Comparison of Student Success in F2F Versus Online Soil Science Lab-based Courses

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Questions for the Audience

1) How many of you have an NR-related degree?
2) Did you take online or correspondence classes to earn the degree?
3) How many teach classes with a lab? In general, do you find that the labs tend to clarify concepts for the students?
4) How many teach a class with a field component? Do you think you can teach that component to an online student?
5) How many teach online classes? Students that take online classes?

Purpose: Explore the challenges of distance delivery of a course that is essential to natural resources professionals and compare learning success of students at a distance compared to those on campus.

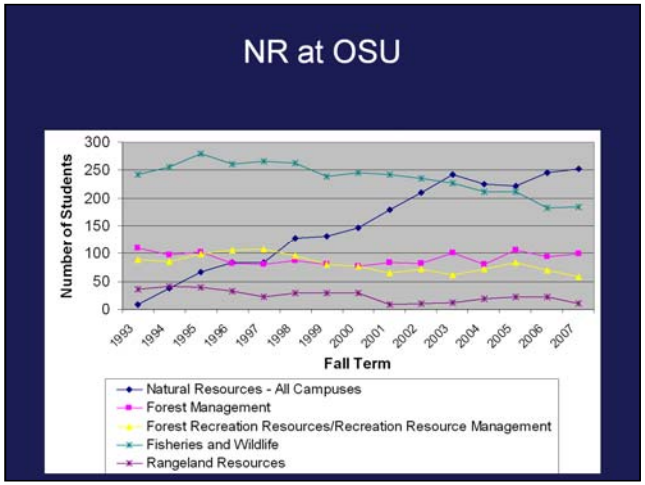
Agenda

- What is the course
- Online course design
- Comparative study setup
- Comparison results
- Implications for online education

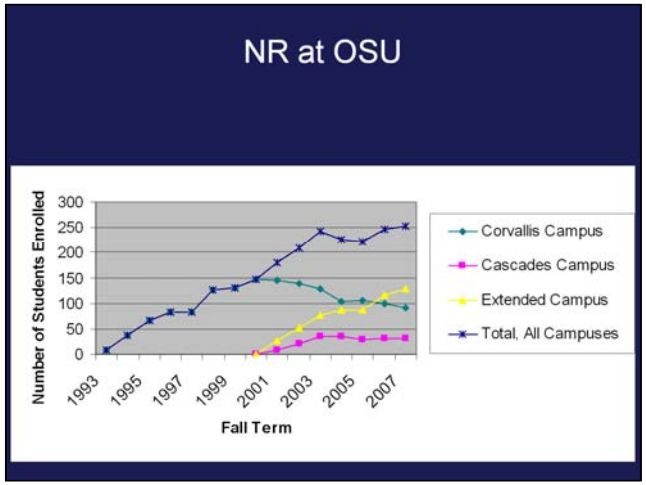
First we'll do a quick course overview so you understand what the class is about

I'll describe the study design for comparing the online and f2f course

Look at the results of student success and then wrap up with a couple of observations and conclusions

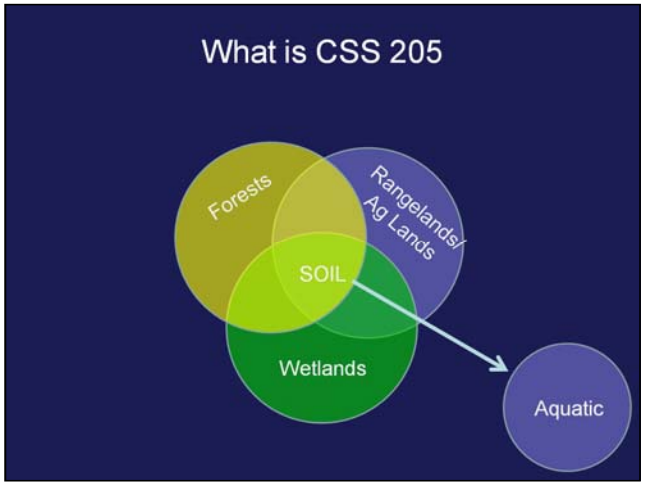


The development of the NR degree at OSU in the early 1990's was a desired degree, most likely because it combined a little of all the other degrees into one. That makes it pretty appealing. This graph indicates that NR has been a popular degree at OSU. But what is even more intriguing is when you look at how the NR degree is being completed by OSU students.



Enrollment on campus reached saturation in 2000, about the same time several intelligent people here in this room worked to launch a distance education version. This online program has been steadily increasing in number of majors and is what makes the overall NR line look so good.

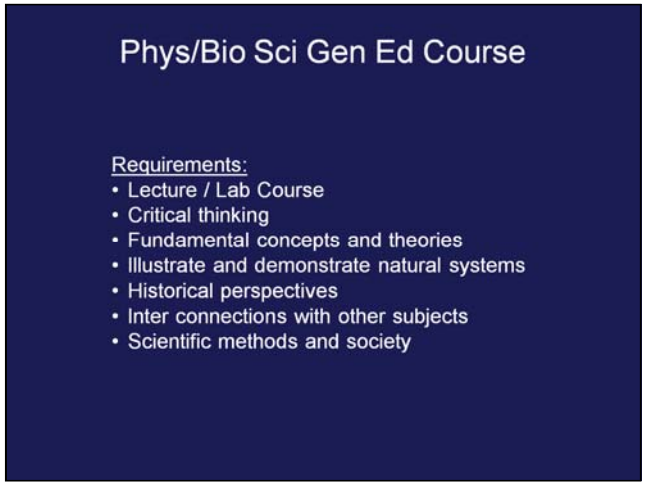
Now I majored in Environmental Resource Management at Penn State. The ERM degree, and its partner the ES degree at OSU, are admittedly more hard science based than the NR degree, but this degree still requires some science and field work. How can you offer the entire degree online and ensure the students are meeting learning objectives of the degree?



I may be a little biased here, as a soil scientist by training, but I have a hard time envisioning a NR professional without a soils lab class, even a soils for poets class as a minimum.

With the exception of aquatic systems, soils are the root of ecosystems NR professionals will be charged with managing. And soils still definitely impact aquatic systems. A basic understanding of the properties and processes is essential.

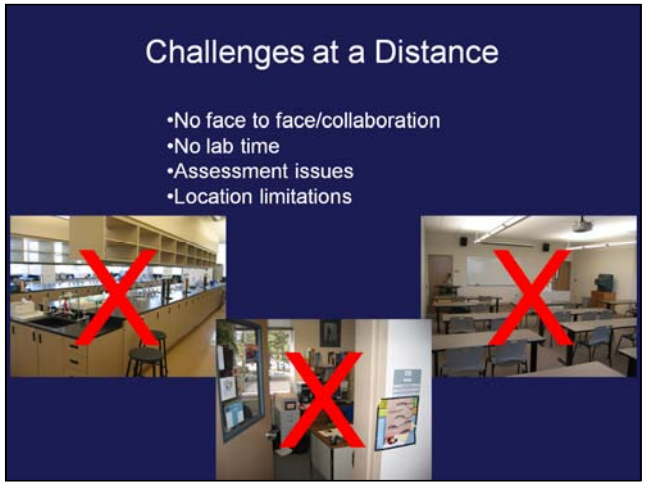
At OSU, for non soils majors, that course is CSS 205 Soils: Sustainable Resources



At OSU Soils 205 class can also meet general education requirements for biological or physical sciences. Such classes must have a lab component. Instructors of lab classes or classes with recitation and field components recognize that those parts of a course are often where the synergistic combination of book learning and hands-on experience drive home important concepts.

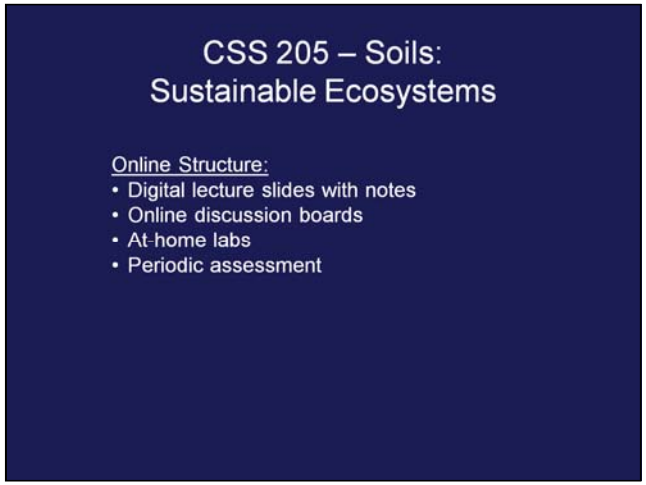
One of the questions that always develops is how does the online class compare to the one that students take on campus. Is the online one of lower quality, is it equal, or is it superior? Many educators over the years have worked to show that students online are effectively learning the same as on-campus students.

Publications are plentiful supporting this concept…but not so much for a lab-based course, and certainly not soils. With this in mind I set out to develop an online lab-based soils course that would utilize simple experiments a student can do at home, a method for documentation so the instructor knows work is being done, and hopefully would provide that distance student a significant learning experience and hopefully will give them that synergy. The course is CSS 205 Soils: Sustainable Resources. And recently I taught the same course both online and oncampus and compared student success to see if student learning success is similar.

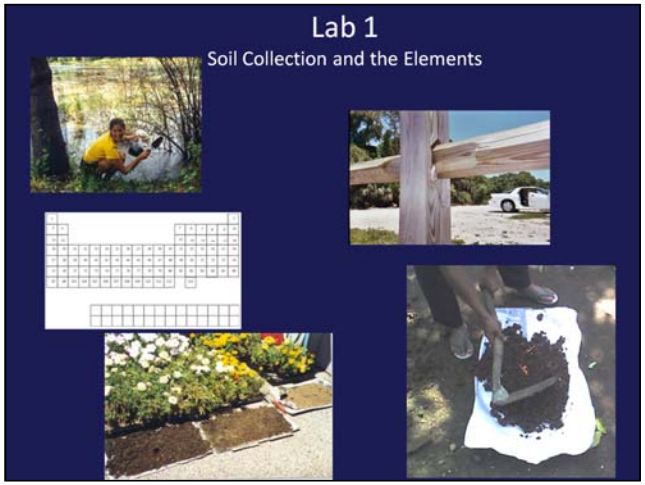


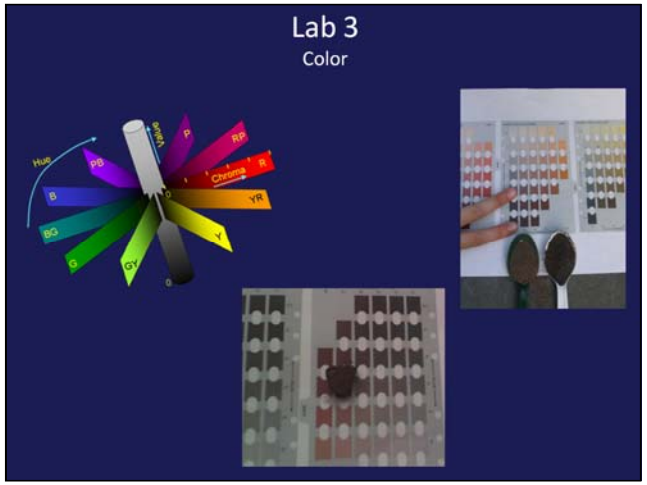
Doing this at a distance is difficult because there is no in-class interaction. No 50 minute lectures during the week. There is no specified lab time in a traditional lab classroom. There is no easy way test students remotely, and there are no face to face office hours when the instructor is in Oregon and the student is in Saudi Arabia.

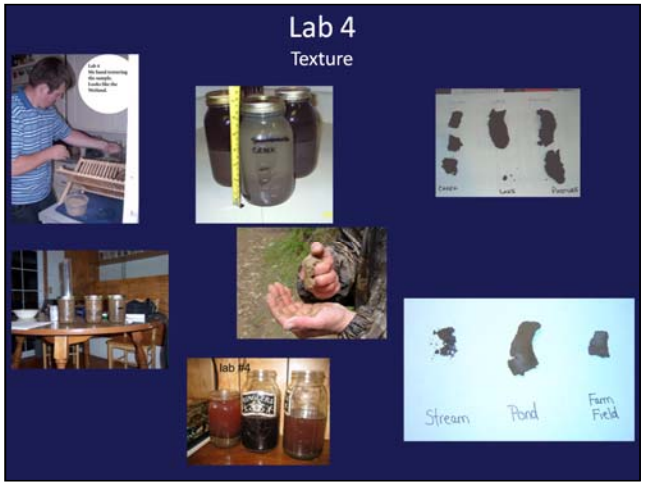
CSS 205 at OSU was designed to meet the GEN ED science requirements and has been taught on campus for many years. In 2004 I developed the online version of the course. The learning outcomes are …. The course is more fully described in the Dec 2007 issue of JNRLSE.

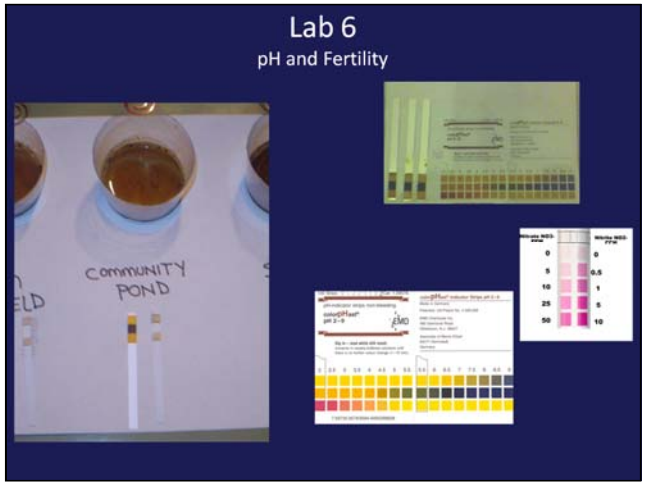


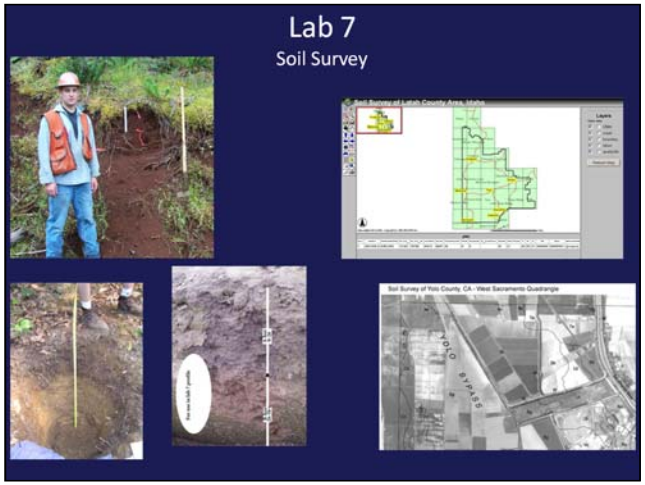
Development of the course has a similar structure to an on-campus course, only that the students do the experiments at home.

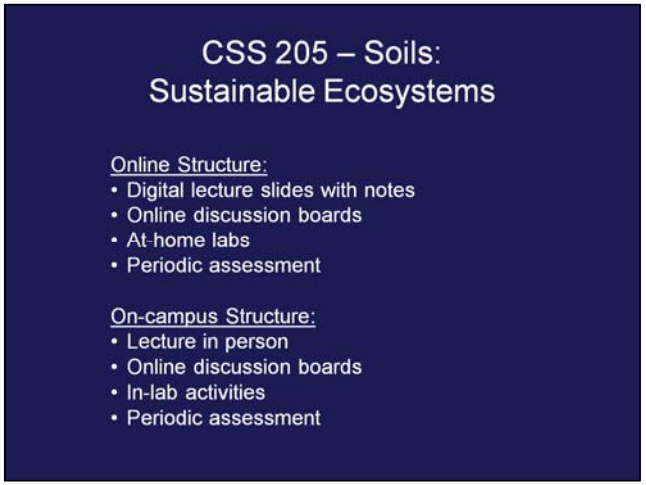

Lab 1
Soil Collection and the Elements


Lab 3
Color
Hue
Value
Chroma
P
RP
R
YR
Y
GY
G
BG
B
PB


Lab 4
Texture
lab #4
Stream
Pond
Farm Field


Lab 6
pH and Fertility
COMMUNITY POND





This past spring I taught an online version through Oregon State's Ecampus and an on-campus version at OSU Cascades in Bend Oregon. The basic layout of the two delivery styles is shown here

Each group of students utilized online course software (blackboard in this case) and had access to the same lecture notes and reading materials. The main difference was that I met with the on-campus group for both lecture and lab whereas the online students had all virtual communication with me.

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Online / On-Campus Comparison

Objective

- To determine if there is a difference in student success between an online and on-campus lab-based course course

Online / On-Campus Comparison

Study Design
- Pre-course assessment
- Demographic survey
- Post-course assessment

Pre-Assessment: 26 questions that a soils student would have likelihood of answering, MC and TF

Demographic survey

Post-assessment: same 26 questions plus 3 essay questions and 2 standardized soil texture samples. The additional questions were designed to test student comprehension and not just memorization. The soil texturing was to test their field skill learning.

Demographics

	Online	On-Campus
n	20	25
Female	55%	24%
Male	45%	76%
Survey respondents	13	14
Average age	37	25
Previous online class	12	2
Previous soils course	5	1
Soils covered in other course	10	10
Self or family in NR field	5	6

First let's look at the demographics. The online class had fewer participants and was a more equal split between male and female. Looking at the final results for both groups, gender was not a significant factor in student success for either course.

About half the students in each class returned the survey. The differences between the two groups are the average age, which was significantly different, the previous online course experience – which is to be expected. I wanted to evaluate the impact of previous courses in terms of pre-course soils knowledge. Also, I was curious about the effect of family or job on success in the class.

Key obeservation here is age – online students in my classes tend to be older, returning students or no-traditional students.

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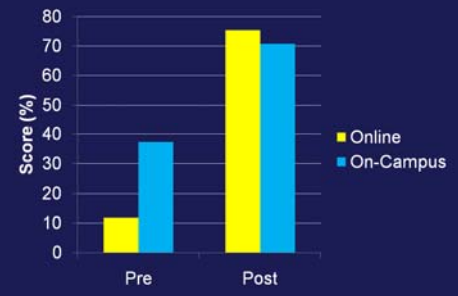
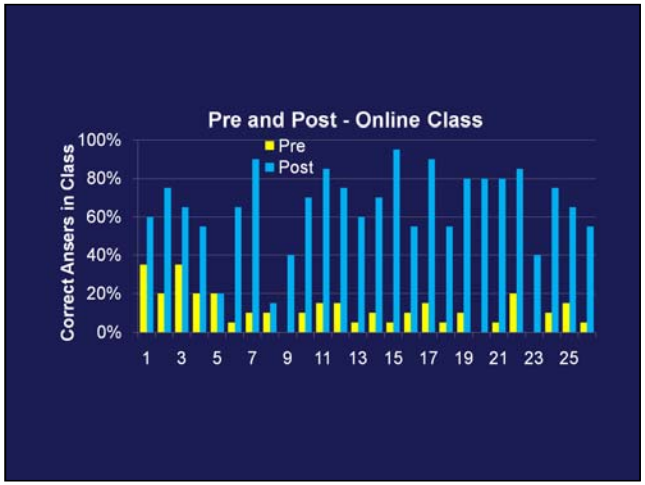
Overall Test Results



Here we have the results from the pre and post assessments. The pre was the 26 MC/TF questions. The post test include the essay questions and the texturing samples.

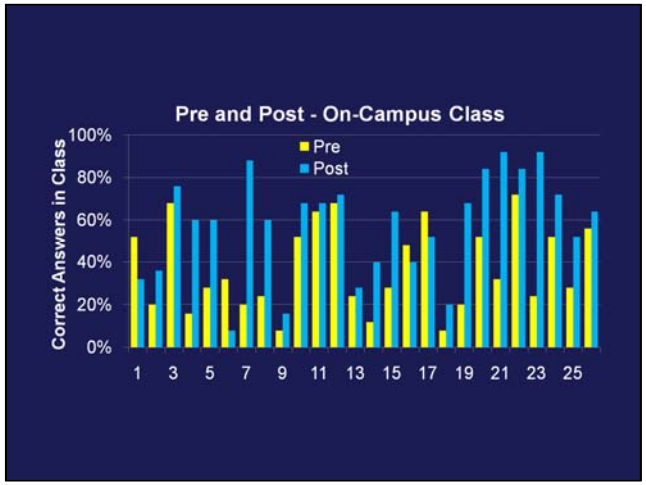
Post assessment scores were not significantly different for on-campus and online. Means for the pre-assessment were significantly different between the two groups.

At the start of the course the on-campus students were, as a whole, better prepared. And while there is not a significant difference in the post assessment, the online students faired slightly better.

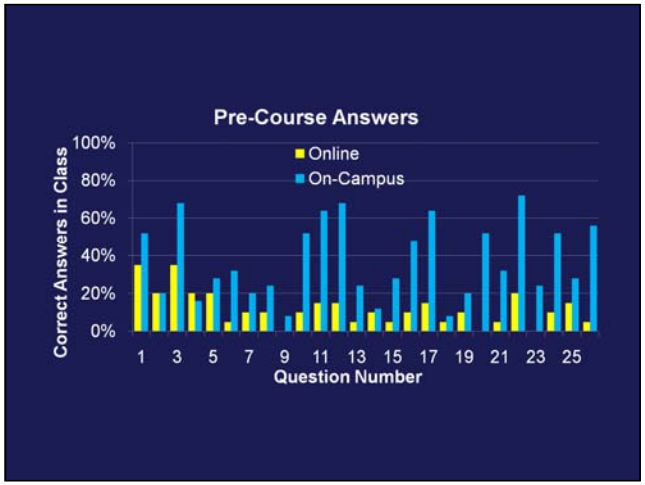


This chart show percent correct answers for the 26 questions MC/TF questions and the next few slides will have a similar set up.

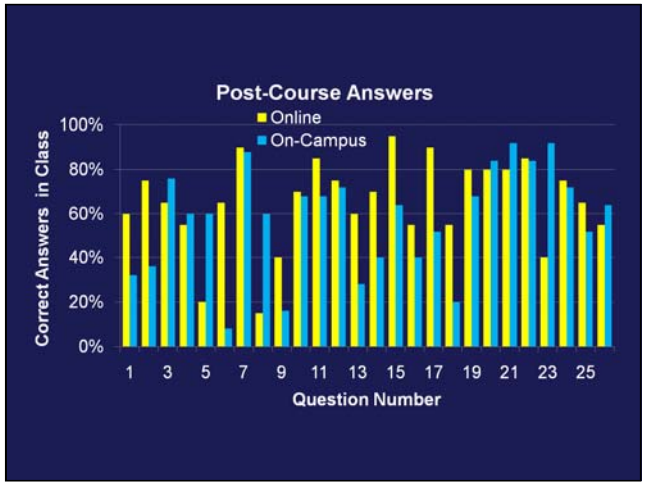
Looking at the online class and responses to individual questions, we see that prior to the course, the online students were fairly low level in ability to answer the questions. After the course, they were much more successful at answering the questions. There were some questions that they did not fair well on in the beginning or the end (#8 for example) and that may be due to the wording of the question, the lack of coverage of that topic, or, potentially but I doubt it, some error on the part of the instructor.



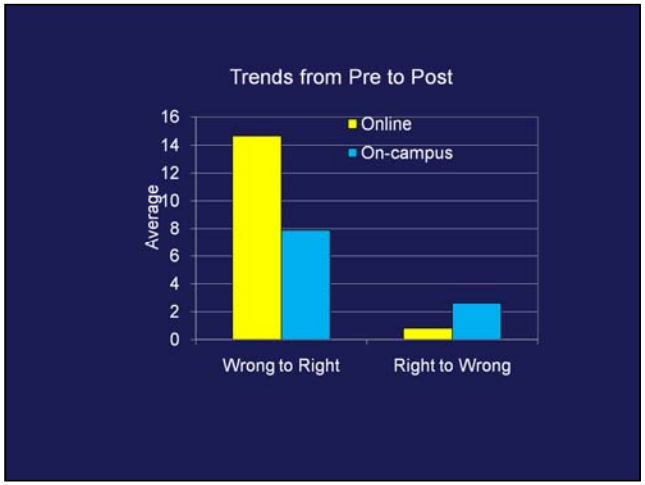
For the on-campus students, they definitely tested higher pre-course than the online students. Their success rate post course is not as consistent as the online. We'll look at that detail in a moment.



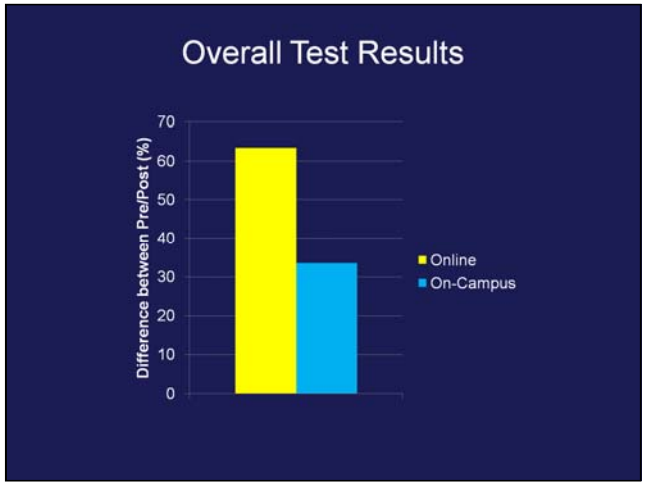
If we put the two courses side by side, we get a better feeling for how better prepared the on-campus students were – or perhaps they were really good multiple-guessers. And we can look at whether that is the case in a moment too by comparing how they answered a specific question in the pre test compared to the post test.



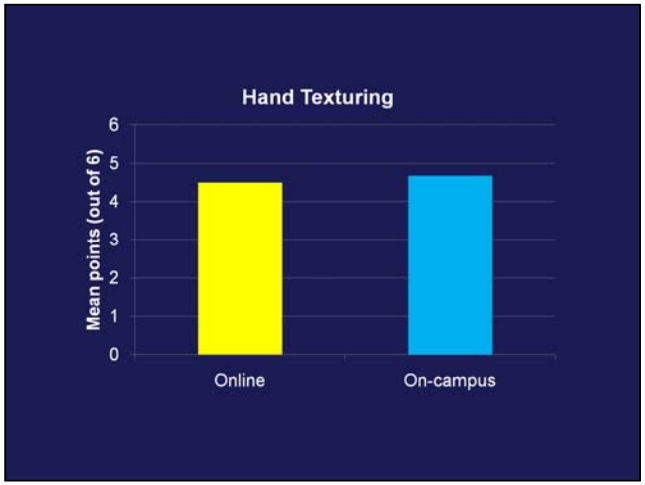
Post course, the online students out performed the on-campus by more than half on 7 questions (1, 2, 6, 13 etc.), while the oncampus only did that to the online on 3 questions. In a minute we'll look at what some of those questions are and why that may be.



So, how well did the students improve and was the improvement real? In the post-course assessment, online students, on average, answered 14 questions right which they had gotten wrong on the pre test. On-campus only improved an average of 8 questions. And the online students had, on average, 1 answer that they reversed on, getting it wrong on the post test when they had gotten it right on the pre test. The oncampus students averages about 2.5 reversals.

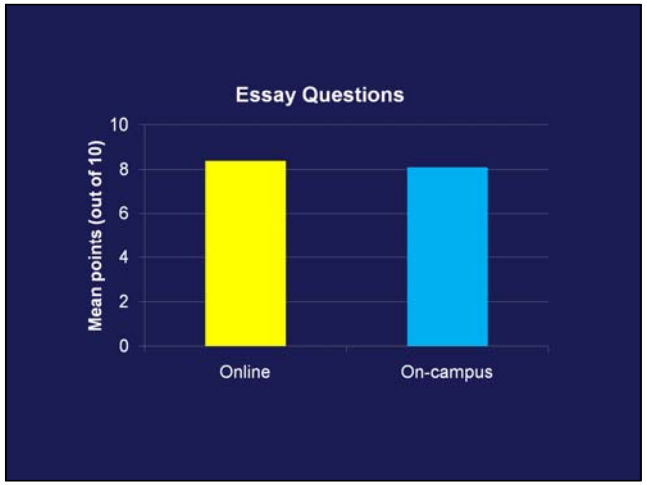


If we look at the Mean differences in percentages from the two classes, the online students added around 65% to their original test score whereas the on-campus students only added ~32%. These were significantly different.



On the post test, essay questions and hand texturing were added to indicate if lab and field concepts were coveyed to the students. Success in these questions is based on interpretation and skill level, not multiple guess.

No significant difference for hand texturing, with students scoring around 4.5 points out of six on average.



No significant difference on the essay questions either. So looking at the post-test scores, both groups performed similarly on the lab and interpretation or skill. The main areas they had problems were in what I call the cold-hard facts of soils – the learning of the principles.

Let's look at the questions that posed difficulty.

Problem Question Topics

- Chronosequence: Online>On-campus
- Soil Survey Agency: Online>On-campus
- OM breakdown rates: Online<On-campus
- Fe – pH relationship: Online>On-campus
- Soil water potential: Online>On-campus
- Grav. water content: Online>On-campus
- Nitrogen processes: Online>On-campus
- Carbon Reservoirs: Online<On-campus

Trend that I observe is that most of the questions that the online students did better on were covered more extensively in the readings compared to f2f lecture. Also, I may have briefly talked about it in class but the notes and readings associated with lecture have more detail. What I gather from this is that the online students are actually reading the text book whereas the on-campus students are relying more on instructor conveyance and not reading as much or not doing their homework.

Also, the water potential questions tested knowledge developed through lab exercises. The online students had to do these on their own. Oncampus students typically did these in groups – so some of them may not have fully comprehended the topic because they did not have to do it all on there own to get the correct answer.

Overall success in the class

Concluding Thoughts

- Online students show higher improvement rates
- Online labs provide real hands-on experience and comprehension
- With careful and thoughtful planning, it is possible give online students meaningful lab and field experience

They are reading more of the material, they are more involved in the online discussions (not all of them mind you, because some of them do slack off), they are taking a very active role in their education because they are vested in it. It costs them more both in time and money to do this.

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and Online Soil Student

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