that this was likely correct.

Students affected by pilot

579 enrolled students (as of 12/3/2014)

The same model was employed in a similarly sized section in Spring 2015.

Approximate time spent by [department] faculty and staff on the project

Team Member	Hours
Ida Mirzaie	525*
Ana Ramirez	#
John-David Slaughter	#
Other Staff	#
Apoorva Rama	#
Joe Duggan	#
Other GTAs	#
Total	**[total]**

* The time reported is an additional time spent on this course compared to a regular delivery time of the course.

Approximate total cost (not including staff time)

Resources	Cost
Equipment purchases: TA Computer, Microphone, other	$2,800
PollEverywhere	$600
Total	**3,400**

Project Implementation Process/Timeline, aka, Steps Taken to Accomplish Project Goals and Objectives

Milestone / Deliverable / Event	Due	Completed	Responsible
Draft of all assessment instruments	Fri 4/4/2014	6/26/2014	Ida, Ana, Henry
IRB submission	Sat 4/12/2014	7/21/2014	Ida, Ana, Henry
Information about previous student course questions compiled (by admin TA)	Wed 4/16/2014	4/16/2014	Duggan
CarmenConnect open workshop	Fri 4/25/2014 10:30 AM	Fri 4/25/2014 10:30 AM	Votino, Henry
Ida trained on Connect and SRS	Sat 5/10/2014	5/10/2014	Henry, Ida, ODEE
Course Carmen Shell rebuilt using ODEE best practices template	Wed 5/21/2014	7/1/2014	Henry, ODEE, TA

Lecture Materials Revised (to incorporate SRS and HyFlex delivery)	Sat 5/24/2014	8/1/2014	Ida, TA
John-David bootcamp training in Carmen complete	Sat 5/31/2014	5/31/2014	John-David, ODEE
Ida - vacation	Wed 5/28 - Sat 6/14/2014	---	
Final Decision about Testing Modality Made (In-person, GEC-aligned, Carmen, Other)	Mon 6/16/2014	6/1/2014	All
REGULAR TA STARTS WORK	Tue 6/17/2014	6/17/2014	
SUMMER SESSION STARTS	Tue 6/17/2014	6/17/2014	
[TA training on Carmen]	Fri 6/20/2014	began on time	TA, ODEE
Online Assessment System Designed (Revision of Former Recitation Quizzes)	Wed 7/2/2014	7/1/2014	Ida, TA (with ODEE)
CarmenConnect and SRS configured	Sat 7/5/2014	7/5/2014	Ida, TA (with ODEE)
Online Information System complete (Carmen revision: news, discussion, and content)	Sat 7/12/2014	7/10/2014	Ida, TA
Recitation materials revised for HyFlex	Sat 7/12/2014	7/10/2014	Ida, TA, Admin TA
Recitation TA trained on course content and recitation material	Tue 7/15/2014	7/1/2014	Ida, TA
CarmenConnect and SRS testing window starts	Fri 7/18/2014	began on time	All
CarmenConnect and SRS Built	Sat 7/19/2014	7/19/2014	Ida, TA
TAs trained on SRS and Connect	Sat 7/26/2014	7/26/2014	TA, ODEE
ADMIN TA STARTS WORK	Sat 7/26/2014	8/26/2014	
Virtual Office Hours Ready to Go	Sat 7/26/2014	N/A	Ida, TA (with ODEE)
100 Questions for In-class polling & response uploaded	Tue 7/29/2014	7/29/2014	Ida, TA
Online Quiz Questions Written and Uploaded	Thu 7/31/2014	7/31/2014	Ida, TA
TA Training Prepared	Fri 8/1/2014	8/1/2014	ODEE
CarmenConnect and SRS Tested	Sat 8/2/2014	8/1/2014	All
Dress Rehearsal	Tue 8/5/2014	8/6 + 8/13/2014	All
Recitation Rooms Configured in Connect	Tue 8/5/2014	8/5/2014	TA (with ODEE)
TAs trained on HyFlex Model + Course Material	Thu 8/7/2014	8/7/2014	TAs, ODEE
HyFlex Recitations Tested	Sat 8/9/2014	8/6/2014	All
Quizzes Written and Uploaded	Thu 8/21/2014	6/15/2014	Ida, TAs
TAs trained on Course Material	Sat 8/23/2014	8/22/2014	Ida, TAs
All GTA's information session- TAs Ready to Go	Tue 8/26/2014	8/22/2014	All
DAY ONE -- All course components ready to go	Thu 8/28/2014	Went on time	All

Relation of Charter Timeline to Project Timeline

Overall, the project followed the timeline, and no major thread of the project was delayed in a way that affected the student experience. Every team member went above and beyond to ensure that the project stayed on schedule and succeeded.

There were some changes in the sequence of activities, as project members' availability and the priority of specific activities changed. A few threads of the project took more time than expected to implement, such as identifying the specific limitations of group work in CarmenConnect. Scope creep played some role, as Carmen and powerpoint redesigns delayed some work that otherwise would have happened sooner. IRB, as usual, took longer than anticipated.

Project Assessment

Outcome summary

The grant project went well. The project plan laid out several goals. All goals were successfully implemented (except online office hours, which were not attempted) and most changes improved the course experience for students and instructors. Above all, technology enabled students to customize their engagement with the course, rather than forcing a single educational model on all.

High-level insights from this project include:

- HyFlex lecture was very successful. Students made extensive use of synchronous HyFlex delivery and recorded lectures and expressed strong preference for continued and expanded use of both.
- HyFlex recitation was less effective. Online options for recitations were not used as much as expected and were not as effective as in-person activities.
- Online assessment was well-received. Students made use of and expressed appreciation for the online quizzes.
- Efforts to streamline the logistical aspects of the course were successful, which made the class better, but not less effortful. Student-instructor contact time shifted to conceptual/content questions. Total effort (student questions, office hour visits, etc.) did not diminish, however, as students asked significantly more content and conceptual questions.
- Carmen course and powerpoint redesigns improved student experience.

Based on what we learned from implementation of the project during the pilot, we are making adjustments driven by cost-benefit analysis. We will continue HyFlex offering of lectures but not recitations. We will continue with online quizzes on Carmen and we will also continue using Carmen's Content page, Discussion section, and Grade book as tools to communicate with students.

Overview of Assessment Plan and Methods

Data to assess the effectiveness of the project and impact of technology were gathered from three main sources:

Surveys

- Early-course:
- Mid-course #1:
- Mid-course #2:
- End-of-course:

System Data

- Carmen
- CarmenConnect
- PollEverywhere
- SIS

Student Grades

Highlights from Assessments

- HyFlex attendance did not significantly impact course performance, but attendance itself did. Those who attended did better in the course than those who did not. It did not matter how students failed to attend.

Details from Assessments

HyFlex Lecture

Students report making use of HyFlex attendance option – or choosing not to do so

- 51% of students reported that they attended lectures online at least half the time in the end-of-course survey, up from 42% on the second survey. Interestingly, this change came mainly from those who originally reported they attended "Rarely Online": their numbers dropped from 45% on survey 2 to 28% on survey 4. Those who reported attending "Never Online" rose from 13% to 22%.
- Students were generally attracted to online attendance over the course of the semester with 31%-44% reporting that they were attending online more than they had initially thought, while only 7%-9% reported that they attended less often.
- On Survey 1, 78% of students agreed that they were "comfortable in their ability to accomplish course tasks that include Adobe Connect."

CarmenConnect system data roughly confirms student self report

- 383 students were logged into the course for a relevant number of minutes at some point during the semester.
- On average, students were logged in for 40.4 minutes per class session. Standard deviation of 12 min indicates it was not rare for students to attend the full 50 minutes, but most arrived and/or left a few minutes early.
- Average minutes per session remained roughly consistent throughout the term, with a slight decline in November.
- The number of online attendees increased rapidly through September, then leveled out with only slight increases for the remainder of the term.

Students made use of recorded lectures

- Increasing numbers of students watched lectures when they missed class: 16% on Survey 2, 24% on Survey 3, and 29% on Survey 4.
- The percent of students who missed class and did not watch or intend to watch recorded lectures consistently dropped 68% on Survey 2, 53% on Survey 3, and 44% on Survey 4.
- Over 90% of students reported having viewed recordings of lectures that they also attended, either in person or online. 17%/24%/26% reported having watched all or most of the recorded lectures they also attended.

Students valued HyFlex attendance option and recorded lectures

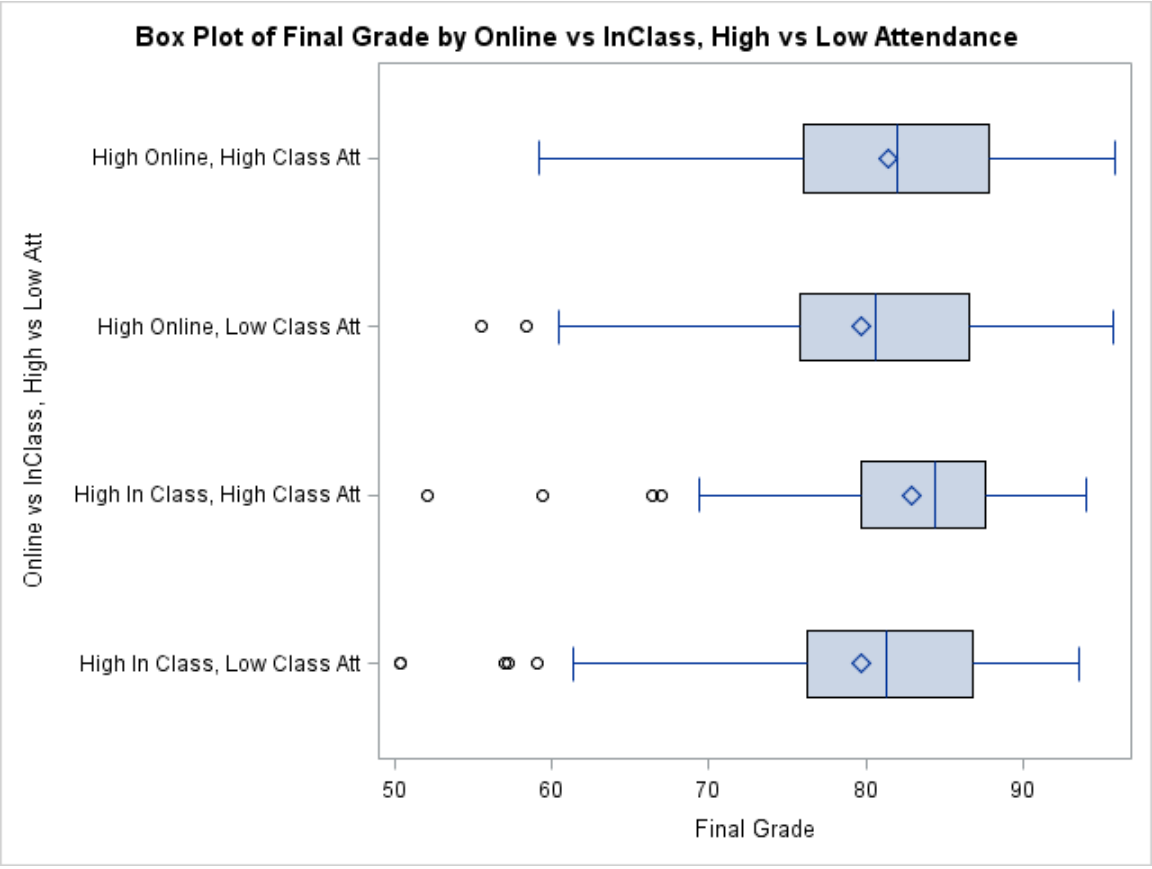
- 61%/73%/77% agreed that "technology will make it easier to understand the language used in this course."

- 58%/66%/68% agreed that "having course lectures available to me via Adobe Connect is helping me learn."
- 44%/49%/54% agreed that "listening to recorded lecture helps me to understand the concepts better."

HyFlex attendance did not predict course performance

- Frequency of attendance versus modality of attendance revealed that there were four consistent cohorts:
    - 183 Frequent in-person attenders
    - 126 Frequent online attenders
    - 164 Infrequent attenders, who attended in person when at all
    - 79 Infrequent attenders, who attended online when at all

- Frequent attenders received higher grades than non-attenders
- Frequent in-person attenders received slightly, but not statistically significant, higher grades than frequent online attenders.



HyFlex/Online Recitation

Students did not make frequent use of HyFlex attendance option in recitation

- 84%/76%/74% reported that they rarely or never attended recitation online via CarmenConnect.

Students generally valued learning activities in recitation.

- 70%/66%/73% agreed that "group work during recitation sections helped me practice and understand the concepts of the course."
- 75%/83%/78% agreed that "discussions during recitation sections helped me practice and understand the concepts of the course."
- 75%/83%/78% agreed that "discussions during recitation sections helped me practice and understand the concepts of the course."
- 86%/84%/85% agreed that "problem assignments during recitation sections helped me practice and understand the concepts of the course."
- 78%/78%/78% agreed that "additional lectures during recitation sections helped me practice and understand the concepts of the course."

They found less value in the use of learning technology during recitation.

- 45%/48%/46% agreed that "Instructional technology helped me engage with members of my groups during recitation sections."
- 27%/31%/36% agreed that "attending recitation online via CarmenConnect provides a better learning experience than attending recitation in person"

Online Assessment

Students valued online assessments

- At the beginning of the term, 95% of students reported that "I feel comfortable taking quizzes online."
- Students completed multiple attempts of quizzes:
    - Quiz 1: 916
    - Quiz 2: 1358
    - Quiz 3: 1018
    - Quiz 4: 848
    - Quiz 5: 957
    - Quiz 6: 973
    - Quiz 7: 946
    - Quiz 8: 858
    - Quiz 9: 785
- Students completed multiple attempts of online homeworks:
    - Homework 1, Part 1: 3016
    - Homework 1, Part 2: N/A
    - Homework 2, Part 1: 854
    - Homework 2, Part 2: 1109
    - Homework 3, Part 1: 841
    - Homework 3, Part 2: 766

Logistical Improvements

Students made use of the online syllabus and course overview resources

- Syllabus (Word): 518

- Syllabus (online): 444
- Syllabus (Course Overview and Objectives): 297
- Syllabus (Course Materials): 216
- Syllabus (Grades and Grading Policies): 296
- Syllabus (Participation and Communication Expectations): 137
- Syllabus (Academic Integrity): 62
- Syllabus (Accessibility Accommodations): 80
- Welcome: Let's Get Started: 248
- Syllabus & Technology quiz: 557

Students found limited value in online course information resources

- 71%/62%/64% agreed that "Q & A on Carmen helps me to find answers to my questions without having to email my instructor."
- 281 students accessed the FAQ content item for an average of about 2.3 minutes per user, indicating that over half of the students sought and found answers there.[1]
- Participation in discussion forums was mixed, but significant:
    - There were 132 posts (original or reply) in 92 threads in 12 discussion forums, including 51 questions posed via PollEverywhere and addressed in the forums..
    - 430 students read at least one post, though only 29 posted.
    - Students who read at least one post read an average of 30 posts.
    - Students who posted at least once posted an average of 1.5 posts.

General Course and Economics Appreciation

Students had skills and devices required for the course

- 98% reported that they have access to a tablet or a smartphone.
- At the beginning of the term, 90% of students reported that "I feel comfortable in my ability to accomplish course tasks that include PollEverywhere.com."
- At the beginning of the term, 78% of students reported that "I am comfortable working in an online environment."
- At the beginning of the term, 85% of students reported that "I am comfortable using technology as described for this course."

Students valued the use of technology

- 83%/76%/76%/81% agreed that "Instructional technology used in this course is helping me learn."
- 83%/48%/48%/52% agreed that "The online discussion used in this course is helping me participate more actively."
- 69%/73%/76%/77% agreed that "Instructional technology used in this course increases my satisfaction with the course."
- 77%/82%/84%/76% agreed that "Instructional technology helps me engage with the content of this course."

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[1] About a dozen visits longer than 45 minutes were deleted as likely failures to log out, rather than measures of actual use.

- 64%/58%/63%/60% agreed that "Instructional technology helps me engage with the instructor of this course."
- 46%/44%/50%/47% agreed that "Instructional technology helps me engage with my peers in this course."
- 49%/53%/67% agreed that "The use of PollEverywhere.com to ask questions during lectures is helping me learn."

This course improved students' perception of economics and the department

- 98% of students reported taking the course as a requirement, 76% as part of a major or minor.
- 82%/81%/74% of students also reported interest in learning economics.
- Most students had limited experience with economics:
    - 57% had taken no other economics courses
    - 14% had taken macroeconomics
    - 28% were repeating microeconomics
    - 2% had taken economics in high school
- Students' confidence in their knowledge about economics increased consistently. 45% agreed that they felt confident on the first survey. 80%/78%/77% on subsequent surveys.
- 74%/69%/64%/75% rated the importance of learning microeconomics important or very important. Only 2-3% rated learning economics unimportant.
- 79% agreed that "After taking this course, I will recommend other students take economic courses like this."
- 64% agreed that "After taking this course, I will take at least one more economic course."
- 66% agreed that "After taking this course, I am interested in learning more about economics."

Technology helped students (including those learning English) learn the language of economics

- 96% of students consistently identified themselves as native or fluent English speakers.
- 60%/73%/76% of students agreed that "Technology will make it easier to understand the language used in this course."

Experience of Teaching with Learning Technology

Survey

Please indicate how strongly you agree or disagree with the following statements: (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree)

1) The use of technology improved student learning in my course.

   Strongly Agree

2) The use of instructional technology improved my teaching.

   Strongly Agree

3) My students had the technology skills needed to succeed in my courses.

   Strongly Agree

4) My students had adequate access to hardware and software.

   Strongly Agree

5) There was adequate network access for all on-campus activities.

   Neutral

6) I spent too much class time teaching technology to my students.

   Neutral

7) Additional comments or feedback

Effect of Learning Technologies on Instruction

Recorded lectures, online quizzes, and discussion section on Carmen provided us a continued communication with students beyond the lectures.

Effect of Learning Technologies on Learning Outcomes

Students' grades and their satisfaction with the course improved compared to previous semesters.

Best Examples of Effect of Technology on Teaching

I use Polleverywhere and discussion section of Carmen to check if there are any concepts that need more explanations, examples and/or practices. Altogether, using different tools in my teaching has made me a better teacher and more responsive to students' needs.

Challenges

- Implementation of the changes took more time than I was expecting.
- The technology was not working as we were expecting.
- It took time for students to learn how to use the available resources.

Assessment of Assessment Plan

- We decided not to continue with HyFlex recitation.
- We decided change homework from previous semester to practices this semester.
- We continued with improved online quizzes based on our last semester's experience.

Experience of Tech-enhanced Teaching

My teaching in regard to the method of the delivery and the content has improved. The preparation time is lower this semester compared to the last, but it is still more compared to teaching a standard course as I am still working on improving the usage of PollEverywhere and the content.

Moving Forward

I have found online streaming of the lecture, recording the lectures, usage of quick response system very helpful in improving my communication with my students. Application of "Quality Matter" principles on lecture notes and Carmen Content have improved this course. I would like not only continue with my current course, but also apply it to any course with more than 50 students

Survey

Please indicate how strongly you agree or disagree with the following statements: (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree)

8) I am satisfied with the communication I received from the ODEE staff.

Strongly Agree

9) I am satisfied with the grant project contributions I received from the ODEE staff.

Strongly Agree

10) I have learned the skills necessary to continue related work on my own.

Strongly Agree

11) I found the ODEE staff approachable.

Strongly Agree

12) The lessons learned during this pilot will guide future course design.

Strongly Agree

13) Additional comments or feedback

Reflections on the grant process—what went well

Overall, we were able to apply changes in a timely manner.

We were able to deliver what we had promised.

In the process, I had the opportunity to get to know and work closely with ODEE staff people, graduate students in our department, and staff people from the department who helped and were ready to help well above my expectations.

I learned many new aspects of using technology that I am able to apply them not just to the current course but also to the other courses I teach.

Reflections on the grant process—what did not go well

We added to changes more than what we were planning to.

For example, I changed the PowerPoint slides more than twice since the final version of the master slides did not get ready until the beginning of the semester. The final version was so good that it was worth the time to use, but it put lots of additional hours of work than expected.

It took a while to realize and adjust to what we can and what we cannot do when using Quizzes on Carmen. Because of that, we had to readjust the format of the questions and the setting of quizzes and homework problems in order to make them workable. This also added to the workload.

Key lessons learned

Using technology helps to teach more effectively. At the same time, it is a time consuming process since many of changes are either new or not widely used. We had to learn via trial and error when it came to Carmen Connect, online quizzes on Carmen and PollEverywhere.

It is a good idea to remember what are in the scope and what are out of the scope of the project. This way, it is easier not to add to the project and make things more challenging than what they already are.

Suggestions for future recipients

Have your plan as detailed as possible and keep in mind that no matter how prepared you are in dealing with issues, you will always have to deal with unexpected and adjust the actual work.

While summer gives you time to do the initial preparation, many issues will not arise until the actual implementation of project when semester starts. Plan to spend more time than you regularly do even when everything seems ready.

Be prepared to learn as much as you can in using the technology and always have back up plans as some parts of the project may not work unexpectedly for one reason or another.

Even when you have lots of help in the process, there will be times that you are the one who has to resolve the issue one way or another since, after all, this is your course to teach.

Three words to describe working with the ODEE Team

1. Collegial
2. Reliable
3. Knowledgeable

Ah-ha moment of the grant process

☺

Department Chair Statement of Impact

THE OHIO STATE UNIVERSITY

College of Arts and Sciences
Department of Economics
[illegible]
[illegible]
[illegible] Phone
[illegible] Fax
[illegible]

June 1, 2015

Rob Griffiths
Senior Director of Distance Education
Office of Distance Education and eLearning
152 Mount Hall
1050 Carmack Road
CAMPUS

Dear Mr. Griffiths,

I am writing to express my appreciation for the Impact Grant awarded to Dr. Ida Mirzaie to incorporate technology in Economics 2001: Introduction to Microeconomics. The introduction of HyFlex attendance, online quizzes, a real-time student response system, and other tools were beneficial to student learning in the course. I especially appreciate the research component of the project, which indicates a thoughtful, student-driven approach to technology.

I especially want to draw attention to the contributions made by members of the Department of Economics staff who assisted Dr. Mirzaie, including Ana Ramirez and John-David Slaughter, as well as the graduate students on the team, Apoorva Rama and Joseph Duggan. It is my understanding that the Carmen, Classroom, and Communication teams within ODEE were especially crucial to the success of the project.

The work accomplished by Dr. Mirzaie and her team is an important step in our department's adoption of new teaching methods. We look forward to extending the collaboration with ODEE and using the insights gained from the Impact Grant project to make similar changes to other courses in the curriculum, as appropriate.

Sincerely,

David Blau

David Blau
Chair, Department of Economics

cc: Ida Mirzaie
Ana Ramirez
John-David Slaughter
Apoorva Rama
Joseph Duggan

This project went very well and demonstrates the ability of elearning tools to improve the student experience even in very large courses. The success of the project is primarily due to the hard work and dedication of the departmental project lead and team, who consistently put in the extra hours necessary to introduce several new technologies into the course. Results demonstrate that the effort successfully improved student experience.

Goals and objectives pre and post relation/connection

The project team accomplished what we set out to do, with a few exceptions. The overarching goal of the course – to improve student experience by means of technology – was achieved, and those improvements included the major changes originally identified as objectives: HyFlex lecture delivery, HyFlex recitation, online quizzes and homework, and improved online communications. One objective, online office hours, was not pursued, after preliminary explorations indicated it would require a lot of effort, while informal feedback from students indicated there was little interest in online office hours. Other technological changes to the course were achieved, despite being outside the planned objectives, such as the introduction of a textbook that students could purchase in electronic form and supplement with publisher-provided online systems.

Project Charter to Analysis relation

This project generally adhered to the charter, though there were some significant departures. The changes were refinements to a strongly consistent large vision, however, rather than fundamental changes to the project. The decision to improve Carmen and PowerPoint design, rather than invest that time in developing online office hours, for example, was a tactical decision about how best to devote limited project resources to maximize the impact of the online components of the course.

Number and roles of ODEE individuals involved in the grant project

5 ODEE staff played major roles in this project, while another 3 provided limited support.

- Henry Griffy was project lead and instructional design consultant
- Tim Lombardo was instructional design consultant, especially helpful in providing Quality Matters-driven feedback on the use of Carmen
- John Votino provided CarmenConnect and Carmen training and support
- Andy Kuhar coordinated classroom support, especially troubleshooting errors processing sound in the podium computer
- Nicole King consulted on effective design of PowerPoint presentations for hybrid delivery and the use of templates for efficient updating
- David Gerad provided communications support

Approximate number of ODEE people-hours spent on the grant project

150 hours

Reflection of what aspects of the grant process, procedures, and collaboration worked at or above expectations.

- Effective coordination of skills across ODEE
- Effective use of feedback from previous grant application to sharpen proposal and project
- Effective use of existing ODEE systems (supplemented by other tools to fill gaps in the toolkit)
- Strong communication and responsiveness on all parts
- Patience and persistence when there were technical problems
- Effective management of a large project/course team

Reflection of what aspects of the grant process, procedures, and collaboration were below expectations.

- Technical breakdowns -- podium audio, especially, but also Carmen survey output
- Limited success collaborating with other instructional efforts in the department (GE Online)

Three words to describe working with the recipients.

- Diligent
- Persistent
- Open

Describe an "ah-ha" moment during the grant project.

Seeing Independence 100, both empty and full.

Changes to our processes from this grant experience

This project affirmed most grant processes. Ida had applied in a previous semester, not been selected, and followed up. We collaborated both on changes she could make outside the grant framework and on her next application, which was selected. Planning went well, as all team members attended meetings, contributed ideas, and worked outside meetings to gather and organize what we needed to know. The work itself went smoothly, as several ODEE colleagues came together to help prepare the wide-ranging Economics team for the launch of the course and helped resolve glitches as quickly as possible. We gathered a lot of valuable data, which the Economics team was well suited to help us analyze. We are maintaining an ongoing support relationship and are collaborating on ways to help other instructors in the department make use of what we learned.

All grant projects can be streamlined so that more energy goes to production work and less to planning. This project helped identify some aspects of the planning process that can be streamlined. Also, we began "the work of the work" sooner than sometimes in the past, before planning was complete, in order to avoid any negative impacts of delay.

Appendix A: Assessment of HyFlex Recitation

by Apoorva Rama

Introduction

The purpose of this report is to update interested individuals involved in the Impact Grant about the progress of HyFlex Recitation taught by Apoorva Rama (Me!) for the Principles of Microeconomics (Econ 2001.01) course taught by Ida Mirzaie.

Structure of Recitation

The purpose of recitation is to give students the opportunity to practice some of the more challenging concepts taught in class. I specifically gear my recitations towards assisting students with understanding the more difficult "calculation-type" questions that could show up on quizzes, exams or homeworks. At the request of students, I also review concepts that they require further clarification on.

Before recitation officially begins, I hand out a worksheet to students attending recitation in class. The worksheet consists of approx. five short answer questions that relate to the material covered in the two most recent lectures of the course. Students online have access to a file-share which contains the same document (they can download the word document and save it to their computer).

What the students online see is identical to what the students attending recitation in-person see on the projector screen. When recitation starts, I select "share my screen" and I go through a PowerPoint that has all the items I would like to cover in recitation. The PowerPoint usually has a few slides to remind students of open items (i.e. quizzes and homeworks due in the near future), the recitation agenda (what topics are on the worksheet and will be covered in recitation) and any review items (i.e. formulas and concepts). All review items are done at the beginning of class and with student participation. For example, if I know students will need to use a specific formula for the worksheet, I will ask them to tell me what the formula is and put this annotation on the PowerPoint for everyone to see. Students can participate by either raising their hand and answering in-class, or typing in the answer online in the chat box. I also review concepts or calculation procedures that students specifically contact me about. I have found that this initial review is important for students to get the most out of the groupwork. If I don't do the review at the beginning, students often don't know how to get started on the worksheets and I end up individually answering the same question multiple times.

If students have no further questions, I let the students in the classroom work on the worksheet in groups of 3-4. I specifically mention which questions on the worksheet to go over and give them around 15-20 minutes to work on this. I usually walk around the classroom to answer questions or to casually check answers and assist with the way students approach the question. This is a very useful tactic, because it allows for me to have one-on-one interaction with students; therefore, I can cater my explanations and assistance towards the specific difficulties of the few students. Further, by the first midterm, I am aware of which students struggle early on and need immediate help, and which students just need me to casually check in later on. For students online, I upload a PDF version of the worksheet and share this document. Then I divide the students so that they are each in their own "breakout room". In the breakout room, they are required to work on the document on their own and show their work. While the online students are in their breakout room, I usually do not get the opportunity to check in on them. So I rely on them to "send a message to the host" in order to contact me if they have any questions while working on the worksheet.

At the end of this 15-20 minute block, the class reconvenes and we cover the material as a group. I go back to "sharing my screen" and use the PowerPoint to make annotations and go over each question. For each question,

I ask for a student volunteer walk me through the answer; this means that the student describes the answer and I simply write what the student says on the PowerPoint. I try to make a point to have students from different groups answer the questions so that everyone gets practice. When no one volunteers, I offer to walk a student through the answer if they don't know the answer, which is also useful. People online are also active in participation; although they cannot extensively explain their answers in the chat box, many do type in quick answers and sometimes brief explanations.

Attendance is taken in two ways. For those who attend in person, they sign into a paper sign-in sheet. For those who attend online, they are required to put their name in the breakout room document or notepad. After recitation is over, I go into the breakout room, check the work that has been done and then record the student's name. The students online have 4 options to show their work for recitation:

1. They can show their work on the PDF by using the draw tools and textbox
2. They can show their work and write their answers on the notepad or chat box which also shows up in the breakout room
3. They can type out their answers on a word document and upload this into the file share
4. They can type out their answers or write out their answers and email it to me within 15 minutes after recitation ends. This option is only open to students who have technical difficulties and for some reason get kicked out of their breakout room.

I also go into the reports section of CarmenConnect and ensure that the individuals getting credit for recitation were logged in for the majority of recitation.

Differences in Online vs. In-Class

Since I see the students who attend in-class, I am more familiar with their names and faces. When these students participate and try to explain their answers, I have a better understanding of the areas they struggle in and I can guide their learning better. When I split students into groups to work on the worksheets, I walk around to provide one-on-one assistance. As a result, I have an idea of what general area my students in the classroom struggle with and what areas they have mastered. Further, I am more comfortable approaching these students on my own. For example, throughout the semester, I reached out and offered assistance to students who attended recitation in class and were doing relatively poorly. I only recently noticed that I never really reached out to students who attended online and did poorly, because I am not as familiar with these students and, therefore, didn't feel comfortable individually approaching them about their performance.

Overall, students attending online received relatively less attention from me. In general, I am unable to directly assist these online students when they are doing work alone online, unless they directly ask for help by messaging me. Further, I am unable to guide them to the correct answer or ask them for a detailed explanations when they attempt to participate in the course through the chat box. As a result, online students have to work independently and actively communicate to me about when they are having difficulties.

Office Hours

Only two different people tried online office hours. Although both gave strong, positive reviews for the online office hours, neither used it more than once. During the first half of the semester, only a small number of students visited my office hours in-person. After the second midterm, I had several students come regularly until the Final. For next semester, I would either forsake having online office hours or keep the online office hours but advertise it more to encourage students to use it. Teaching other TAs to learn how to set up and use online office hours has a low cost, so it is something that we could probably implement across the board if we

decide to keep it. We could also potentially treat online office hours as a live discussion board, where students can pose questions similar to what they might put on the discussion board, but get answers almost immediately.

Student Performance

All the graphs and tables are in the appendix after this section of the report. Table 1, Graph 1, and Table 2 have summary statistics of the different grade items in the course, separated by different groups. Table 1 has the distribution of final grade scores (without the extra credit) of my students. I divide the students into different groups so that it is easier to compare across groups (i.e. by student class year, by recitation section, by number of recitations attended, and by online attendance). I used a majority rule to determine if a student should be classified as being "online" or "in-class"; this means that student is considered to be primarily attending "online" if he or she attended more recitations online then in person. Further, I didn't exclude students who withdrew from the class or have incomplete grades (this is why some of the minimums are "0"). Table 1 shows that Freshman & Juniors performed better then Sophomores & Seniors; students that attended more (10-13) recitations performed better than those that attended less (0-1,2-5, or 6-9) recitations; students that attended primarily online did only slightly worse than students that attended recitation primarily in class. A t-test comparing the group means between online and in-class final grades (without extra credit points) results in a two-tailed p-value of 0.53 which is greater than a chosen significance value of 0.05; this indicates that the means are not statistically different. Therefore, on average, students who did recitation primarily online performed as well as those who did recitation in-class.

Graph 1 has the kernel density of online and in-class final grade scores. I use an epanechnikov kernel and the default bandwidth in Stata for this. We can clearly see that the distribution of final grade scores is fairly similar (both are skewed to the left), although the in-class distribution has a wider range of scores and higher density in the higher score range (80-100).

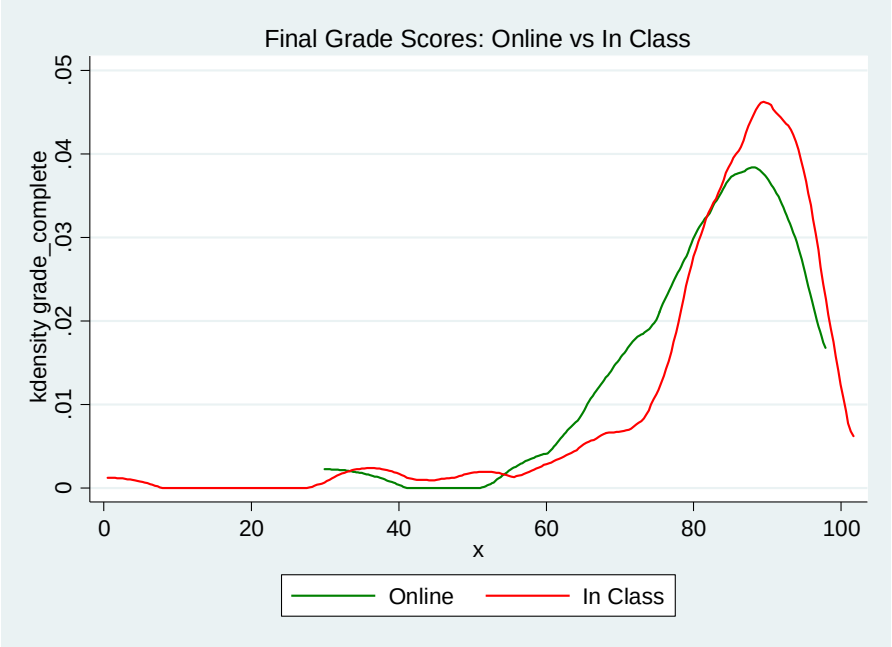
I didn't get a chance to do any further statistical analysis (i.e. t-test/ANOVA for the other groups, Tukey, Chi-Squared, etc.) so please contact me if there is anything else that seems interesting that I can look into in the future.

Table 2 has the distribution of final grade scores (with extra credit), homework average, quiz average, midterm 1, midterm 2, midterm 3, and the final exam for different groups. Since there are 6 homework assignments, I took the average of these assignments to have a single variable that represents a student’s homework performance. Table 2 shows the distribution of the student’s homework average in the class. The same is done for the quizzes since there is a total of 10 quizzes. Finally, the final exam distribution only includes the scores of those who took the exam.

Data regarding HyFlex Recitation Sections:

Table 1: Distribution of Final Grade before Extra Credit						
By Class Year						
Year	**N**	**Mean**	**Std**	**Min**	**Med**	**Max**
Freshman	35	79.48	13.08	25.71	83.29	93.41
Sophomore	54	75.15	16.34	0.00	79.29	90.71
Junior	22	81.77	9.07	58.24	84.13	96.14
Senior	6	80.00	5.77	75.57	77.12	88.83
By Recitation Section						
Rec Sec	**N**	**Mean**	**Std**	**Min**	**Med**	**Max**
18588 (R 4-5)	39	73.85	17.13	0.00	77.53	90.41
18589 (R 5-6)	41	81.87	8.85	49.13	84.14	93.41
18590 (M 9-10)	37	77.89	14.09	33.43	81.14	96.14
By Recitation Attendance						
#Rec Attended	**N**	**Mean**	**Std**	**Min**	**Med**	**Max**
10-13	82	81.42	8.25	49.13	83.45	96.14
6-9	20	73.99	14.83	25.71	77.86	93.84
2-5	14	66.39	24.61	0.00	76.81	88.97
0-1	1	33.57		33.57	33.57	33.57
By Online Attendance						
Online Att	**N**	**Mean**	**Std**	**Min**	**Med**	**Max**
In Class	86	78.44	14.37	0.00	81.92	96.14
Online	31	76.56	12.99	25.71	80.34	93.84
Total						
	N	**Mean**	**Std**	**Min**	**Med**	**Max**
	117	77.94	13.99	0.00	80.86	96.14

*N refers to the number of students, Mean is the Average Score, Std is the standard deviation, Med is the Median Score


Final Grade Scores: Online vs In Class
kdensity grade_complete
0
.01
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60
80
100
x
Online
In Class

Table 2: Distribution of Other Grade Items

Year

		Final Grade			Quiz Avg			HW Avg			Midterm 1			Midterm 2			Midterm 3			Final		
Year	**N**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**
Freshman	35	84.7	13.5	88.3	3.8	0.7	3.8	8.4	2.0	8.8	20.2	2.6	21.0	18.7	4.6	20.0	16.6	4.3	17.0	38.3	5.8	39.5
Sophomore	54	80.3	17.4	85.1	3.5	0.9	3.6	7.6	2.4	8.4	18.4	5.0	19.5	17.6	5.0	19.0	16.0	4.6	17.0	37.0	5.8	38.0
Junior	22	87.1	9.1	89.7	3.9	0.7	4.1	8.5	1.8	9.4	20.7	2.5	21.0	19.5	5.2	20.5	17.2	4.6	18.0	38.4	3.4	39.0
Senior	6	85.2	5.9	83.4	3.9	0.5	3.8	8.3	1.3	8.6	17.8	3.9	18.0	15.8	8.1	18.5	18.0	2.5	18.0	39.0	4.4	37.0

Recitation Section

		Final Grade			Quiz Avg			HW Avg			Midterm 1			Midterm 2			Midterm 3			Final		
Rec Sec	**N**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**
18588	39	79.0	17.9	82.8	3.5	0.9	3.5	7.5	2.3	8.0	18.5	4.5	19.0	17.2	6.2	19.0	15.8	4.5	17.0	35.2	5.6	35.0
18589	41	87.3	9.2	90.0	3.9	0.6	4.1	8.8	1.7	9.5	19.8	4.1	21.0	18.9	4.3	20.0	17.6	2.7	18.0	38.3	5.3	40.0
18590	37	82.9	15.0	87.4	3.5	0.8	3.7	7.8	2.2	8.8	19.8	3.4	20.0	18.5	4.4	19.0	16.1	5.5	17.0	39.2	4.7	40.0

Recitation Attendance

		Final Grade			Quiz Avg			HW Avg			Midterm 1			Midterm 2			Midterm 3			Final		
Rec Att	**N**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**
10-13	82	87.0	8.4	89.1	3.9	0.6	4.0	8.6	1.6	9.3	19.9	3.5	20.0	19.4	2.9	20.0	17.4	2.6	17.5	38.5	4.8	40.0
6-9	20	79.2	15.0	83.0	3.2	0.8	3.2	6.9	2.2	6.8	19.4	2.9	19.0	16.0	8.1	19.0	15.2	5.9	16.5	36.1	6.8	37.0
2-5	14	69.6	25.6	79.8	3.0	1.2	3.5	6.6	3.1	7.9	15.9	6.5	17.0	15.5	5.7	17.0	14.3	6.8	18.0	35.0	6.0	36.0
0-1	1	35.1		35.1	1.6		1.6	3.3		3.3	23.0		23.0	0.0		0.0	0.0		0.0			

Online vs In Class

		Final Grade			Quiz Avg			HW Avg			Midterm 1			Midterm 2			Midterm 3			Final		
	N	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**
In Class	86	83.7	15.2	87.3	3.7	0.8	3.9	8.2	2.2	9.0	19.1	4.4	20.0	18.6	4.8	19.5	16.7	4.2	17.0	38.2	5.7	39.0
Online	31	81.7	13.2	85.6	3.4	0.7	3.5	7.7	2.1	8.2	20.2	2.7	20.0	17.1	5.8	19.0	16.0	4.9	17.0	36.5	4.5	36.0

Total

		Final Grade			Quiz Avg			HW Avg			Midterm 1			Midterm 2			Midterm 3			Final		
	N	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**	**Avg**	**Std**	**Med**

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