SCHOOL OF NATURAL RESOURCE SCIENCES

ASSESSMENT REPORT
2010-2011

Prepared by:
Don Kirby

School of Natural Resource Sciences

Assessment Outline

Level: Bachelors

Prepared by: Don Kirby
Date: July 2011

Intended Student Outcomes	Type of Assessment	Conditions for Assessment (to whom; when)	Date Results Available
1. Appreciate student's concerns and background as a component of class instruction.	a) class survey	a) all majors by: all teaching faculty	a) at beginning of semester
2. Understand and synthesize the physical, chemical and biological aspects of soil science' natural resources management; rangeland ecology and management; insect ecology and integrated management and closely associated fields. Students will be able to identify and understand common problems related to the various uses of soil and rangeland resources and make appropriate management recommendations. Students must be able to locate, organize, evaluate and interpret appropriate sources of information.	b) term papers c) senior capstone course projects d) field experience e) seminar oral report f) seminar written report g) graduation exit survey	b) all majors c, d, e, f, g) all majors by: b, d, e) all teaching faculty f, g) instructor g) chairman	b,c,d,e,f) end of semester g) at graduation

School of Natural Resource Sciences

Assessment Outline

Level: Masters

Prepared by: Don Kirby
Date: July 2011

Intended Student Outcomes	Type of Assessment	Conditions for Assessment (to whom; when)	Date Results Available
1. Appreciate student's concerns and background as a component of class instruction.	a) class survey	a) all majors by: all teaching faculty	a) at beginning of semester
2. Develop detailed knowledge in one or more areas of the physical, chemical or biological aspects of soil science, rangeland ecology and management, natural resources management, and insect control and management.. Students will be capable of investigating problems related to use of soil and rangeland resources, insect ecology, or natural resources management.	b) term paper c) seminar oral report d) seminar written report e) master's oral examination f) thesis g) graduation exit survey	b) all majors c through g) all majors by: b,c) all teaching faculty d) instructor e,f) graduate committee, chairman g) chairman	b,c,d) end of semester e,f,g) near graduation

School of Natural Resource Sciences

Assessment Outline

Level: Doctoral

Prepared by: Don Kirby
Date: July 2011

Intended Student Outcomes	Type of Assessment	Conditions for Assessment (to whom; when)	Date Results Available
1. Appreciate student's concerns and background as a component of class instruction	a) class survey	a) all majors by: all teaching faculty	a) at beginning of semester
2. Develop detailed and intimate knowledge along with philosophical understanding of all areas in the soil, range science, natural resources management or entomology disciplines with a particular emphasis leading to professional expertise. Students will be able to develop new hypotheses and knowledge in a particular area of emphasis.	b) term paper c) seminar oral report d) seminar written report e) doctoral written examination f) doctoral oral examination g) dissertation h) graduation exit survey	b through h) all majors by: b,c) all teaching faculty d) instructor e) examining committee f, g) graduate committee, chairman h) chairman	b,c,d) at end of semester e, f, g, h) near graduation

Assessment Outline
2010 Assessment Report

FROM: Entomology Department
Natural Resources Management Program
Range Science Program
Soil Science Department
School of Natural Resource Sciences

TO: Office of Assessment and Institutional Research

DATE: July 26, 2011

Outcome No. 1. Appreciate students concerns and background as component of class instruction.

The following courses in the School of Natural Resource Sciences conducted an assessment tool and are included in the following report:

ENT 350 - General Entomology -Deirdre Prischmann-Voldseth

What Did You Do?

In 2010, I continued to revise and improve ENT350. Based on student feedback from 2009, the lecture material was changed from 3 to 4 units with an exam following each unit (1: basics & terminology – external morphology, 2: who are the insects – taxonomy, 3: how do insects function – physiology, and 4: insect interactions – plant pests, IPM, medical entomology). In 2009, many students felt overwhelmed by the amount of new terminology, and so this was the sole focus of the initial unit. Having the first exam focus on a limited amount of material gave students a solid foundation on which to build throughout the semester. Lecture PowerPoint presentations and notes were also rearranged, updated, and more video clips added in order to present information more effectively and increase clarity. Supplemental video clips (links to YouTube videos – primarily from professional organizations, *e.g.* National Geographic, Animal Planet) were posted on Blackboard that complemented and expanded on the material presented in lecture. Lecture pop quizzes were added to encourage attendance.

In response to student feedback from 2009, several changes were made in the lab. The previously required insect collection was changed into an optional, extra credit assignment and replaced with an in-class collection experience that spanned several lab periods (students collect, preserve, arrange, and identify specimens). Fifteen students elected to complete the optional insect collection, which was worth 100 points (High score: 100, low score: 38, mean: 62).

Lab worksheets were updated and graphics/diagrams added to decrease student-generated drawings. We utilized digital cameras/digital microscopes to project close-up pictures of important structures/concepts to the entire class.

One way I assessed student comprehension was by giving students a non-graded quiz at the start of the semester (Initial Knowledge Survey). The quiz consisted of nine multiple choice questions. I then gave the students the same quiz at the end of the semester (Final Knowledge Survey) and compared the results (Table 1). Overall, students had higher scores on the Final Knowledge Survey.

Table 2 summarizes the grades for major class exams and assignments. Note that I participated in the Mid-term grading reporting program administered by the NDSU Office of Registration and Records.

What Did You Learn?

Formal evaluations of the course (SROIs and comments) were generally positive (Table 3), and an improvement from 2009. In addition to formal course and instruction assessment at the end of the semester, student feedback was obtained several times during the semester. Comments were varied, with many students expressing the fact that they learned a lot, enjoyed the instructor / TAs / class, appreciated the video technology used in the class, and the fact that the insect collection was optional.

What Will Be Done Differently As A Result Of What Was Learned?

Some students felt the course needed more of a focus on agriculture and integrated pest management, and had issues with the lab handouts and identification key. These will be topics that I will attempt to address in fall 2011.

Table 1. Results from a knowledge survey given at the start and end of the semester.

	Initial Knowledge Survey	Final Knowledge Survey
Possible points	9	9
Mean score	4.7	7.4
Highest score	9	9
Lowest score	2	4
Number of students	48	44

Table 2. Grade assessment for major class assignments. Numbers reflect the total number of students in each grade category.

	A	B	C	D	F
Exam I	30	11	9	0	2
Exam II	29	8	3	7	4
Exam III	23	10	9	4	2
Final Exam	40	8	4	0	0
Lab Practical	17	14	10	2	7
MIDTERM GRADE	31	8	5	5	2
FINAL GRADE	35	9	3	2	2

Table 3. SROIs for each class section.

Section	Delivery	Design	Outcome	Overall
3047, Tues.	4.50 ± 0.57	4.50 ± 0.58	4.49 ± 0.54	4.50 ± 0.57
3049, Thurs.	4.43 ± 0.74	4.46 ± 0.76	4.17 ± 1.07	4.35 ± 0.83

ENT 790-01 - Introduction to the Research Process - Jason Harmon

I created this 1 credit graduate seminar for two primary reasons. The first reason was that at the time the Entomology department had many new graduate students who had little experience with the scientific research process. Thus, this seminar helped familiarize students with the basics of research including formulating research questions, using the scientific literature, designing experiments, and communicating results. Secondly, teaching this seminar to graduate students gave me important information about how to teach similar course(s) to undergraduate and graduate students. Spring 2010 I taught a similar course for undergraduate students (ENT 299 How to Do Science: A Research Experience from Proposal to Poster). That course was designed to teach undergraduates the basics of scientific research while they were undergoing their own research experience in an NDSU research laboratory. Teaching both courses gave me a much better sense of what content, experiences, and format were going to be useful for meeting the needs of both undergraduates and beginning graduate students. Performing assessment on this course was a vital part of both of these objectives. It helped me understand how well I was able to meet the overall learning objectives of the course will providing critical information for planning the future of these courses.

What Did You Do?

Throughout the semester I used three approaches to assess student learning. The most frequently used approach was weekly assignments related to that week's readings. Each assignment briefly introduced students to the reading and explained why I was having them read the material. Then students were asked to prepare brief written answers that challenged the student to apply the ideas in the readings to the research project(s) that s/he is pursuing for graduate studies. We then supplemented lectures by using the prepared writings as the center of discussions during the class. This allowed students to communicate their ideas and to receive feedback from me and their peers. Both verbal and written answers assessed the students' understanding of each week's material and ideas.

The second assessment method used was a pre-test and post-test given on the first and last day of class. The test was composed of 10 short-answer questions that were each graded on a 5 point scale. The questions covered both factual knowledge (e.g. what are the standard parts of a scientific paper?) and skills (e.g. look at this figure from a scientific paper and tell me what the results are). The material covered what I expected students to learn by the end of the course.

Category	Pre-Course Score	Post-course Score
Number of students	10	9
Possible points	50	50
Mean score	28.3	46.4
Standard deviation	6.2	2.6
Highest score	39.5	49.5
Lowest score	17	42

What Did You Learn?

Students were assured that their performance on each test would not influence their grades. The pre-test gave me a good idea of how much time I should spend on different areas and the post-test was useful for helping to determine how well students learned different classroom material throughout the course. Students improved their scores by over 60% with the difference being highly significant (Paired t-test, d.f.=8, $p < 0.0001$).

What Will Be Done Differently As A Result Of What Was Learned?

Finally, I also assessed myself as a teacher using comments on SROIs as well as a simple mid-semester evaluation. These evaluations were extremely helpful in determining the following changes for the next iteration of this course:

1) Students thought the course would be better suited as a 3 credit course rather than a 1 credit seminar. This would allow more time for greater depth in subjects such as experimental design and writing introductions as well as time for additional projects such as an end of the semester presentation of their research ideas.

2) Most of the students were very excited to share their ideas and to receive feedback from both instructors and their peers, and wished the class had even more opportunities to do this. I will establish assignments that allow students to receive more critical, yet constructive feedback from their peers. These assignments will be in the form of written and/or verbal communication and will help the students to accumulate and present the ideas they are developing with the weekly assignments discussed above. Examples include presentations of their research topics and written proposals, both of which can easily be peer reviewed.

NRM 225 / RNG 225– Natural Resources & Agro-ecosystems - Carolyn E. Grygiel

An assessment of student learning is conducted as a "pre-course assessment" administered on the first day of class, an "interim-course assessment" administered mid-point in the course, and a "post-course assessment" administered during the last two weeks of the semester. These assessments focus on the student's evaluation of their personal learning achievements relative to the material presented in this course. Other assessment tools, adapted and developed for use in this course is a designated "Sequential-Course Assessment" (RSQC2) and a course-comprehensive assignment that allows students to apply various concepts presented in this course in an analysis of the Maya use of agriculture. Another assessment tool is the "Ecological Footprint" which is available on several websites

for educational use and allows the students to assess their personal utilization of natural resources. These assessment tools are discussed in detail in the following section.

The pre-course assessment consisted of ten questions designed to measure the student's general knowledge about the science of ecology and the environment. The interim-course assessment and the post-course assessments consisted of the same ten questions, as follows:

- A basic tenet of Systems Ecology is _____.
- The view that humankind's proper role on Earth is to extend our power over nature as far as possible, is termed: _____.
- What do you know about the Gaia Hypothesis?
  A. Never heard of the Gaia Hypothesis
  B. Am somewhat familiar with the Gaia Hypothesis
  C. Know enough about the Gaia Hypothesis to have an intelligent conversation.
  D. Have read several books about the Gaia Hypothesis.
- Nitrogen gas comprises approximately ____% of the atmosphere.
- Most biological activity occurs within the range of ___ degrees Celsius to ___ degrees Celsius.
- The "rain shadow" effect occurs as a result of this type of precipitation: _____.
- This principle states that two different species cannot occupy the same niche without some conflict: _____.
- In scientific research, the clearly stated testable idea is termed an (a) _____.
- Humans created agriculture approximately _____ years ago.
- The human population on planet Earth is approximately _____.

A comparison of the results from the first 10 questions of the pre-course assessment, interim-course assessment and the post-course assessment are as follows:

Assessment	Mean Score
Pre-	48%
Interim-	67%
Post-	72%

The average score for the pre-course assessment was 48% in 2011as compared with 45% in 2010 as compared with 46% in 2009 as compared with 48% in 2008 as compared with 41% in 2007 as compared with 47% in 2006, 44% in 2005 and 53% in 2004. The average score for the post-course assessment in 2010 was 72%, as compared with 70% in 2010 as compared with 70% in 2009 as compared with 74% in 2008 as compared with 73% in 2007 as compared with 71% in 2006, 73% in 2005 and 73% in 2004. The Interim-Course Assessment for 2011 showed an average score of 67% as compared with an average score

of 61% in 2010 as compared with 65% in 2009 as compared with a score of 56% in 2008. This demonstrated a positive progression of understanding with increasing scores from 45% to 61% to 70% as the semester progressed. The students demonstrated a significantly higher understanding of the material on the post-course assessment as compared with the pre-course assessment; this was the expected response.

RSQC2 Assessment Tool

An assessment tool was implemented for Spring Semester 2007 and continued in use for Spring Semester 2008, 2009, 2010 and 2011. This assessment tool is a common assessment tool described in various forms on several websites where it is designated an "RSQC2 Comprehensive Assessment." This assessment tool is administered five times throughout the semester. This tool consists of a one-page sheet of questions as indicated below.

Application of this tool was successful in that it offers the students an opportunity for immediate self-assessment of a learning experience. The student's answers were not simply "yes" or "no", but were thoughtful expository responses highly reflective of the lecture's content. This seemingly simple tool generated a profound impact on the student's participation in classroom discussion and discussions among small groups of students when the class session ended. Upon reviewing the assessments, it also allowed the instructor to gather data useful at the next class session for clarifying misunderstood concepts and generating discussion in response to a student's written query. This sequential course assessment tool has proven itself to be an extremely valuable addition to the assessment process and will continue to be enhanced for utilization in succeeding semesters.

RSQC2 Comprehensive Assessment

Reference: Angelo, T.A. & Cross, K.P. Classroom Assessment Techniques: A Handbook for College Teachers, 2nd edition. San Francisco: Jossey-Bass, 1993, pp. 344-348.

Name_____
ID#_____

1. Take 1 minute to Recall and list in rank order the most important ideas from the previous day's lecture.

2. Take 2 minutes to Summarize those points in a single sentence.

3. Write one major Question that you want answered.

4. In a few sentences, identify a thread or theme to Connect this material to the course's major goal. Exactly what is the relationship of this topic to the overall course plan? Why is this material important?

Course Goal: Enhance your understanding of basic ecological principles as they occur in nature and in agro-ecosystems, expand your perspective regarding current issues of ecological interest and define your role as one of the life forms living on an island in the Universe i.e., this planet Earth.

5. Add a Comment regarding your degree of confidence in your understanding of the specific course content.

Case Study and Concept Mapping Assessment Tool

An additional assessment tool was adapted and implemented to assess the students understanding of how ecological principles apply to managed agro-ecosystems. This assessment tool also introduced students to a powerful application of "concept mapping." This assessment tool was adapted and modified from the Ecological Society of America website, which presented an array of assessment tools for education use.
This assessment tool is offered as an extra-credit assignment.

Case Study:
Unraveling the Mystery of the Mayans using GIS

Photo: http://www.guidetobelize.info/en_maya.html

Objectives
Upon completion of this assignment, you will be able to:

Identify and illustrate how knowledge of ecological principles helps us in understanding the past and planning for the future.

Recognize how GIS works and illustrate its many applications.

Formulate a persuasive argument on how new knowledge from a variety of disciplines, combined with new technology, can be applied toward managing agro-ecosystems today.

Instructions
This is a three-part assignment involving concept mapping and essay writing. Read through the entire assignment carefully before you begin putting ideas to paper. Your work is to be completed independently and is worth 6 points. All three parts are due at the beginning of class on the designated date (see syllabus; late assignments will not be accepted)
Project presentation:

- Draw each concept map on a plain, white, 8 ½ x 11 piece of paper.
- Essay should be typed; double-spaced; use Times New Roman font size 12.

- Staple pages together; write your name in the top right corner of the *back* side of each project page.

I. Concept Mapping

Refer to the attached materials for explanation and examples of these maps.

1. Create a Mayan Empire concept map. Using *Mayan Empire* as the key word, explore a minimum of 5 threads and nodes and expand on each. Research the mystery surrounding the collapse of the Mayan Empire via the Internet. Ask yourself questions throughout the process to assist you in: expanding on knowledge you may already have about the topic, applying and using information you have learned in class, and thinking "outside the box" about theories, supporting evidence, etc. Here are a few to get you started:

□ Where can I find credible, scientific information about this topic?

□ When and where did the Mayan civilization exist?

□ What are the theories about its collapse?

□ How is modern technology assisting in understanding the past?...the future?

□ What is the relationship between civilization collapse and what I have learned in this course?

□ How does this affect me? My country? My world? Future generations?

Below is an article on NASA's site to get you started. Keep track of websites that contain information you want to cite in your essay.
http://science.nasa.gov/headlines/y2004/15nov_maya.htm

2. Create a GIS concept map. Using *GIS* as the key word, explore a minimum of 5 threads and nodes and expand on each. Research GIS via the Internet. Ask yourself questions throughout the process. Here are a few to get you started:

□ What is GIS? How was it invented; why?

□ How does it work?

□ How is it different from the traditional map? What advantages/disadvantages does it present?

□ What are its various applications?

□ What is the relationship between this technology and ecological principles we have studied in class?

□ What potential do I see in future applications of this technology? What might be the drawbacks?

Here are a few suggested sites—there are many sites containing fascinating information about GIS. Keep track of websites that contain information you want to cite in your essay.

Overview:
http://erg.usgs.gov/isb/pubs/gis_poster/
Case studies:
http://www.geo.ed.ac.uk/home/research/whatisgis.html
Try out a few demos on the ESRI site:
http://www.esri.com/industries/university/education/demos.html
Another interactive site is the Geography Network
http://www.geographynetwork.com/maps/arcexplorerweb.html#usingaeweb

3. Essay
Write a one-page essay persuading the general public that new knowledge and new technologies can be useful in helping humanity create sustainable agro-ecosystems today and in the future. Include three ecological concepts we have covered in class. Cite a minimum of 4 credible sources. Use the attached essay rubric to assist you in assessing your writing. You are encouraged to take advantage of the NDSU Writing Center(in the lower level of the Library) in writing/reviewing your essay.

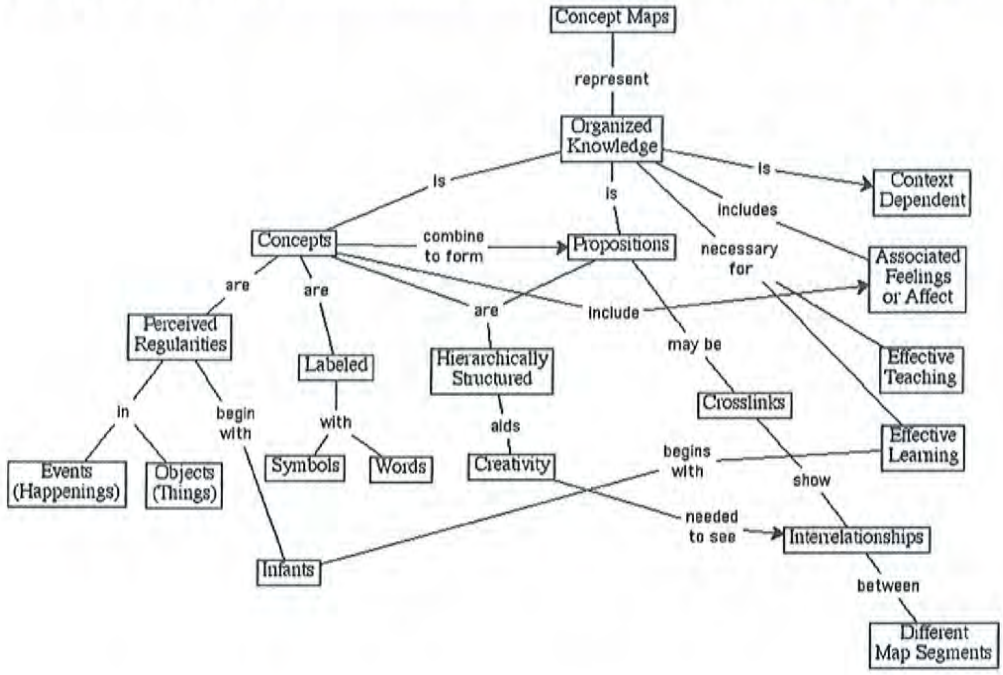
"Concept Mapping" Procedures
"Concept Mapping" (also called mind-mapping or diagramming) is a tool for assisting and enhancing many of the types of higher-level thinking and learning you are required to do in college. Mapping, by its structure, provides opportunity for convergent thinking, fitting ideas together, as well as thinking up new ideas, since it requires all ideas to be connected to one topic and possibly to one another.

The examples below are simply a place to start: there is no one right way. However, your map should reflect your engagement with the topic—it should fill the page with connected knowledge and ideas and have a clean, legible presentation.
Example 1 Source: http://www.peterussell.com/MindMaps/HowTo.html
1. Write your topic inside a circle in the middle of a sheet of paper -- it may be a word, a phrase, or a couple of juxtaposed ideas.
2. Draw a number of lines ("threads") radiating from the circle outwards - about five to begin with. Label each of these threads with a question related to your topic, such as "What is it?" "How does it work?" "Who or what does it affect?" You can also use verbs or words describing relationships ("is responsible for", "creates", etc.)
3. As you explore the topic, place generated knowledge, concepts, ideas or answers in circles ("nodes") at the end of each thread. These nodes then become a cluster with threads of their own, generating more questions and answers.

Other suggestions:

- Use color to depict themes, associations and to make things stand out.
- Anything that stands out on the page will stand out in your mind.
- Think three-dimensionally.
- Use directional arrows, icons or other visual aids to show links between different elements.
- Don't get stuck in one area. If you dry up in one area go to another branch.

Example 2 Source: http://www.mindtools.com/pages/article/newISS_01.htm



Advantages of mapping

Here are some advantages of mapping, which will become more apparent to you after you have practiced this technique a few times:

□ It clearly defines the central idea, by positioning it in the center of the page.

□ It allows you to indicate clearly the relative importance of each idea.

□ It allows you to figure out the links among the key ideas more easily. This is particularly important for creative work such as essay writing.

□ It allows you to see all your basic information on one page.

□ As a result of the above, and because each Map will look different, it makes recall and review more efficient.

□ It allows you to add in new information without messy scratching out or squeezing in.

□ It makes it easier for you to see information in different ways, from different viewpoints, because it does not lock it into specific positions.

□ It allows you to see complex relationships among ideas, such as self-perpetuating systems with feedback loops, rather than forcing you to fit non-linear relationships to linear formats, before you have finished thinking about them.

□ It allows you to see contradictions, paradoxes, and gaps in the material -- or in your own interpretation of it -- more easily, and in this way provides a foundation for questioning, which in turn encourages discovery and creativity

Source: *http://www.coun.uvic.ca/learn/program/hndouts/map_ho.html*
Unfortunately, this website is no longer accessible.

Essay Rubric

For assistance with writing/reviewing your essay, contact the NDSU Center for Writers, located in the NDSU Library.

Purdue University offers excellent guidance on avoiding plagiarism:
http://owl.english.purdue.edu/handouts/research/r_plagiar.html

To read NDSU's policy addressing plagiarism, go to:
http://www.ndsu.nodak.edu/policy/335.htm

Evaluation Criteria & Points	Below Standard 1	Approaches Standard 2	Meets Standard 3	Exceeds Standard 4
Mechanics & Grammar	Sentences and paragraphs are difficult to read and understand due to poor grammar or mechanics.	The essay contains numerous grammatical and mechanical errors.	The essay contains minimal grammatical or mechanical errors.	The essay is virtually free of grammatical or mechanical errors.
Thesis & Structure	The essay is unclear due to a lack of thesis and structure.	The main points of the essay are ambiguous. Organization of the essay is a challenge to follow due to inadequate transitions and/or rambling format.	Writing has logical organization and a basic thesis statement; may occasionally drift from the thesis. Basic structure is followed: introduction, main points, transitions, closing.	The essay establishes and maintains a clear focus with ideas developed in depth. Writing follows a seamless structure employing effective transitions and coherent paragraphs.
Evidence & Citations	The essay does not attempt to use evidence to support the thesis. Facts are incorrect or not referenced. Details are random, inappropriate, or barely apparent. Few sources are cited.	The use of evidence is minimal although some of it supports the thesis. Some facts are incorrect. Details lack elaboration or are repetitious. Most sources are cited.	There is evidence to support almost every point. Technical details are generally correct and for the most part are elaborated and appropriate. Details are appropriate. Sources are cited.	Every point is clearly supported by strong evidence. Details are effective, vivid, explicit, and pertinent. All facts are correct, and the technical explanation is both concise and complete. Sources are cited.

Analysis & Critical Thinking	Writing exhibits little understanding of the topic. The essay does not attempt to explain how the evidence relates to the thesis. Student raises no serious objections. Student does not argue logically.	Writing reflects minimal understanding of the topic. The analysis of the evidence lacks consistent relation to the thesis. Objections are weak and responses not developed.	Writing reflects general understanding of the topic. The analysis explains how the evidence supports the thesis in most cases. Implicit objections are raised and responded to.	Writing reflects a clear understanding of the topic. The analysis shows a strong relationship between the evidence and the thesis. Major objections are presented and responded to logically. Insights and ideas are striking, significant and/or illuminating.

Ecological Footprint – Assessment Tool

Another assessment tool was implemented during Spring Semester 2010. This assessment tool employed a pre/post ecological footprint assessment in conjunction with a video entitled "*The Ecological Footprint.*" The pre-ecological footprint was due on the day of the fourth lecture during the introductory portion of the course. This pre-assessment allowed the students to evaluate their current impact on the environment previous to understanding the ecological concepts presented during the course. The post-ecological footprint was due after all the ecological concepts presented in the course have been discussed and after an informative video entitled "The Ecological Footprint" is shown in class. Both pre- and post-assessments were reviewed and commented on by the instructor and then returned to the students. This assessment allows the students to evaluate and compare their impact on the planet before and after understanding basic ecological concepts. The change in size of the individual student's "ecological footprint" allowed each student to assess and evaluate their understanding of an application of basic ecological principles.

Apply ecological principles to real world problems and explore complex problem solving
Analysis: Ecological Footprint

Upon completion of this assignment, you will be able to:

□ Explain and provide examples of global ecosystem services and terms associated with footprint accounting.

□ Provide examples of global initiatives addressing global ecological concerns.

□ Analyze your role in the current and potential natural resource issues facing our world.

Instructions. This unit examines human impact on, and the threats to services derived from, natural and agro-ecosystems on a global scale. It also explores how humans are addressing these issues from a global perspective.
This assignment is worth 2 points and is due at the beginning of class as designated on the syllabus. Late assignments will not be accepted.

I. Footprint Activity

a. Access the *Global Footprint Network* at http://www.footprintnetwork.org/index.php
b. Take the *Your Footprint* Quiz. On the global map, click on the United States and select English. Take the entire quiz. Make educated guesses for any questions you are unsure of.
c. Print your results. Complete the following questions.

Record your results in the table below. Use the remaining results to answer questions c-e.

Category	Acres
Food	
Mobility	
Shelter	
Goods/Services	
Your Total Footprint	

b. Read the following information about the measurement unit of the Footprint.

Footprint results are expressed in global acres (or global hectares in metric measurement). Each of those acres corresponds to one acre of biologically productive space with world-average productivity. Today, the biosphere has 26.7 billion acres (or 10.8 billion hectares) of biologically productive space corresponding to less than one-quarter of the planet's surface. These 26.7 billion acres include 5.7 billion acres of productive ocean and 21 billion acres of productive land.

c. Compare your Total Footprint acreage to the average ecological footprint in the United States. Is your footprint larger or smaller? _____

d. Compare your Total Footprint acreage to the biologically productive acres per person worldwide. How many more/less acres are you using?
(KEY: Total – 4.5 =) _____

e. If everyone in the world lived like you, how many planets would we need? _____

f. Take the quiz again. This time, adjust your answers to reflect changes you could make in your lifestyle that would reduce your Total Footprint. List three changes you made:
1_____
2_____
3_____
g. After completing the quiz this second time, how many planets would we need to accommodate a world population living your lifestyle? _____

NRM 150 – Natural Resources Management Undergraduate Orientation - Carolyn E. Grygiel

NRM 150 Pre-course/post-course "Survey of Learning" Lecture Assessment:
1. Briefly define the term: Natural Capital 2. Define the acronym "GNP"; What does this combination of letters describe?
3. What is the most important factor contributing to the global environmental crisis?
4. What is our most economically important natural resource?
5. List three ways humans have affected the natural environment:
6. Most important nutrient for all life forms on planet Earth.
7. What is the approximate current human population on planet Earth?
8. By approximately what percentage does the population in the United States increase each year?

9. What percentage of Americans oppose hunting because they feel it causes animals to suffer?
10. What human practice places the greatest demands on our water resources?

The average score for the pre-course lecture assessment for Fall Semester 2010 was 27%. The average score for the post-course lecture assessment was 90%. The students demonstrated a significantly higher understanding of the material on the post-course lecture assessment. This was the expected response.

Pre-Course / Post-Course Assessment of 10 General Questions in Ecology
Fall Semester 2010
NRM 150 – Natural Resources Management Orientation

Question	Q#1	Q#2	Q#3	Q#4	Q#5	Q#6	Q#7	Q#8	Q#9	Q#10	Mean Score
Pre-	10%	20%	40%	45%	80%	30%	20%	0%	20%	0%	27%
Post-	70%	70%	100%	80%	100%	100%	100%	85%	100%	90%	90%

Sequential Course Assessment Tool – NRM 150

A "Sequential Course Assessment" tool as previously noted was designed and developed for implementation in NRM 150 during Fall Semester 2010. This assessment tool was initially implemented during Fall Semester 2005 and proved so powerful that it was used again during 2006, 2007, 2008, 2009, 2010 and will continue to be used in succeeding semesters with updates and modifications as necessary. This assessment tool is comprised of five questions and was presented to the students at the end of each lecture. The students were required to answer all of the questions in a short essay format; the students returned the assessments to the instructor at the next class period. These assessments were reviewed and graded and then returned to the students

Sequential Course Assessment Questions for NRM 150.

□ Briefly describe the content of today's lecture.

□ How did this presentation broaden your perspective regarding the environment?

□ State at least one new concept you learned during this lecture.

□ What did you find most interesting from this lecture?

□ From a technical perspective, how would you rate this presentation in terms of visual aids, hand-out materials, public speaking abilities of presenter.

It must be noted that NRM 150 is a Freshman Orientation class that is presented in a seminar format by a series of guest lecturers. The Sequential Course Assessment enables the students to assess not only their understanding of the material presented, but their evaluation of the presenter's skills as a public speaker, power-point show coordinator, and writer of hand-out materials. This is an extremely important "learning tool" in that all of these students will eventually need to make presentations.

Application of this tool was successful in that it allowed the students the opportunity for immediate self-assessment of a learning experience. The student's answers were not simply "yes" or "no," but were thoughtful expository responses highly reflective of the lecture's

content. This seemingly simple tool generated a profound impact on the student's participation in classroom discussion and discussions among small groups of students when the class session ended. Upon reviewing the assessments, it also allowed the instructor to gather data useful at the next class session for clarifying misunderstood concepts and generating discussion in response to a student's written query. This sequential course assessment has shown itself to be of great value and will continue to be part of the assessment process for this course.

NRM 420/620 - Scenarios in Natural Resources Management – Jack Norland

The class at the start of the semester was asked this question. "What is a scenario and how does making scenarios in Natural Resources Management help in the present and future management of natural resources."

The responses at the start of class to the question were varied, but a consistent theme was that scenarios were viewed as predictions of the future and could assist in planning of future natural resource management. Some saw scenarios as the worst case situations allowing for crisis planning. Others saw it as problem solving tool.

The question was asked again at the end of the semester during the class evaluation. There the students agreed on several points to the question: 1) that scenarios were a plausible tale of the future but that they were not a prediction of the future, 2) Several scenarios should always be considered when doing a scenario development with the understanding that uncertainty makes none of these scenarios an actual prediction, 3) The usefulness of scenarios was to examine the drivers and their dynamics allowing for decision makers to understand the uncertainty that can be inherent in the future, 4) An important outcome of scenarios was identification of what signals to monitor and how that can point to certain future developments outlined in the scenarios.

In all, the students come to a fuller understanding of the usefulness of scenarios and how these can benefit decision makers and future decisions when there are uncertainties present. This was the expected result.

NRM 421/621 - Environmental Outreach Methods – Christina Hargiss

Spring Semester 2011 was the initial offering of this course and enrollment greatly exceeded expectations. A pre-course and a post-course assessment of student learning were conducted in this class. The pre-course assessment was presented to the students on the first day of class and the post-course assessment was presented to the students near the end of the semester.

The pre-course assessment average was 10% for undergraduate students and 21% for graduate students. The post-course assessment was 93% for undergraduate students and 94% for graduate students. The same questions were asked on both examinations and the students clearly demonstrated an increase in knowledge by significantly increasing their scores on the post-course assessment as compared with the pre-course assessment. This was the expected result.

NRM 431 / 631 –NEPA and Environmental Impact Statements – Christina Hargiss

A pre-course and a post-course assessment of student learning are conducted in this class. The pre-course assessment is presented to the students on the first day of class and the post-course assessment is presented to the students near the end of the semester. Fall Semester 2010 enrolled 45 students (28 undergraduate and 17 graduate). The majority of students (78%) were from the Natural Resources Management Program major.

For Fall Semester 2010, the pre-course assessment average was 10% for undergraduate students and 21% for graduate students. The post-course assessment was 93% for undergraduate students and 94% for graduate students. The same questions were asked on both examinations and the students clearly demonstrated an increase in knowledge by significantly increasing their scores on the post-course assessment as compared with the pre-course assessment. This was the expected result.

Assessment Results

Graduate Students		Undergraduate Students
Pre-course Assessment	21%	10%
Post-course Assessment	94%	93%

Pre-Course and Post-Course Assessment Questions

1. What is the basis of federal planning?
2. What is NEPA?
3. What year was NEPA enacted?
4. What is the role of the Environmental Protection Agency?
5. What is the role of the Council on Environmental Quality?
6. In the NEPA context, what is a —proposed action?||
7. Define Categorical Exclusions and Environmental Assessments.
8. Define Environmental Impact Statements.
9. What is a Management Action Plan?
10. What is a Notice of Intent?
11. How is the purpose and need of an EIS developed?
12. Define —Affected Environment|| as it pertains to NEPA?
13. What are cumulative impacts?
14. What is post monitoring and mitigation?
15. What is the —Rule of Reason and Sliding Scale approach?||
16. What is a NOI?
17. What are the state's rights/responsibilities in Federal planning?
18. Can an agency's decision be challenged? If so, how?
19. What is Total Federal Planning?
20. Why is NEPA limited to federal actions; do you agree with the Congressional decision?

NRM 453 / NRM 653 – Rangeland Resources Watershed Management – Jack Norland

The assessment for NRM 453 / NRM 453 consisted of 20 multiple choice questions taken from various internet based quizzes generated by government agencies concerned with watersheds and water quality management and outreach. The questions are designed to reflect what a well-educated individual should know about watershed management. This

assessment measured not only what should have been learned in class, but what educators believe should be known by professionals who manage watersheds.

The almost doubling of scores in the post-course assessment as compared with the pre-course assessment is indicative of learning in the class about issues that professionals in watershed management consider important for the public and natural resource management professionals to know.

Assessment Results

Pre-course assessment results	49%
Post-course assessment results	91%

Pre-course and post course assessment questions:

1. A watershed is generally defined as:
   A. a building that stores water
   B. all the land area that drains to a given point in a water body
   C. all the water that drains to a given point in a landform
   D. a moment in time when you cross into a new area
2. Percentage of Americans who can correctly answer the previous question, according to national surveys.
   A. every red-blooded American
   B. 20%
   C. 41 %
   D. 0%, and we shouldn't discuss this subject.
3. Stream order is a technique to:
   A. stop stream disturbance by issuing regulatory permits
   B. classify streams based on their location in the drainage network
   C. prevent flow from running downhill
4. How much land in a watershed would be taken up by a stream buffer network that extends a distance of 100 feet from either side of the stream?
   A. 15%
   B. 25%
   C. 0%
   D. 5%
5. Recent watershed research has discovered that urban stream quality begins to decline sharply once impervious cover in a watershed exceeds:
   A. 10%
   B. 25%
   C. 40%
   D. 75%
6. _____ vegetation is characteristic of wetland environments.
   A. hydrostatic
   B. hydrologic
   C. hydrophobic
   D. hydrophytic
7. Most precipitation enters streams.
   A. True
   B. False

8. Which of the following comprises the greatest percentage of impervious cover in suburban areas?
   A. rooftops
   B. lawns
   C. roads, driveways, parking lots
   D. vacant lots
9. Which is best watershed management unit for conducting local watershed management plans?
   A. watershed
   B. basin
   C. subwatershed
   D. catchment
10. Which is the largest watershed management unit?
   A. basin
   B. watershed
   C. catchment
   D. subwatershed
11. When a first order stream flows into another first order stream, the resulting stream order is:
   A. first order
   B. second order
   C. third order
   D. back ordered
12. First and second order streams comprise what percent of the total stream and river mileage of the United States?
   A. 20%
   B. 40%
   C. 67%
   D. 100%
13. How much more storm water runoff is produced by a one acre parking lot compared to a one acre meadow?
   A. 75%
   B. no difference
   C. 200%
   D. 1600%
14. Which class of organism can survive with lower D.O.
   A. Warm water fish
   B. Cold water fish
   C. pouch snails
15. Organisms that live in or close to the bottoms of streams are?
   A. benthic
   B. littoral
   C. riparian
   D. hydrophytic
16. What is a BACI monitoring system ?
   A. poor monitoring system
   B. monitors only riparian areas
   C. monitors before impact, after impact, at a control and an impact site
   D. monitors the stream geomorphology

17. What is a TMDL?
    A. Monitoring system for stream geomorphology
    B. method to set pollution standards
    C. a stream restoration technique
    D. technology to prevent erosion of agricultural fields
18. Manure provides what nutrient at higher levels than what plants need.
    A. nitrogen
    B. phosphorus
    C. potassium
    D. iron
19. Stream restorations should be inspected after what kind of stream event?
    A. a low water event
    B. during a channel forming discharge event
    C. after a peak flow event from a typical summer thunderstorm
    D. during average discharge events
20. Which vegetation is most effective in trapping sediment?
    A. trees with complete canopy coverage
    B. mowed lawn
    C. Kentucky Bluegrass
    D. tall grass

NRM 491 / 690 - Natural Resources Management Undergraduate / Graduate Seminar - Carolyn E. Grygiel

What Did You Do?

A pre-course and a post-course assessment of student learning are conducted in this class. The pre-course assessment is presented to the students on the first day of class and the post-course assessment is presented to the students on the last class day preceding the team presentations of case studies. The student's scores were significantly higher for the post-course assessment; this was expected.

The questions scored in these assessments were questions 1 - 5 on the pre-course assessment and questions 1 - 5 on the post-course assessment (see following). Analyses of the pre-course and post-course assessment are shown on the following Table below.

Pre-course and Post-course assessment evaluations for NRM 491/690

	Average Pre-Course Assessment	**Average Post Course Assessment**
Understanding of Group Dynamics	Fair to Good understanding	Very good to excellent understanding
Comfort Level in the Role of a Public Speaker	A little nervous sometimes	Much more at ease than previously
Understanding of Environmental Ethics	Scale of (1 – 10) Average Score = 6.3	Scale of (1 – 10) Average Score =8.7
"PowerPoint" Skill Level Rating	Scale of (1 - 10) Average Score =7.3	Scale of (1 – 10) Average Score =9.2
Familiarity with Case Study Analysis	Used a few times in other classes	Very familiar

Pre-Course Assessment

1. We will be discussing several aspects of group dynamics in this seminar. Based upon the following scale, how would you rate your understanding of the listed components of group dynamics.

Scale: Excellent – Very Good – Good – Fair – Poor – Not Sure

Component Rating

Group Structure _____

Group Cohesion & Development _____

Group Conflict _____

Group Leadership _____

2. How would you rate your comfort level in the role of a public speaker?

_____ Completely at ease

_____ A little nervous sometimes

_____ Would prefer not to address an audience

_____ Would do so only when forced

_____ Simply will not speak in front of a group

3. On a scale of 1 – 10, how would you rate your understanding of "ethics" in terms of environmental ethics. _____

4. How many times have you composed a "PowerPoint" presentation? _____

On a scale of 1 – 10 how would you rate your skill level in composing a "PowerPoint" presentation. _____

5. How many times have you composed a professional poster such as one that may be presented at a professional meeting?

6. How familiar are you with case study analysis?

_____ Very familiar

_____ Somewhat familiar

_____ Used it a few times in other classes

_____ Unfamiliar

_____ Never heard of case study analysis

7. Provide a list of what you expect to learn in this class

_____

_____

_____

_____

8. Provide a list of three people who have inspired you in terms of their leadership abilities.

1. _____ 2. _____ 3. _____

Post-Course Assessment

1. We discussed several aspects of group dynamics in this seminar. Based upon the following scale, how would you rate your understanding of the listed components of group dynamics.

Scale: Excellent – Very Good – Good – Fair – Poor – Not Sure

Component Rating

Group Structure _____

Group Cohesion & Development _____

Group Conflict _____

Group Leadership _____

2. How do you think your comfort-level in the role of a public speaker has been enhanced by the material presented in class concerning "The Art of Scientific Presentation" and "The Art of PowerPoint"? Are you now:

_____ Completely at ease
_____ More at ease than previously
_____ A little nervous sometimes
_____ Would prefer not to address an audience
_____ Would do so only when forced
_____ Simply will not speak in front of a group

3. On a scale of 1 – 10, how would you rate your understanding of "ethics" in terms of environmental ethics. _____

4. On a scale of 1 – 10 how would you rate your skill level in composing a "PowerPoint" presentation. _____

5. How familiar are you with case study analysis?

_____ Very familiar
_____ Somewhat familiar
_____ Used it a few times in other classes
_____ Unfamiliar
_____ Never heard of case study analysis

Sequential Course Assessment Tool – NRM 491/690

A "Sequential Course Assessment" tool was designed and developed for implementation in NRM 491/690 during Spring Semester 2008. This assessment tool was deemed a "PR-6" and was used for the first time for the 2008 semester. The PR-6 has proven so powerful that it will continue to be used in succeeding semesters with updates and modifications as necessary. This assessment tool was successfully used for Spring Semester 2011. This assessment tool is comprised of six questions for undergraduate students and seven questions for graduate students. The students were required to answer all of the questions in a short essay format; the students returned the assessments to the instructor at the next class period. These assessments were reviewed and graded by the instructor and then returned to the students.

Sequential Course Assessment Questions for NRM 491/690.

1. One paragraph briefly describing the content of the presentation.

2. One paragraph describing how the presentation broadened your perspective on the subject.

3. List three new concepts you learned from this presentation.

4. A statement indicating what you found most interesting about this presentation.

5. A statement describing what you learned from the technical perspective of giving a presentation.

6. Additional comments, if any.

7. (Graduate Students) Please state a question for discussion you will present to your undergraduate team members.

It must be noted that NRM 491/690 is a graduate/undergraduate seminar where the class is divided into teams of four or five students with a graduate student serving as a team leader. The PR-6s are required of all ten didactic lectures which cover various topics including group dynamics, presentation skills, PowerPoint skills, leadership, etc. This enables the students to assess not only their understanding of the material presented, but their evaluation of the presenter's skills as a public speaker, power-point show coordinator, and writer of hand-out materials. The instructor serves as a role model for demonstrating the skills the students should garner from this course.

Application of this tool was successful in that it allowed the students an opportunity for immediate self-assessment of a learning experience. The student's answers were not simply "yes" or "no", but were thoughtful expository responses highly reflective of the lecture's content. This seemingly simple tool generated a profound impact on the student's participation in classroom discussion and discussions among small groups of students when the class session ended. Upon reviewing the assessments, it also allowed the instructor to gather data useful at the next class session for clarifying misunderstood concepts and generating discussion in response to a student's written query. This sequential course assessment has shown itself to be of great value and will continue to be part of the assessment process for this course.

Application of all the assessment tools used in this course resulted in an increase in student learning, understanding, and incorporating into practice a set of "lifetime learning skills." This was the expected result.

RNG 336 – Introduction to Range Management – Amy Ganguli

Fall 2010 was the first semester I taught Introduction to Range Management. After receiving feedback from NDSU colleagues (including previous instructors), students, and other individuals who teach this course across the country I discovered that there were many opportunities to improve and augment the material traditionally presented in this course. Since this course is used as a prerequisite in several of the upper division Range and Natural Resource Management courses I surveyed instructors of these courses to identify skills and knowledge they would like to have incoming students possess.

What Did You Do?

I updated and improved RNG 336 by adding new content, creating new lecture material, and modifying the range plant identification portion of this course. I also chose to utilize a textbook Range Management, which was optional in previous years. To ensure that students utilized the textbook and got the most out of their assigned readings I designed blackboard quizzes to accompany their readings. I utilized blackboard extensively and made all of my course materials, including power points, study guides, and supplemental readings available on the RNG 336 Blackboard site.

I made assessment of student learning an important feature of RNG 336. Based on previous experience and reading research about assessment and learning in today's classrooms I greatly increased the amount of assessment in this class. Throughout the semester I assigned 12 Blackboard quizzes on mandatory readings and allowed students to drop their two lowest scores. These quizzes were designed to reinforce concepts covered in the reading. Students were also assigned short assignments to reinforce concepts covered in

lecture. Because this course covers a wide array of topics I chose to break up the material into 4 in-class quizzes, 3 in-class exams, and a final comprehensive exam. The quizzes were designed to help students prepare for the in-class exams. Prior to exams I conducted in class reviews and offered students the opportunity to attend out-of-class review sessions.

What Did You Learn?

As an additional form of assessment I gave a knowledge assessment "pre-test" during the first class, assuring the students that their performances on the pre-test would not affect their grade. Graded pre-tests were not returned to students. I assessed the knowledge students acquired throughout the semester by asking incorporated questions from the pre-test into their comprehensive final. Students did considerably better on the "post-test" compared to the pre-test (see Table 1).

What Will Be Done Differently As A Result Of What Was Learned?

- In addition to SROI's, I conduct a mid-semester "start, stop, continue" assessment that asked students to share what they would like me to start, stop, or continue doing. Utilizing the mid-semester assessment, SROI's, my observations, and those shared by my graduate student teaching assistants I have identified the following changes I will make:

- I will post pdf's of the lecture slides on blackboard prior to lecture.

- I will attempt to make the plant identification portion of the course more interactive and will move this to one of the first items we cover so that we can look at live specimens rather than just herbarium mounts.

- To address the general discomfort students have in performing mathematical calculations I will attempt to incorporate more information in lectures and assignments that improves their ability and confidence to use routine mathematical operations to solve natural resource problems.

- I will continue to add new material to keep this course up-to-date and modify content to meet the diversity of the students enrolling in this course.

Table 1. Knowledge assessment scores for students enrolled in RNG 336 (Introduction to Range Management).

	Knowledge Assessment	
	Pre-test	Post-test
Number of Students	66	59
Mean Score	16%	66%
Standard Deviation	10%	17%
Highest Score	36%	92%
Lowest Score	0%	22%

Appendix 1. Questions used in the knowledge assessment of students taking RNG 336.

Please provide a brief definition of the following terms:

Climax vegetation-
Peak Oil-
State and Transition Model-

Answer the following Questions about Federal Management Agencies.

1. List one agency that deals primarily with private land management issues. Is this agency in the USDA or DOI?

2. List two agencies that deal with public land management issues and label the agency as being in the USDA or DOI:

3. What are the four chambers of a ruminant's digestive system?

4. What is the State grass of North Dakota?

5. List an example of a rhizomatous, stoloniferous, and cespitose grass:
   -rhizomatous:
   -stoloniferous:
   -cespitose:

6. List 5 of the 17 indicators used to assess Rangeland health.

7. What is a Noxious weed and list 3 noxious weeds on the North Dakota List.

8. Most grass plants in North Dakota's prairies rely on which method to reproduce:
   a. seed
   b. stolon
   c. tiller
   d. root
9. Which animal diet would be least competitive with cattle:
   a. bison
   b. elk
   c. horse
   d. antelope
10. Of the total weight of a grass plant, what percentage of this weight is below the ground surface:
   a. 20-30%
   b. 40-50%
   c. 55-65%
   d. 75-85%
11. Fire is least damaging to:
   a. grasses
   b. forbs
   c. shrubs
   d. trees

12. How many species of vascular flora are found in North Dakota?
    a. 600
    b. 750
    c. 1,000
    d. 1,200
13. Which is the most destructive use of rangelands?
    a. recreation
    b. grazing
    c. hunting
    d. subdividing

RNG 456/656 – Range Habitat Management - Amy C. Ganguli

Spring 2011 was the first semester I taught Range Habitat Management. Prior to teaching this class I surveyed NDSU colleagues (including previous instructors) and students to identify content traditionally covered in this course and the content traditionally covered in upper division/graduate Range Science and Natural Resource Management courses at NDSU. Through these surveys and personal observation I identified what I considered to be skills and knowledge gaps that could be nicely addressed within the scope of this course.

What Did You Do?

I updated and improved RNG 456/656 by completely redesigning this course by adding new content, creating new lecture material, and modifying course topics. The most considerable change I made was to separate the undergraduate and graduate portions of this course and taught them separately. In a previous split level course I taught, I determined that knowledge and ability spectrum that I had from an undergraduate perspective, was too wide to effectively teach to both undergraduate and graduate students. Furthermore, this course was also taught through IVN to Dickinson State University, further broadening the knowledge and ability spectrum. After hearing similar frustrations from other faculty members and by students I decided to split the undergraduate and graduate portions of the course and teach them at different times.

In both courses I utilized Blackboard extensively and made all of my course materials, including power points, study guides, and supplemental readings available on the associated course blackboard site. Assessment of student learning was an important feature in each course, however, I appropriately utilized different forms of assessment for each class. In RNG 456, I used more frequent forms of assessment including blackboard reading quizzes designed to reinforce concepts covered in the mandatory readings, 5 in class quizzes, 2 exams (including the final), and assignments, which included journal article summaries, stocking rate and seeding rate calculations. In RNG 656, I used graduate level forms of assessment that included comprehensive journal article summaries, essay based exams, lectures, and discussion leading.

What Did You Learn?

As an additional form of assessment I gave a knowledge assessment "pre-test" during the first class, assuring students that their performances on the pre-test would not affect their grade. For each class I used the same pre-test and graded pre-tests were not returned to

students. I assessed the knowledge students acquired throughout the semester by asking incorporating questions from the pre-test into their final. Students in each class did considerably better on the "post-test" compared to the pre-test (see Table 1).

What Will Be Done Differently As A Result Of What Was Learned?

In addition to SROI's, I conduct a mid-semester "start, stop, continue" assessment that asked students to share what they would like me to start, stop, or continue doing. Utilizing the mid-semester assessment, SROI's, my observations, and those shared by my graduate student teaching assistant I have identified the following changes I will make:

- I will attempt to formally split these classes out and teach RNG 656 at a 700 level. In the School of Natural Resource Sciences we have a shortage of 700 level classes and based on the feedback I received from student taking this class, I believe this would be a well received option.
- I will post pdf's of the lecture slides on blackboard prior to lecture
- I will seek opportunities to add a field trip to this course, despite the challenges of Spring in North Dakota.
- I will continue to add new material to keep this course up-to-date and modify content to meet the diversity of the students enrolling in this course

Table 1. Knowledge assessment scores for students enrolled in RNG 456/RNG 656 (Range Habitat Management).

	RNG 456		RNG 656	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
Number of Students	11	12	10	11
Mean Score	19%	83%	35%	83%
Standard Deviation	9%	12%	14%	10%
Highest Score	35%	98%	65%	93%
Lowest Score	7%	65%	16%	66%

Appendix 1. Questions used in the knowledge assessment of students taking RNG 456/RNG 656.

1. What is habitat (i.e., list the 4 components that make up habitat) (5pts.)?
2. What is the difference between a fine filter and a coarse filter approach to wildlife habitat management in rangeland ecosystems (5pts.)?
3. Draw and label an example of a hypothetical state and transition model (make sure to include all of the critical components). What is the value of using state and transition models in rangeland management (5pts.)?
4. List 5 unique concerns associated with losing biodiversity on rangelands (5pts.).

5. How can mechanistic understanding of succession be used to design management strategies of degraded rangelands (provide examples) (5pts.)?

6. A particular 'state' in an ecological site has a recommended stocking rate of 0.50 AUM/ha. How many hectares would be needed to graze 70 steers (0.6 AUE) from May 15 to September 1 (5pts.)?

7. If a seedlot sample of 100g has: 65% germination, 5g of weed seeds and 10g of other inert material (i.e., non-seed stuff), what is the % Pure Live Seed (5pts.)?

8. Determine the amount of bulk seed needed for reseeding a 100-ha field at 6 kg/ha PLS. Germination=60%, Purity=80% (5pts.).

9. What three elements must be present in order for fire to occur (i.e., to initiate and continue the combustion process) (5pts.)?

10. Identify and characterize the four primary states of combustion (5pts.).

Soil 210 – Introduction to Soil Science – R. Jay Goos

What Did You Do?

The past 4-5 years, a series of questions were asked at the beginning of the semester (pretest) and were asked again at the end of the semester on the final exam. The analysis of the data consistently showed:

1. Students enter Soil 210 with almost no technical knowledge of soils
2. There was marked improvement in the students' ability to answer basic questions about soils.
3. The more often a topic was covered, in lecture or lab, the higher the level of mastery of the students on the topic.
4. Covering a topic just once in lecture was not adequate. The most important topics must be covered in both lecture and lab to assure an acceptable level of student retention at the end of the semester.

It was decided not to do the pretest-type of analysis again, since the prior years' analyses all showed the same thing. Instead, it was decided to analyze the students' performance on the important calculations related to the discipline of soil science.

The calculations performed in Soil 210 are all practical and important. The calculations involve the following knowledge areas:

1. Mass and concentration concepts. Concentration vs. content. Parts per million, percent, and related concepts (mg/kg, etc.). In subsequent tables, for brevity, this will be referred to as "Mass and concentration concepts."

2. Soil bulk density, soil particle density, soil compaction, calculation of soil texture from hydrometer readings, soil water content, available water in soil, irrigation requirement. In subsequent tables, for brevity, this will be referred to as "Soil density and water concepts."

3. Soil cation exchange capacity, exchangeable acids and bases, percent base saturation, exchangeable sodium percentage. Lime requirements, gypsum requirements. . In subsequent tables, for brevity, this will be referred to as "Soil chemistry concepts."

These three knowledge areas are covered on tests 1, 2, and 3, and again in a comprehensive manner on the final exam.

The students are trained to do these problems via weekly problem sets.

What Did You Learn?

The results are summarized in Table 1. The performance of students on problems was not kept separate for every test in the Fall Semester 2010. In the two areas comparable between the two semesters, there seems to be an overall improvement of student scores between the Fall Semester 2010 and Spring Semester 2011. For example, for concepts of soil density and water, only 50% of the students got 80% of the points in Fall 2010, but 85% of the students got at least 80% of the points in Spring 2011. Similar results were obtained for the comprehensive examination. The percent of students getting at least 80% of the points for the comprehensive exam was 54% for Fall 2010, but that was increased to 67% for Spring 2011. The trend for increased ability of students to do the calculations is probably due to a change in how the students are trained to do the problems. In the past (Fall 2010 and before), one large problem set was handed out about two weeks before exam, and it was due a week before an exam. In Spring 2011, problems are assigned on a more continuous basis, a smaller problem set every week. Problems are typically handed out on Wednesday, and handed in on Monday. This gave the students more opportunities to learn how to do the problems, and had the added benefit of essentially forcing them to attend the two lectures of the week. This led to improved student performance in the class as a whole.

Table 1. Student achievement on calculations important to soil science. Percent of students achieving different percentages of problems done correctly.

	Fall 2010		Spring 2011			
Percent correct	Soil density and water	Comp.	Mass and concentration	Soil density and water	Soil chemistry	Comp.
	% of students					
< 90%	21	33	63	35	51	25
< 80%	50	54	75	85	77	67
< 70%	66	67	83	91	92	86

Comp.=comprehensive

What Will Be Done Differently As A Result Of What Was Learned?

It will be necessary to run this analysis for another few semesters to determine if this trend continues.

Soil 217 - Introduction to Meteorology and Climatology – F. Adnan Akyuz

What Did You Do?

During the 2010-2011 academic year, two surveys were administered to the students at the beginning and the end of the semester. Participation was voluntary but all students that were present on the days of the surveys participated. Each survey contained 20 responses; 10 beginning-of-semester questions and 10 end-of-semester questions. There were three types of questions to assess the student learning at varying depths; content learning, application learning and deep application learning.

The content learning questions were designed such that content learning could be distinguished from prior knowledge. Knowledge improvement was calculated by subtracting the responses from the first assessment survey from that of the second assessment survey. I was mostly interested in the number of responses that showed the confidence in the correct answer such as the response-D ("I have a clear idea of what these terms mean and I can explain them").

The application learning survey questions were designed to assess whether students had learned to use meteorological methods, concepts or theories acquired in the class in new situations or to solve problems. I was mostly interested in the number of responses that showed the confidence in the correct answer such as "I am certain that...". For that reason I was mostly interested in percentage statistics for answers C, D and D for questions 4, 5 and 6 respectively.

The deep application learning questions were designed to assess students' ability to see patterns and separate concepts into component parts, thus deeper application learning. These types of questions usually starts with a paragraph that gives the students current setting followed by set of questions asking student to consider the initial conditions given in the paragraph in order to answer the question(s). Just like the application learning questions, I was mostly interested in improvement in the highest certainty in the correct answer. Specifically, questions 7 through 10 were constructed to measure their deep application skills that they acquired throughout the semester. Findings were listed under the "What was learned" section next.

What Did You Learn?

The numbers in the following table are the % knowledge improvement in the three category mentioned above; content learning, application learning, and deep application learning. They are the difference between prior knowledge and the knowledge gained after the class. The following series of tables show the summary for content learning (Table 1), application learning (Table 2) and deep application learning (Table 3). Table 4 is a summary for all 3 categories.

Table 1. Content Learning

Questions	1	2	3	Average
1st Assessment Proficiency(%)	2.65	4.42	4.42	**3.83**
2nd Assessment Proficiency(%)	52.63	56.14	78.95	**62.57**
% Improvement	49.98	51.7	74.53	**58.74**

Table 2. Application Learning

Questions	4	5	6	Average
1st Assessment Proficiency(%)	39.29	3.54	20.35	**21.06**
2nd Assessment Proficiency(%)	80.36	21.43	59.65	**53.81**
% Improvement	41.07	17.9	39.3	32.75

Table 3. Deep Application Learning

Questions	7	8	9	10	Average
1st Assessment Proficiency(%)	24.78	19.47	9.73	7.14	**15.28**
2nd Assessment Proficiency(%)	53.57	53.57	31.58	37.5	**44.06**
% Improvement	28.79	34.1	21.85	30.36	28.78

Table 4. Summary of Learning

	Knowledge Improvement (%)
Content Learning	58.74
Application Learning	32.75
Deep Application Learning	28.78

See the following interpretation help for the data displayed above:
On the average 3.83% of the students participated had a prior knowledge of the contents of the given subject. At the end of the semester, that percentage was 62.6% yielding 58.7% improvement in knowledge. Similarly, Application Learning and Deep Application Learning yielded positive trend with 32.8% and 28.8% knowledge improvement compared to prior knowledge respectively. It was noted that as the difficulty of the concept increased, student knowledge improvement decreased. It was an expected outcome.

What Will Be Done Differently As A Result Of What Was Learned?

Analysis of individual questions allows me to see which subject requires more attention. From previous years, I was able to see that the Atmospheric Moisture needed more attention. This year, I put more emphasis on the Atmospheric Moisture. Improvement in students' learning was evident on their responses not only on the assessment but also in their exam outcome. Question 5 tells me that I need to bring more emphasis on the relationship between the vertical pressure gradient and vertical wind speed as compared with horizontal wind speeds. Next year I will show some examples of daily wind speed magnitudes from observed values. This way, students would have a clear idea of range of acceptable vertical wind speeds as well as horizontal wind speeds in the atmosphere.

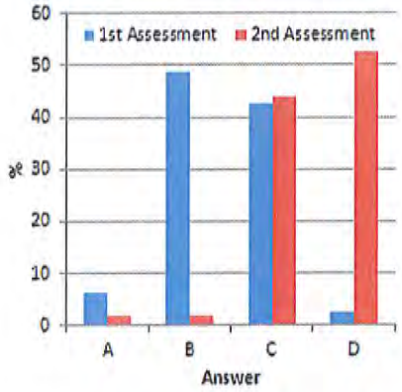
The student evaluation for the class and the instructor was very positive. Overall, I am satisfied with the result and I will maintain the method of teaching in the same level next year.

Questions

Questions as well as responses are given in the appendix section below. Blue bars and red bars are the responses on the first and second assessment surveys respectively. Plus sign (+) under the bar indicates the correct answer, while negative sign (-) indicates incorrect answer. Double positive sign (++) indicates the correct answer with confidence. Double negative sign (--) indicates incorrect answer while the student was confident that it was the correct answer.

Content Learning Questions and Responses

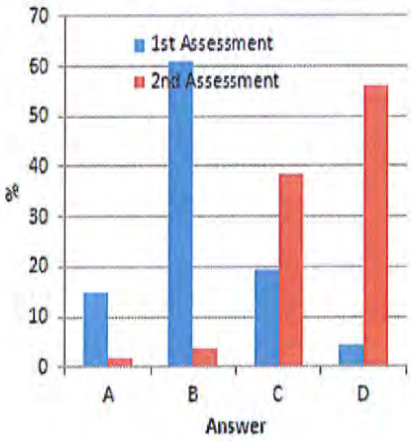
Question 1



Two types of energy constantly move vertically through the atmosphere in the form of radiation. One type, *solar radiation*, is generated by the Sun. The second type, called *longwave radiation* or *Earth radiation*, is generated by the earth and clouds.

A. I have never heard of the italicized terms before.
B. I have heard of at least some of these terms before but I really don't understand what they mean.
C. I have some idea of what these terms mean, but I would have difficulty explaining them.
D. I have a clear idea of what these terms mean and I can explain them.

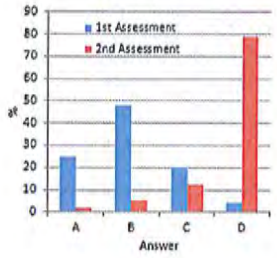
Question 2



Latent heat of condensation is a form of energy that is released when water changes from a vapor to a liquid. In order to achieve condensation and to form a cloud, water vapor usually cools *adiabatically* until reaching its *dew point* temperature.

A. I have never heard of the italicized terms before.
B. I have heard of at least some of these terms before but I really don't understand what they mean.
C. I have some idea of what these terms mean, but I would have difficulty explaining them.
D. I have a clear idea of what these terms mean and I can explain them.

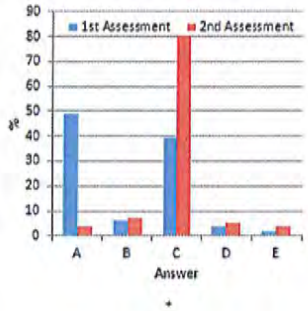
Question 3



A *pressure gradient* is a horizontal difference in air pressure between two locations. A pressure gradient generates a *pressure gradient force* which causes air to move, creating wind. The *Coriolis force*, caused by the earth's daily rotation, helps determine which direction the wind blows.

A. I have never heard of the italicized terms before.
B. I have heard of at least some of these terms before but I really don't understand what they mean.
C. I have some idea of what these terms mean, but I would have difficulty explaining them.
D. I have a clear idea of what these terms mean and I can explain them.

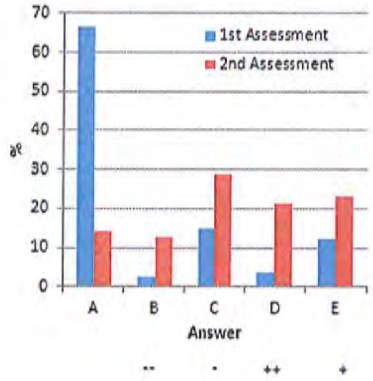
Question 4



Suppose lower pressure is located to the west, and higher pressure is located to the east. The pressure gradient force would be directed

A. I don't know
B. Toward the east
C. Toward the west
D. Toward the north
E. Toward the south

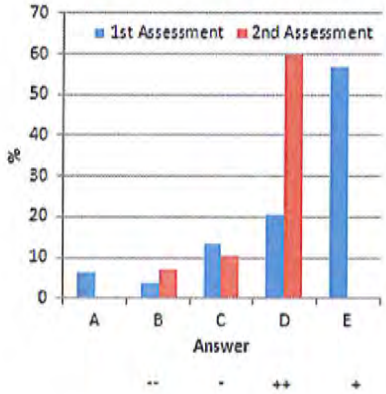
Question 5



Pressure gradient is much greater in vertical than in horizontal. Thus, wind speed is directly proportional with the pressure gradient force, meaning that you would expect higher wind speeds where pressure gradient is higher. Do we observe vertical wind speeds much greater than the horizontal wind speeds in general?

A. I do not know which would be greater.
B. I am certain that the vertical wind speeds are expected to be much greater than the horizontal wind speeds in general, and I can explain why.
C. I suspect that the vertical winds peeds are expected to be much greater than the horizontal wind speeds in general, but I would have difficulty explaining why.
D. I am certain that the horizontal wind speeds are expected to be much greater than the vertical wind speeds in general, and I can explain why.
E. I suspect that the horizontal wind speeds are expected to be much greater than the vertical wind speeds in general, but I would have difficulty explaining why.

Question 6



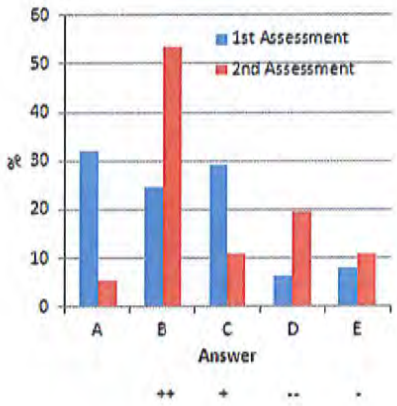
During winter when temperatures are very cold, frost sometimes forms on poorly insulated windows. Does frost form on the inside or the outside of the windows?

A. I really have no idea on which side of the windows frost will form.
B. I'm certain that the frost forms on the outside of the windows, and I can explain why.
C. I suspect that the frost forms on the outside of the windows, but I would have difficulty explaining why.
D. I'm certain that the frost forms on the inside of the windows, and I can explain why.
E. I suspect that the frost forms on the inside of the windows, but I would have difficulty explaining why.

Question 7 refers to the following paragraph.

The atmosphere's general circulation is modified by the irregular placement of oceans and continents across the earth's surface. The heat capacity of water is many times larger than that of soil. This means that it takes much more energy to warm water than it does to warm the land.

Question 7



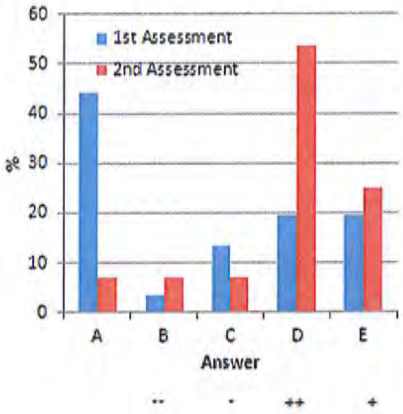
The atmosphere's general circulation is modified by the irregular placement of oceans and continents across the earth's surface. The heat capacity of water is many times larger than that of soil. This means that it takes much more energy to warm water than it does to warm the land. In a laboratory experiment lasting exactly one hour, equal amounts of energy are applied to one kilogram samples of soil and water. Both samples have the same temperature at the start of the experiment. After one hour, which sample will have a higher temperature?

A. I really have no idea which sample will have a higher temperature.
B. I'm certain that the soil will have the higher temperature, and I can explain why.
C. I suspect that the soil will have the higher temperature, but I would have difficulty explaining why.
D. I'm certain that the water will have the higher temperature, and I can explain why.
E. I suspect that the water will have the higher temperature, but I would have difficulty explaining why.

Questions 8 and 9 refer to the following paragraph.

Water vapor is one of several gases which absorb the longwave radiation emitted by the earth's surface. Clouds also absorb longwave radiation. On two different nights the temperature at sunset is 55°F and skies remain clear throughout the night. On the first night there is a moderate amount of water vapor in the atmosphere, and the temperature drops throughout the night to a minimum of 45°F.

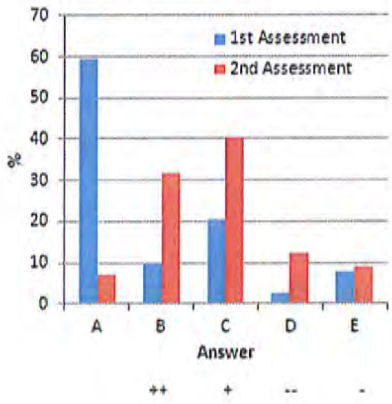
Question 8



Suppose the sky had become cloudy during the first night. How would the clouds change the minimum temperature on this night?

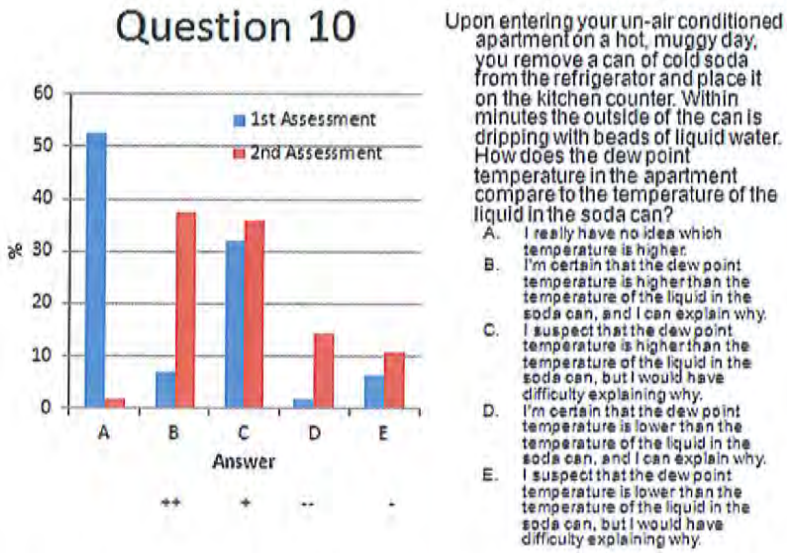
A. I really have no idea what minimum temperature to expect.
B. I'm certain that the minimum temperature will be colder than 45°F, and I can explain why.
C. I suspect that the minimum temperature will be colder than 45°F, but I would have difficulty explaining why.
D. I'm certain that the minimum temperature will be warmer than 45°F, and I can explain why.
E. I suspect that the minimum temperature will be warmer than 45°F, but I would have difficulty explaining why.

Question 9



On the second night the level of water vapor in the atmosphere dropped dramatically. What minimum temperature would you expect on the second night?

A. I really have no idea what minimum temperature to expect.
B. I'm certain that the minimum temperature will be several degrees colder than 45°F, and I can explain why.
C. I suspect that the minimum temperature will be several degrees colder than 45°F, but I would have difficulty explaining why.
D. I'm certain that the minimum temperature will be several degrees warmer than 45°F, and I can explain why.
E. I suspect that the minimum temperature will be several degrees warmer than 45°F, but I would have difficulty explaining why.



SOIL 322 – Soil Fertility and Fertilizers – Larry Cihacek

Soil Science 322 (Soil Fertility and Fertilizers) has an enrollment of 30 students during spring semester 2011.

What Did You Do?

Course learning and information retention was evaluated through three exams and a comprehensive final exam. Exams consisted of 45 to 70 multiple choice, true/false and matching questions that were graded by optical scanning. Feedback was provided to the students after each exam. Seventeen questions presented during the first three exams representing key concepts were repeated on the final exam. Scores for these questions were compared using the results analysis provided by the optical scan grading system.

What Did You Learn?

From these analyses, 6 questions showed an increase of +3 to +35% in correct scores (average +12.5%), 3 questions showed no change, and 8 questions showed a decrease of -3 to -10% in correct scores (average -6.9%). Overall the scores showed a +1.2% increase indicating information retention or slight improvement in overall learning over the semester.

What Will Be Done Differently As A Result Of What Was Learned?

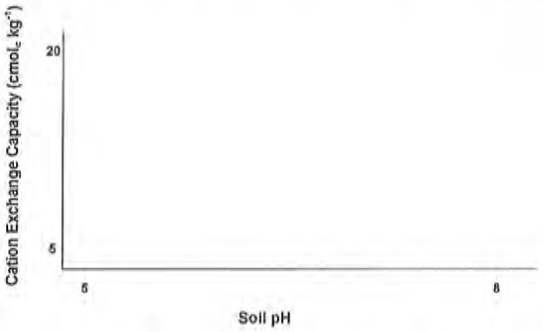
In 2012, a larger pool of questions will be used to improve the assessment process.

SOIL 410/610 – Soils and Land Use – Tom DeSutter

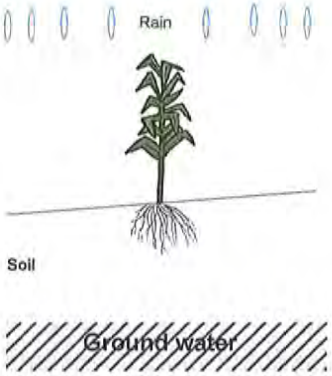
What Did You Do?

The following questions were given as pre- and post-assessment questions:

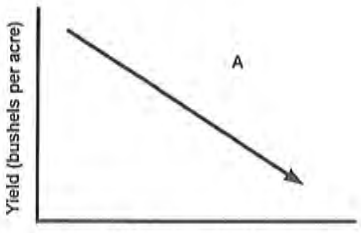
7. Using the graph provided, show how soil pH and CEC are related when: 1) there is **NO** organic carbon in the soil and 2) when there **IS** organic carbon present in the soil. (you will need to draw two curves)

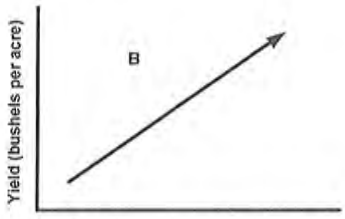


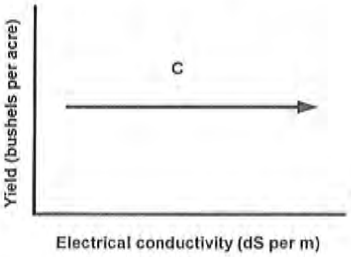
8. In the picture below, use labeled arrows and describe the hydrologic cycle:

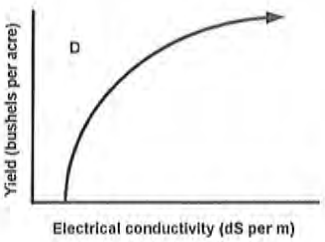


9. How does soil salinity influences the yield of soybeans? (circle your best answer)









1. What are the five soil forming factors? (circle your answer)
a. tillage, climate, sunlight, relief, rainfall
b. relief, climate, parent material, time, sunlight
c. time, parent material, climate, tillage, relief
d. time, relief, climate, living organisms, parent material
e. parent material, rock, living organisms, sunlight, temperature

2. Which form of nitrogen is the most reduced form? (circle your best answer)
a. NH_4^+
b. NO_2^-
c. NO_3^-
d. N_2
e. N_2O

3. Which of the following cations are used to determine the sodium absorption ratio of a soil? (circle your answer)
a. Mg, Ca, Na
b. Mg, K, Ca
c. Ca, Mn, Na
d. Mn, Fe, Na

4. If a Barnes soil series has sand, silt, and clay contents of 44, 34, and 22%, respectively, and a Flaming soil series has sand, silt, and clay contents of 89, 6, and 5%, respectively, which of the two soil series likely has:
-the most organic carbon?_____
-the highest concentration of base cations?_____
-the greatest ability to leach water?_____
-the greater aggregate stability?_____
-the greater potential to be wind erodible?_____

5. Rank the following salts that are commonly found in soil from the most soluble (1) to the least soluble (3):
_____ $CaCO_3$
_____ $CaCl_2$
_____ $CaSO_4$

6. Which of the following statements best describes this soil classification? (circle your answer)

"Coarse-loamy, mixed, superactive, mesic Typic Haplustept"

a. loamy texture, mineralogy is variable, high cation exchange capacity, inceptisol
b. loamy texture, A horizon has been plowed, calcareous, inceptisol
c. loamy texture, A horizon has been plowed, calcareous, vertisol
d. loamy texture, mineralogy is variable, calcareous, andisol
e. Wow, this is funny language!

10. If a soil had a total inorganic carbon concentration of 1,000 mg/kg and a bulk density of 1,000 kg/m^3, what would be the total mass of carbon in the soil within an area of 10,000 m^2 that is 0.1 m deep? (circle your best answer)
a. 1 Mg
b. 500 kg
c. 500 Mg
d. 1000 Mg

11. What is the total porosity of a soil that has a bulk density of 1 g/cm^3 and a particle density of 2.65 g/cm^3? (circle your best answer)
a. 50%
b. 13%
c. same as the bulk density
d. 62%

12. If the concentration of H^+ in the soil is 1×10^{-6}, what is the pH of this soil? (circle your best answer)
a. -6
b. 6
c. 1,000,000
d. 7

13. If a soil sample was taken in a cylinder having a diameter of 10 cm and a height of 6.4 cm, what is the bulk density of this soil if its oven dry weight is 600 g? (circle your best answer)
a. 0.9 g/cm^3
b. 0.5 g/cm^3
c. 2.65 g/cm^3
d. 1.2 g/cm^3

14. A saturated paste extract came back from the soil testing laboratory and results are below. What is the exchangeable sodium percentage (ESP) for this soil? (circle your best answer)

Cations	$cmol_{(c)}$ kg^{-1}
Ca	6.7
Mg	5.2
Na	2.8
K	1.1

a. 2.8%
b. 15.8%
c. 17.7 %
d. 23.3%

Student diversity

As in the past, this course had high student diversity and the enrollment was 31 (9, 410 students and 22, 610 students). Of the 410 students, 3 were NRM majors and the remaining students were Crop and Weed Sciences (3), General Agriculture (1), Soil Science (1), and Range Sciences (1). Of the 610 students, 10 were NRM and the remaining students had majors of Plant Sciences (8), and Range Sciences (4). There were one and six women students in the 410 and 610 courses, respectively, and one and four international students, respectively.

Summary of Assessment

Student answers were scored based on their ability to correctly answer multiple choice, unit conversions, and problem solving/reasoning questions (Tables 1 and 2).

Table 1. Student pre- and post-assessment answers for Soil 410 (spring, 2011). See above for specific questions. Each value in the table is the number of students falling within respective categories. A total of 9 and 7 students took the pre- and post-assessments, respectively.

Question	Pre-correct	Post-correct
	----------%----------	
1	78	100
2	44	57
3	44	86
4	44	86
5	22	14
6	89	86
7	0	29
8	0	33
9	67	86
10	11	43
11	33	29
12	78	71
13	44	86
14	56	29

Table 2. Student pre- and post-assessment answers for Soil 610 (spring, 2011). See above for specific questions. Each value in the table is the number of students falling within respective categories. A total of 21 students took both the pre- and post-assessments.

Question	Pre-correct	Post-correct
	----------%----------	
1	76	100
2	19	38
3	38	71
4	62	76
5	14	33
6	38	62
7	0	29
8	24	38
9	76	90
10	19	33
11	24	48
12	86	86
13	38	71
14	24	62

Observations and Conclusions

Overall, I was pleased with the learning that took place. For the 410 students, 64% of the questions had improvement and for the 610 students, 93% had improvement. Certainly, the lack of improvement of the 410 students using this assessment is curious, but the improvement of the 610 students is encouraging. The students generally missed Question 8, which should be an easy one, especially since they should have had this in numerous

courses. Constructing two separate assessments for each level may need to be done to better assess learning beyond the exams.

I asked the students early in the course, after the CNN report came out about the lack of learning in colleges, about how they learn best. They indicated to me that demonstrations were the best tool for long-term remembrance. Therefore, I included many more demonstrations this past semester, which I hope will allow them to retain knowledge for my "five years after class" goal. Lee Briese, my current part-time PhD student, taught the salinity section of my course and had demonstrations every class, which were the same demonstrations that he uses to connect with his growers during meetings.

As with every semester I had "super outgoing students" and also "sleeper students" who I found resting their eyes during class. The class dynamics and interactions were again very good. There is difficulty getting the international students involved without directly asking them questions, which I am hesitant to do. The international students do regularly communicate with me outside of class, which allows me to gauge their learning and interest in the course.

SOIL 444/644 – Soil Genesis and Survey – David Hopkins

What Did You Do?

This 4 credit field oriented course is taught in the autumn semester and assessment was conducted via a pretest consisting of 7 general questions ranging in difficulty. For some of the more difficult questions, i.e., 2, 4, 5, 6 responses were evaluated rather rigorously and a rating of "essentially correct" was given only if students were able to provide examples to justify their argument. Answers were assigned to classes of essentially correct, 40-60 % correct, <40% or simply incorrect, and No response, or "don't know".

For the post test, rather than use the identical pre-test as I have done in the past, the actual final exam was evaluated as a post-test. Three questions closely related to the theme of three of the 7 questions listed below were evaluated for the 20 students that took the pre-test. These questions were numbers 2, 4, and 5 because they focus on the nature of soil taxonomy, the importance of the mineral fraction in soils, and the evaluation of actual soil profiles in the field. A major part of the course centers on the application of taxonomy in soils and land use, and I have always tried to emphasize the importance of the mineral fraction in soils. The complete spreadsheet for 2010 is shown in the Appendix A.

The 7 Pre-Test questions were:

1. What are the Five Factors of Soil Formation?

2. What is Soil Taxonomy? Why is it important and how does it work?

3. What is the difference between illuviation and eluviation? Give an example of both.

4. What are secondary minerals? How are they important in soil genesis or soil management?

5. What is a prairie soil profile (i.e., a typical mollisol)? Do they have a distinct pattern of soil horizons?

6. Why do mature soils in Tennessee or France (or any other humid location) possess such different properties than their parent material. Provide some evidence of why this is true.

7. Dr. Goos wanted to know what the principle factor is that drives, e.g. "governs" profile development in soils.

The three final exam questions linked to pre-test questions 2, 4, and 5 were:

2. What is the difference between a ***genetic*** and a ***diagnostic*** soil horizon. Why are both types of horizons important for practical land use interpretations?
4. What is the difference between a "felsic" and a "mafic" primary mineral? Is either class more or less important from edaphic or pedologic perspectives? Provide formal names (not chemical formulae) of four examples from each class.
5. List 5 subordinate distinctions (S&A's "suffixes") that differentiate B horizons and provide a brief description for each distinction. Also indicate where such subordinate distinctions might be found geographically, i.e., northern Maine, southern Spain, or within a specific landscape setting.

Table 1. Pre-test and final exam results for three major themes in Soils 444/644.

Pretest-Responses fractionally ranked for the 20 students					
Question	**Subject**	**Essentially correct**	**~ 40-60 % correct**	**< 40 % correct or just wrong**	**No response or "don't know"**
1	Taxonomy	0.30	0.40	0.20	0.10
2	Secondary minerals	0.30	0.35	0.20	0.15
3	Prairie soils	0.30	0.25	0.15	0.30
Final Exam Responses fractionally ranked for the 20 students					
Question	**Subject**	**Essentially correct**	**~ 40-60 % correct**	**< 40 % correct or just wrong**	**No response or "don't know"**
1	Taxonomy	0.45	0.45	0.10	0.00
2	Secondary minerals	0.25	0.25	0.45	0.05
3	Prairie soils	0.85	0.15	0.00	0.00
Degree of improvement/change ranked by percent over the course of instruction					
Question	**Subject**	**Essentially correct**	**~ 40-60 % correct**	**< 40 % correct or just wrong**	**No response or "don't know"**
1	Taxonomy	15	5	-10	-10
2	Secondary minerals	-5	-10	25	-10
3	Prairie soils	55	-10	-15	-30

What Did You Learn?

Results for the 2010 assessment show that knowledge gained in Soil Taxonomy and prairie soils exceeded that of knowledge regarding secondary minerals in soils. The number of students who demonstrated an improved understanding is only shown as 15 percent of the student population, but thirty percent of the students on the pre-test had either no knowledge of taxonomy or very little, and that number improved to only 10 percent as shown by the final exam. The specific question used to evaluate knowledge of soil taxonomy was rather involved, and without a clear understanding of how Soil Taxonomy is actually structured and practiced, students were not able to excel in their response. It is also true that in evaluating the 4 classes of response for this question in thwe Pre-test I may have been a bit more lenient, whereas I was not in grading the final exam question. This type of inconsistency casts a bit of doubt on the subjective nature of categorizing students responses. The most significant improvement in the three themes was in the area of prairie soils and soil morphologic understanding. Results from the degree of improvement table showed a 25 percent increase in the number of students who mastered this knowledge compared to their knowledge on the pre-test. Additionally, 45 percent of students demonstrated little or no knowledge of prairie soils in the pre-test and by the time of the final exam, no students were recorded in these categories. This improvement in student understanding of a basic theme of the course suggests that the field trip and laboratory experiences are positive educational strategies.

The results also indicate that much more needs to be done to improve the knowledge of secondary and primary minerals in soils. Results from the pre-test and post-test evaluations actually record a decrease in students ranking in the "Essentially correct" category, i. e. -5 percent. These results are difficult to decode, as the pre-test evaluations may be a bit more lenient depending on the students' answers, but in the final exam, a significant degree of knowledge was needed to score well. These data are even more difficult to accept given the large number of geoscience students enrolled last fall; they should have excelled in this theme area.

What Would You Do Differently As A Result of What You Learned?

Results from this assessment indicate that if the mineral fraction of soils continues to be a major theme in Soils 444/644, and it must be, then additional teaching methods need to be developed to "draw" students into a deeper appreciation and knowledge of this theme area. The need for an entire lab session on soil mineralogy is apparent. Often students from disciplines like Range Science, and NRM, and frankly, even Soil Science, seem to feel that soil mineralogy is just something to "get through with", so perhaps clearer teaching objectives and more structured group work using hand specimens will help. The students who have not taken the soils 210 prerequisite typically lag behind the class average, and find the mineralogic concepts more challenging. From my past experience, the opportunity to take students into the field each week is one of the most effective approaches in this course, and by utilizing soil samples collected on the trip for mineralogical analysis in later lab sessions, or even in lecture settings could be helpful.

In addition to the Pre-test and Post-test questionnaire, I have typically asked students what they believed was the most interesting and yet trivial aspect of the course that extended their knowledge in pedology. These responses are listed in Appendix B and are informative. They

suggest that learning is taking place that will benefit the students in their professional careers. Also some of the comments regarding the importance of mineralogy and taxonomy are evident in the student candid comments.

Appendix A: Example of Pre-test and Post Test analysis

Soils 444/644 Pretest Questions

1) What is Soil Taxonomy? Why is it important and how does it work?

Student List	Essentially correct	~ 40-60 % correct	< 40 % or just wrong	no response or "don't know"
1		x		
2		x		
3	x			
4		x		
5	x			
6				x
7				x
8	x			
9			x	
10			x	
11			x	
12			x	
13	x			
14		x		
15	x			
16		x		
17		x		
18		x		
19	x			
20		x		

2. What are secondary minerals? How are they important in soil genesis or soil management?

Student List	Essentially correct	~ 40-60 % correct	< 40 % or just wrong	no response or "don't know"
1		x		
2	x			
3		x		
4			x	
5	x			
6		x		
7			x	
8	x			
9				x
10			x	
11				x
12				x
13	x			
14		x		
15	x			
16	x			
17		x		
18			x	
19		x		
20		x		

3. What is a prairie soil profile (i.e., a typical mollisol)? Do they have a distinct pattern of soil horizons?

Student List	Essentially correct	~ 40-60 % correct	< 40 % or just wrong	no response or "don't know"
1		x		
2		x		
3	x			
4				x
5	x			
6				x
7				x
8	x			
9				x
10			x	
11			x	
12			x	
13	x			
14				x
15	x			
16		x		
17		x		
18		x		
19	x			
20				x

Frequency of responses for the 20 students

Question	Subject	Essentially correct	~ 40-60 % correct	< 40 % or just wrong	no response or "don't know"
1	Taxonomy	6	8	4	2
2	Secondary minerals	6	7	4	3
3	Prairie soils	6	5	3	6

Responses fractionally ranked for the 20 students

Question	Subject	Essentially correct	~ 40-60 % correct	< 40 % or just wrong	no response or "don't know"
1	Taxonomy	0.30	0.40	0.20	0.10
2	Secondary minerals	0.30	0.35	0.20	0.15
3	Prairie soils	0.30	0.25	0.15	0.30

Soils 444/644 Final Exam Answers

1. What is the difference between a *genetic* and a *diagnostic* soil horizon? Why are both types of horizons important for practical land use interpretations?

Student List	Essentially correct	~40-60 % correct	< 40 % or just wrong	no response or "don't know"
1	x			
2		x		
3		x		
4	x			
5	x			
6		x		
7			x	
8	x			
9	x			
10		x		
11	x			
12		x		
13	x			
14		x		
15	x			
16		x		
17		x		
18		x		
19	x			
20			x	

2. What is the difference between a "felsic" and a "mafic" primary mineral? Is either class more or less important from edaphic or pedologic perspectives? Provide formal names (not chemical formulae) of four examples from *each class*.

Student List	Essentially correct	~40-60 % correct	< 40 % or just wrong	no response or "don't know"
1			x	
2			x	
3			x	
4	x			
5		x		
6			x	
7			x	
8		x		
9		x		
10	x			
11			x	
12			x	
13	x			
14			x	
15		x		
16	x			
17				x
18		x		
19	x			
20			x	

3. List 5 subordinate distinctions (S&A's "suffixes") that differentiate B horizons and provide a brief description for each distinction. Also indicate where such subordinate distinctions might be found geographically, i.e., northern Maine, southern Spain, or within a specific landscape setting.

Student List	Essentially correct	~40-60 % correct	< 40 % or just wrong	no response or "don't know"
1	x			
2	x			
3	x			
4	x			
5	x			
6		x		
7	x			
8	x			
9		x		
10	x			
11	x			
12	x			
13	x			
14		x		
15	x			
16	x			
17	x			
18	x			
19	x			
20	x			

Frequency of responses for the 20 students

Question	Subject	Essentially correct	~40-60 % correct	< 40 % or just wrong	no response or "don't know"
1	Taxonomy	9	9	2	0.00
2	Secondary minerals	5	5	9	1.00
3	Prairie soils	17	3	0	0.00

Responses fractionally ranked for the 20 students

Question	Subject	Essentially correct	~40-60 % correct	< 40 % or just wrong	no response or "don't know"
1	Taxonomy	0.45	0.45	0.10	0.00
2	Secondary minerals	0.25	0.25	0.45	0.05
3	Prairie soils	0.85	0.15	0.00	0.00

Degree of improvement/change ranked by percent over the course of instruction

Question	Subject	Essentially correct	~40-60 % correct	< 40 % or just wrong	no response or "don't know"
1	Taxonomy	15	5	-10	-10
2	Secondary minerals	-5	-10	25	-10
3	Prairie soils	55	-10	-15	-30

Appendix B: Student responses to the final exam question "what was the most interesting and yet trivial thing that you learned this semester?" (the question was not graded: student order the same as in pre-and post-test analysis)

Student	Comment
1	I didn't really know and understand all the different soil orders before I started this class. But since, I've grown an appreciation for the diverse 12 soil orders there are and their unique differences. Each has its own characteristics and "environments"; it showed me the broader view on soils and appreciation for the soil we have in ND.
2	The iron content in a soil is actually required to make it turn red in color. It's much smaller than I thought. Like you always said in class, "you don't need much red paint to paint a barn red!"
3	It doesn't take a lot of red paint to paint a barn red- memorizing minerals has been challenging for me.
4	I found the entire course enthralling! But having a geologic background I was amazed to see the overwhelming effects that mineralogy can have on the behavior of a soil, i.e., Ca^{+2} as a flocculating agent, as a pH buffer etc. the implications seem endless and I feel like my new knowledge in this are only scratched the surface!
5	The importance of water and soil. For example, how the MAP rate can manage the depth of secondary minerals in a profile, according to the leaching depth and of course, the texture and structure.
6	I like the huge pit we went to and saw all of the gypsum crystals and that is where I understood slickensides a little better and that they are very fascinating.
7	The processes of the eluvial horizons with the illuvial horizons and how minerals go from solutions to solids, like gypsum we saw on the field trips.
8	The most interesting fact I learned in Soils 444/644 is the couplet presence of E and Bt horizon. The leaching activity removes materials from the upper soil profile with percolating water, when the wetting front stops minerals are deposited and accumulate to forma a Bt horizon.
9	I have learned and found most interesting the different clay structures. Their different structures have such an impact on engineering and edaphic purposes. It's amazing to me that something as small as an ion can have such a huge impact.
10	The most interesting thing I learned was how to use chemical and physical data to distinguish soil orders and horizons. I have always been a "see a picture" not a numbers guy and this showed me how important the numbers are.
11	I find the relationship between soils and plants (edaphic properties) very interesting. Even the way plants affect soil properties whether by root channels or in the release of organic acids from leaf litter decomposition.
12	The subordinate distinctions really improved my ability to read and interpret information on soils.
13	One of the most interesting facts I learned in Soils 644 is that a very well leached profile is not necessarily indicative of a well drained soil series.
14	The effect of pH on a soil.
15	Graveyards are on the high ground-so sandier.
16	I learned that soils are much more complicated than recently thought. What minerals are present before and during development play a tremendous role on what type of soil will develop, and climate can either inhibit or help that development.
17	Trick question-Nothing I learned in this class was trivial and I will apply everything I learned in this class to further develop my understanding of soils.
18	There are lots of interesting things I learned, what comes to mind now is CEC and the isomorphic substitution that used and different between 2:1 and 1:1 clays.
19	That eventually a "kick ass" cambic will become a weak argillic as time marches on.
20	pH was the most important soil property.

SOIL 480/680 – Soils and Pollution – Frank Casey

Course Objective:

The objective of this class is to provide an overview of pollution's interactions with soil and water. Basic understanding of the physical, chemical and organic characteristics of soil that

influence the fate and transport of pollutants are first formed, and then concepts are applied to the "real world." The focus of this course is on the physical and chemical processes, and the description of these processes mathematically. At times, computers were used (mainly advanced spreadsheet calculations) to understand and predict pollution fate and transport. This course is meant for upper–level undergraduates and graduates who wish to have a background in pollution fate and transport.

Class Background Information

The student composition for this class was very diverse and challenging to teach. There were four BS students with Soils as their major or co-major, ten MS students (3 civil engineering, 4 NRM, 1 Range, 2 Soil), and two PhD with Soils as their major. The difficulty of this course is to make sure you challenge all of the students even when you have MS and PhD, with majors that range from CE to Range.

What Did You Do?

A pre-test and post-test were provided to the students to see whether the course objectives were achieved. The test consisted of nine questions on basic soils, soil physics, and on pollution fate and transport. I've learned from previous assessments that conceptual and quantitative questions were the best way to instill knowledge in students. The questions that I asked in the pre- and post-test were mainly conceptual and quantitative in nature.

My course webpage is integral to my teaching and conveying information to the students. Students can download notes, assignments, exam guides, background information, and spreadsheets that I created in class. I also would provide assignment, quiz, and exam solutions on this course webpage. On this webpage I provide "Feedback form" that allows the students to provide me anonymous information (Fig. 1). I encouraged the students to ask question about topics they did not understand and use this feedback form to address these topics. Students did take advantage of this feedback form (See attached emails), but used it mainly as a means to provide suggestions and evaluations about the course. The anonymous e-mails were useful to me to make adjustments according to student comments.

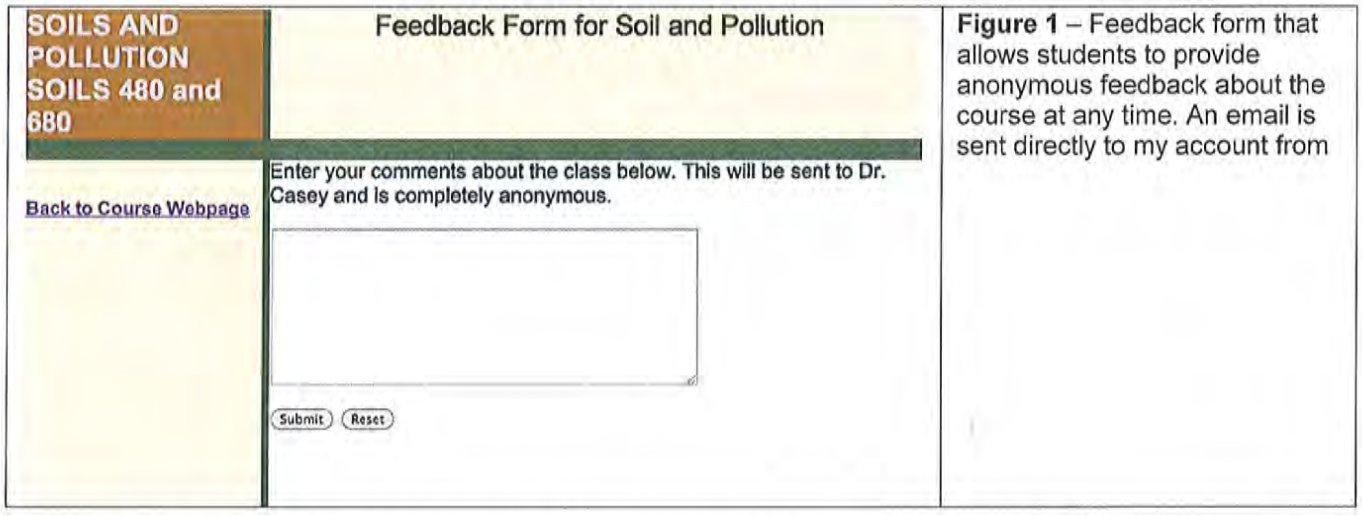


Figure 1 – Feedback form that allows students to provide anonymous feedback about the course at any time. An email is sent directly to my account from

Below are the e-mails that were sent to me this semester via the course feedback form.

Date: May 4, 2011 7:48:20 PM CDT
To: "Casey, Francis" <Francis.Casey@ndsu.edu>
Subject: WWW Form Submission
Below is the result of your feedback form. It was submitted by
() on Wednesday, May 4, 2011 at 19:48:20
Body: I forgot to put on my course eval form that I liked the timing and workload of the assignments, quizes, exams, and final project.
Submit: Submit
From: 480_680_student@ndsu.nodak.edu

Date: April 5, 2011 8:42:09 AM CDT
To: "Casey, Francis" <Francis.Casey@ndsu.edu>
Subject: WWW Form Submission
Below is the result of your feedback form. It was submitted by
() on Tuesday, April 5, 2011 at 08:42:09
Body: When the quiz/test is given, it would be helpful to know how many points each question is worth. This will allow the student to know how much detail is required of each question.
Submit: Submit
From: 480_680_student@ndsu.nodak.edu

Date: March 31, 2011 6:58:32 PM CDT
To: "Casey, Francis" <Francis.Casey@ndsu.edu>
Subject: WWW Form Submission
Below is the result of your feedback form. It was submitted by
() on Thursday, March 31, 2011 at 18:58:32
Body: Can you please post a study guide for exam II? If so, can you do it so we can study over the weekend? Gracias
Submit: Submit
From: 480_680_student@ndsu.nodak.edu

Date: March 28, 2011 1:35:19 PM CDT
To: "Casey, Francis" <Francis.Casey@ndsu.edu>
Subject: WWW Form Submission
Below is the result of your feedback form. It was submitted by
() on Monday, March 28, 2011 at 13:35:19
Body: I've been working on the last problem from Thursday's class and am confused about where some of the numbers came from. Would it be possible to review the problem briefly at the beginning of Tuesday's class?
Submit: Submit
From: 480_680_student@ndsu.nodak.edu

Date: February 23, 2011 8:48:23 AM CST
To: "Casey, Francis" <Francis.Casey@ndsu.edu>
Subject: WWW Form Submission
Below is the result of your feedback form. It was submitted by
() on Wednesday, February 23, 2011 at 08:48:23
Body: Hello Dr. Casey, This is not an anonymous e-mail - this is Eva Sebesta from class. Would you have a couple of minutes after class to go over water potentials quick, plus I have another point? If tomorrow doesn't work, I can meet with you sometime next week. I promise to get this confounded Blackboard figured out to, so I can e-mail more directly. Thanks! Eva :)
Submit: Submit
From: 480_680_student@ndsu.nodak.edu

Date: February 9, 2011 9:02:00 AM CST
To: "Casey, Francis" <Francis.Casey@ndsu.edu>
Subject: WWW Form Submission
Below is the result of your feedback form. It was submitted by
() on Wednesday, February 9, 2011 at 09:02:00
Body: Can we please get our homework back before we take quizzes? Thank you -
Submit: Submit
From: 480_680_student@ndsu.nodak.edu

Results from the Pre- and Post-Test

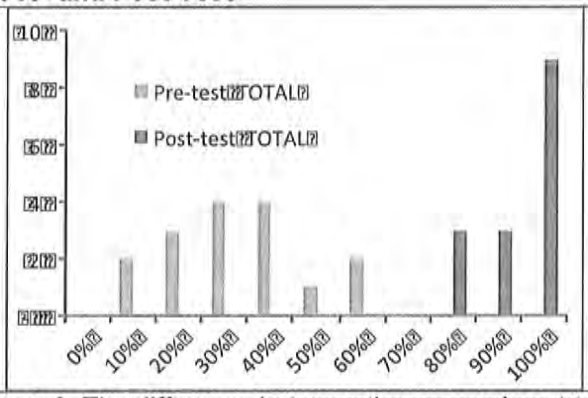


Figure 2. The difference between the pre- and post-test

	Pre-test	Post-test
Mean	0.28	0.90
Std Dev	0.15	0.09
Std Err Mean	0.04	0.02
Upper 95% Mean	0.36	0.95
Lower 95% Mean	0.21	0.85
N	16	16

What Did You Learn?

The difference between the pre- and post-tests were indicative of a shifting population. The students were able to gain information acquired in the class and achieve the objectives that I set out to achieve in this class.

T-test was run for each of the question comparing the pre-test and post-test. All question responses were significantly different between the pre- and post-tests.

Questions 5 and 9 were the ones that the students performed worst in for the post-test. Question 5 was material that I covered later in the semester and I covered hastily. At the end of the semester, I needed to save time for student presentations. Question 9 was material that I presented earlier in the semester and the students had not reviewed the material in some time.

Questions 6 and 7 had the greatest separation in the student performance between pre- and post-tests.

What Will Be Done Differently As A Result Of What Was Learned?

Identified Problem 1: Covering material in haste.
Solution: A solution to this problem is to have the graduate students make their presentations outside of class if there are many graduate students.

Identified Problem 2: Material presented earlier in the semester is not retained as good as the other material.
Solution: Review topics throughout the semester that had been introduced early in the semester.

Other Outcomes: I am proud of the fact that I am able to teach the material to the whole class. There was no statistical difference in the assessment between the graduate and undergraduate students. However, I am afraid that with such a diverse pool of students I am challenging to some but not challenging to others. The only solution I see to this issue is to split the graduate and undergraduate students and teach the graduate students at a more rigorous level.

Additionally, I felt that the CE students' math skills were a great advantage to them. I do not see a solution to this issue unless I put more math prerequisites on the course, and I hesitate to do this.

Also attached are the following:
Examples of pre- and post- test from the students with the highest and lowest grades
Statistical analysis of the questions

Pretest -High grade student

SOILS 480/680 ASSESSMENT 2011

1. **Define the following**
   a. **Soil structure** – Building blocks, how the particles are arranged held together/situated
   b. **Soil Texture** – Particle size Analysis, % Sand, Silt, Clay – Most Important
   c. **Sorption**

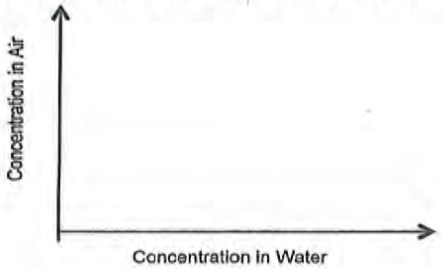
2. **Where do ultisols occur in the United States and why?**
   Ultisols would likely occur in SE USA, humid warm tending to intense weathering/leaching

3. **Write down Darcy's equation, explain each term in the equation, and provide units for each term?**
   $Q = -K \frac{\Delta H}{L} \cdot A$
   Flow (cm^3/s)
   K = Hyd. Cond. (cm/s)
   ΔH = Change Head (cm)
   A = Cross sec. area (cm^2)

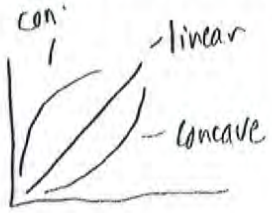
4. **What are the three steps of raindrop impact and how can it lead to facilitating runoff and suspended transport?**
   – Impact ?, – contact ?

5. **You made 30 soil mercury measurements. You first determine the population distribution before applying any statistics. What statistical graph do you use to determine the population distribution? The population is not a symmetric, bell-shape curve, but skewed to the left. What should you do to your data before you apply any normal statistics?**

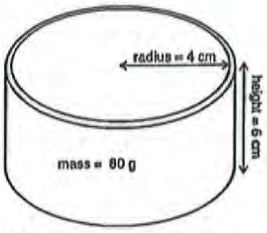
6. **Henry's law describes water and air concentrations of a volatile compound at equilibrium. Write the equation for Henry's law relating its water concentrations to its vapor concentration. Also, draw an example figure below relating the water and air concentrations of a hypothetical compound.**



7. Draw (i) a linear, (ii) a convex, and (iii) a concave sorption isotherms, with appropriate labels and units on the axis. Also, show the mathematical expression for a Fruendlich isotherm and how this equation relates to the linear, convex and concave isotherms.



8. The core depicted in the diagram was used to take a field soil sample. The mass of the wet soil sample and core together was 592.71g. This sample was then oven-dried and the dry soil plus core mass was 508.26 g. Calculate the following:
   a. Bulk Density
   b. Porosity
   c. Volumetric water content



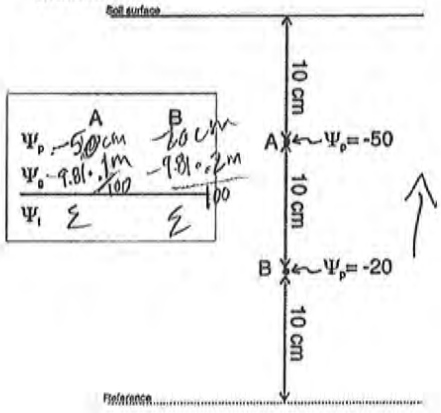
$\frac{M_s}{V_t} = \frac{508.76 - 80}{\pi \cdot 4^2 \cdot 6} = 1.429\ g/cm^3 = \rho_b$

$f = \frac{V_v}{V_t} =$ If $\rho_p = 2.65\ g/cm^3$, $f = 1 - \frac{1.42}{2.65} =$

$\theta_v = \frac{V_w}{V_t} = \frac{592.71 - 508.26}{\pi \cdot 4^2 \cdot 6} =$ $\frac{cm^3}{cm^3}$

9. Fill in the blanks in the box for pressure (ψ_p), gravitational (ψ_g), and total potential (ψ_t) for the situation below. Indicate the flow direction between A and B.

Unsaturated



P

Pretest -Low grade student

SOILS 480/680 ASSESSMENT 2011

1. Define the following
   a. Soil structure - How the soil is composed in terms of horizons and the shape each horizon takes; blocky, prismatic, granual, ect.
   b. Soil Texture - the amount of clay, sand & loam is in a soil. Different textures have different names, clay - loam, sandy - loam, loam, ect.
   c. Sorption

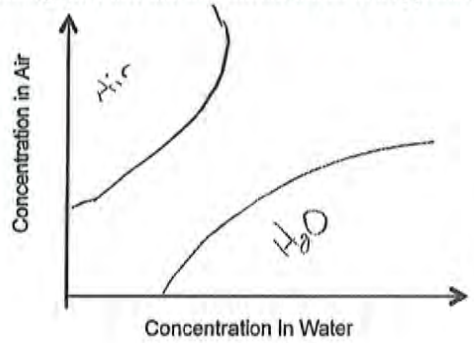
2. Where do ultisols occur in the United States and why?
   Northwest area? Due to wet climates combined with warm temperatures.

3. Write down Darcy's equation, explain each term in the equation, and provide units for each term?

4. What are the three steps of raindrop impact and how can it lead to facilitating runoff and suspended transport?

5. You made 30 soil mercury measurements. You first determine the population distribution before applying any statistics. What statistical graph do you use to determine the population distribution? The population is not a symmetric, bell-shape curve, but skewed to the left. What should you do to your data before you apply any normal statistics? You should use a histograph.
   I'm not sure.

6. Henry's law describes water and air concentrations of a volatile compound at equilibrium. Write the equation for Henry's law relating its water concentrations to its vapor concentration. Also, draw an example figure below relating the water and air concentrations of a hypothetical compound.



7. Draw (i) a linear, (ii) a convex, and (iii) a concave sorption isotherms, with appropriate labels and units on the axis. Also, show the mathematical expression for a Fruendlich isotherm and how this equation relates to the linear, convex and concave isotherms.

i) 

ii) 

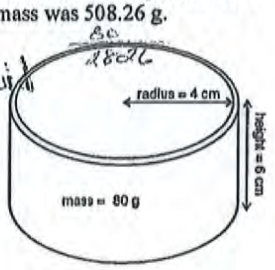
iii) 

?

8. The core depicted in the diagram was used to take a field soil sample. The mass of the wet soil sample and core together was 592.71g. This sample was then oven-dried and the dry soil plus core mass was 508.26 g. Calculate the following:
   a. Bulk Density
   b. Porosity
   c. Volumetric water content

$m_1 - 80 = 512.71$

$m_2 - 80 = 428.26$ dry soil



a. $BD = (soil)(\pi r^2)(h)$

$= (428.26)(6\,cm)(16\pi)$

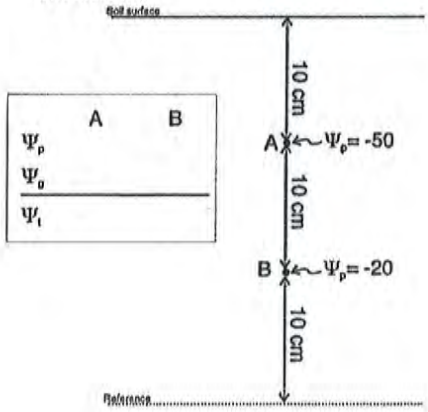
b. Porosity $= (BD)(100\%)$?

?

c. ?

9. Fill in the blanks in the box for pressure (ψ_p), gravitational (ψ_g), and total potential (ψ_t) for the situation below. Indicate the flow direction between A and B.

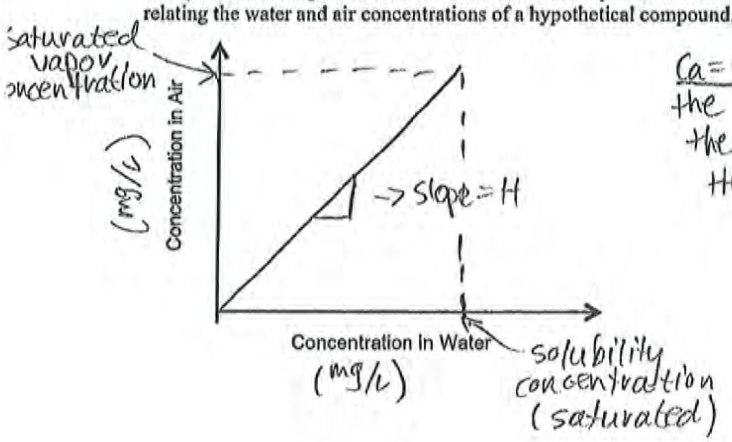
Unsaturated



Post-test -High grade student

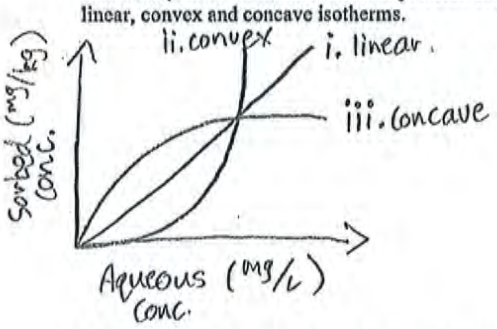
SOILS 480/680 ASSESSMENT 2011

1. Define the following
   a. Soil structure – Soil structure describes how the soil particles are massively arranged & held together as larger units found in the field.
   b. Soil Texture – Soil texture describes the particle size distribution of a soil & % of sand, silt, & clay in the soil.
   c. Sorption – Sorption is the general term for a solute attaching to a soil particles & can consist of both adsorption & absorption.
2. Where do ultisols occur in the United States and why?
   Ultisols generally are predominant in the southeast where more precipitation in the form of rainfall falls & the climate is humid leading to excessively leached & developed soils in that area.
3. Write down Darcy's equation, explain each term in the equation, and provide units for each term?
   Darcy's law: $Q = K \cdot A \cdot \frac{\Psi_p}{L}$ or $q = K \cdot \frac{\Psi_p}{L}$: In these equations, Q = flow (cm^3/min, m^3/sec, ect.), q = darcian flux (cm/min, m/sec, ect.), K = hydraulic conductivity (cm/hr, cm/min, ect.), & Ψ_p/L = the hydraulic gradient (cm/cm, m/m, ect.). within the hydraulic gradient, Ψ_p = the change in potential & L = the length. Additionally, A = cross sectional area (cm^2, etc.)
4. What are the three steps of raindrop impact and how can it lead to facilitating runoff and suspended transport?
   The three steps of raindrop impact are dislodging, transport, & deposition. First, raindrop impact can lead to soil particles dislodging which can contribute to formation of a surface seal. this leads to increased runoff in which disloged sediments may be transported as a suspended load. When runoff decreases due to surface slope or reaches a water body, the suspended particles may then be deposited due to decreased water energy.
5. You made 30 soil mercury measurements. You first determine the population distribution before applying any statistics. What statistical graph do you use to determine the population distribution? The population is not a symmetric, bell-shape curve, but skewed to the left. What should you do to your data before you apply any normal statistics? First, you would plot the measurements in a histogram from which the skew in the data would become visible. Before applying normal statistics, tranformations would have to be applied to the data to decrease the skew. Transformations may include squaring, exp., etc.
6. Henry's law describes water and air concentrations of a volatile compound at equilibrium. Write the equation for Henry's law relating its water concentrations to its vapor concentration. Also, draw an example figure below relating the water and air concentrations of a hypothetical compound.



$\frac{C_a = H \cdot C_w}{}$ where C_a = Concen. in the air (mg/L), C_w = concen. in the water (mg/L), & H = Henry's const.

7. Draw (i) a linear, (ii) a convex, and (iii) a concave sorption isotherms, with appropriate labels and units on the axis. Also, show the mathematical expression for a Fruendlich isotherm and how this equation relates to the linear, convex and concave isotherms.



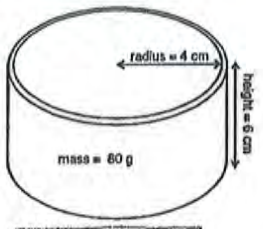
$S = C^N \cdot K_d$

Sorbed conc. (mg/kg) ↑ aqueous conc. (mg/L) ↑ (K_d L/kg) ↑

For the different isotherms, the different shapes are described by different N values in the eqs. above.

$N=1$: linear isotherm
$N>1$: convex "
$N<1$: concave "

8. The core depicted in the diagram was used to take a field soil sample. The mass of the wet soil sample and core together was 592.71g. This sample was then oven-dried and the dry soil plus core mass was 508.26 g. Calculate the following:
   a. Bulk Density
   b. Porosity
   c. Volumetric water content



$Vol. = \pi \cdot 4^2 \cdot 6 = 301.6\ cm^3$

a) $\rho_b = \frac{M_s}{V_t} = \frac{508.26 - 80\ g}{301.6\ cm^3} = \boxed{1.42\ g/cm^3 = \rho_b}$

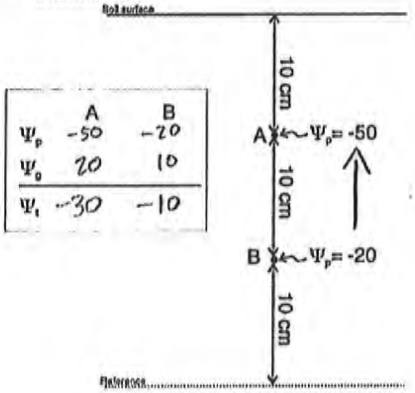
b) Assume $\rho_p = 2.65\ g/cm^3$ $f = 1 - \frac{\rho_b}{\rho_s} = 1 - \frac{1.42\ g/cm^3}{2.65\ g/cm^3} = \boxed{0.464 = f}$

c) $\theta_v = \frac{V_w}{V_t} = \frac{84.45\ cm^3}{301.6\ cm^3} = \boxed{0.28\ cm^3/cm^3 = \theta_v}$

$592.71 - 508.26 = 84.45\ g\ H_2O \cdot \frac{1\ cm^3}{1\ g} = 84.45\ cm^3\ H_2O$

9. Fill in the blanks in the box for pressure (ψ_p), gravitational (ψ_g), and total potential (ψ_t) for the situation below. Indicate the flow direction between A and B.

Unsaturated



	A	B
Ψ_p	-50	-20
Ψ_g	20	10
Ψ_t	-30	-10

$\Psi_t = \Psi_A - \Psi_B = -30 + (+10) = \boxed{-20\ cm}$

Indicates flow direction is B -> A (High to low potential)

Post-test - Low grade student

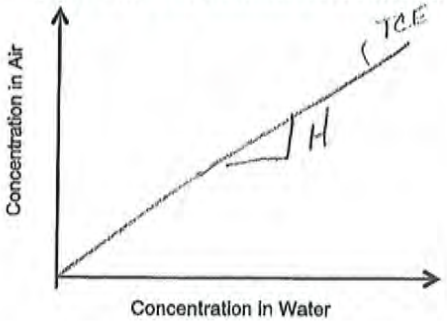
SOILS 480/680 ASSESSMENT 2011

1. Define the following
   a. Soil structure - how the soil aggregates are put together.
   b. Soil Texture - % of clay, silt and sand in a soil.
   c. Sorption – the general transfer between aqueous + solid phases as a whole.
2. Where do ultisols occur in the United States and why?
   The Southeast because of the extensive moisture, ↑ humidity + little change in climate overall.
3. Write down Darcy's equation, explain each term in the equation, and provide units for each term?

$$Q = AK\frac{\Delta\Psi_t}{L} \longrightarrow q = K\frac{\Delta H}{L}$$

q is the hydraulic flux, $\Delta\Psi_t$ is the change in total potential, L is the height, K is the hydraulic conductivity

4. What are the three steps of raindrop impact and how can it lead to facilitating runoff and suspended transport?
   1) Raindrop impacts surface breaking up aggregates
   2) Forms layer of H_2O which leads to lateral flow
   3) The lateral flow carries the broken aggregates to a new location
5. You made 30 soil mercury measurements. You first determine the population distribution before applying any statistics. What statistical graph do you use to determine the population distribution? The population is not a symmetric, bell-shape curve, but skewed to the left. What should you do to your data before you apply any normal statistics? Histograph.
   Find a confidence interval
6. Henry's law describes water and air concentrations of a volatile compound at equilibrium. Write the equation for Henry's law relating its water concentrations to its vapor concentration. Also, draw an example figure below relating the water and air concentrations of a hypothetical compound.



$C_a = HC_w$

H = slope

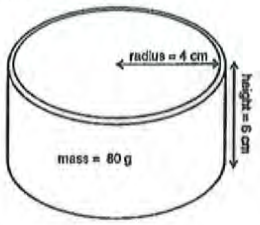
intercept = 0

7. Draw (i) a linear, (ii) a convex, and (iii) a concave sorption isotherms, with appropriate labels and units on the axis. Also, show the mathematical expression for a Fruendlich isotherm and how this equation relates to the linear, convex and concave isotherms.

8. The core depicted in the diagram was used to take a field soil sample. The mass of the wet soil sample and core together was 592.71g. This sample was then oven-dried and the dry soil plus core mass was 508.26 g.
Calculate the following:
   a. Bulk Density
   b. Porosity
   c. Volumetric water content

$m_t = 512.71g$

$m_s = 428.26g$



$V_T = \pi(16)(6) = 301.59\ cm^3$

a) $\rho_b = m_t / V_T \rightarrow \rho_b = 1.70 g/cm^3$

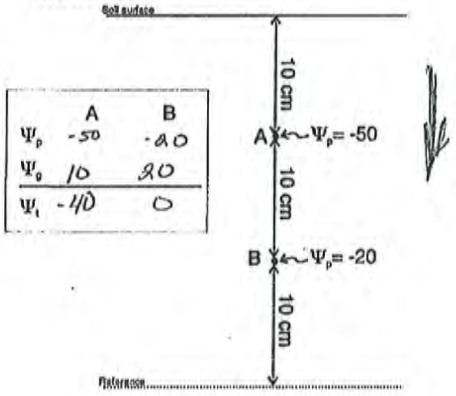
b) $f = 1 - \frac{1.70}{2.65} \rightarrow f = 35.8\%$

c) $\theta_v = \rho_b \theta_g$ $\quad \theta_g = m_l / m_s$

$\theta_v = 2.04 g/cm^3$

9. Fill in the blanks in the box for pressure (ψ_p), gravitational (ψ_g), and total potential (ψ_t) for the situation below. Indicate the flow direction between A and B.

Unsaturated

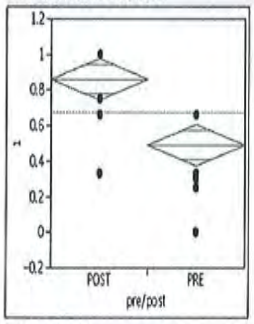


	A	B
Ψ_p	-50	-20
Ψ_g	10	20
Ψ_t	-40	0

Statistical analysis of the pre- and post-test analyzing between pre and post test and between grad and undergraduate students

Fit Y by X Group

Oneway Analysis of 1 By pre/post



Oneway Anova

Summary of Fit

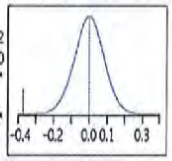
Rsquare	0.411198
Adj Rsquare	0.391571
Root Mean Square Error	0.22825
Mean of Response	0.672813
Observations (or Sum Wgts)	32

t Test

PRE-POST

Assuming equal variances

Difference	-0.36938	t Ratio	-4.57722
Std Err Dif	0.08070	DF	30
Upper CL Dif	-0.20457	Prob > |t|	<.0001*
Lower CL Dif	-0.53418	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*



Analysis of Variance

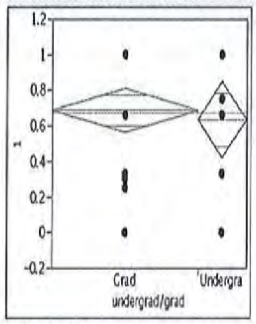
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	1.0915031	1.09150	20.9509	<.0001*
Error	30	1.5629437	0.05210		
C. Total	31	2.6544469			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.857500	0.05706	0.74096	0.97404
PRE	16	0.488125	0.05706	0.37159	0.60466

Std Error uses a pooled estimate of error variance

Oneway Analysis of 1 By undergrad/grad



Oneway Anova

Summary of Fit

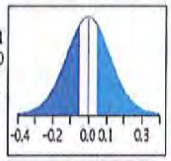
Rsquare	0.006132
Adj Rsquare	-0.027
Root Mean Square Error	0.296545
Mean of Response	0.672813
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Assuming equal variances

Difference	-0.05208	t Ratio	-0.43021
Std Err Dif	0.12106	DF	30
Upper CL Dif	0.19516	Prob > |t|	0.6701
Lower CL Dif	-0.29933	Prob > t	0.6649
Confidence	0.95	Prob < t	0.3351



Analysis of Variance

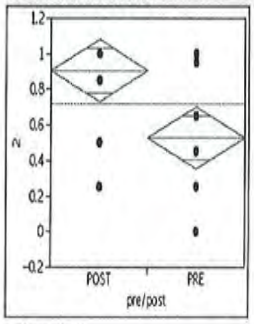
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.0162760	0.016276	0.1851	0.6701
Error	30	2.6381708	0.087939		
C. Total	31	2.6544469			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.685833	0.06053	0.56221	0.80946
Undergrad	8	0.633750	0.10484	0.41963	0.84787

Std Error uses a pooled estimate of error variance

Oneway Analysis of 2 By pre/post



Oneway Anova

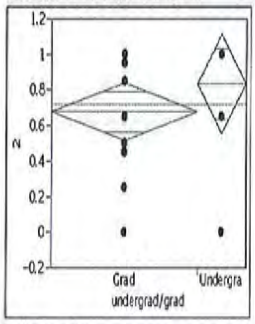
Summary of Fit

Rsquare	0.245658
Adj Rsquare	0.220514
Root Mean Square Error	0.342167
Mean of Response	0.714063
Observations (or Sum Wgts)	32

t Test

PRE-POST

Oneway Analysis of 2 By undergrad/grad



Oneway Anova

Summary of Fit

Rsquare	0.03146
Adj Rsquare	-0.00082
Root Mean Square Error	0.387715
Mean of Response	0.714063
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Fit Y by X Group

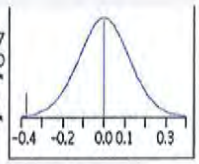
Oneway Analysis of 2 By pre/post

Oneway Anova

t Test

Assuming equal variances

Difference	-0.37813	t Ratio	-3.12567
Std Err Dif	0.12097	DF	30
Upper CL Dif	-0.13106	Prob > |t|	0.0039*
Lower CL Dif	-0.62519	Prob > t	0.9980
Confidence	0.95	Prob < t	0.0020*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	1.1438281	1.14383	9.7698	0.0039*
Error	30	3.5123437	0.11708		
C. Total	31	4.6561719			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.903125	0.08554	0.72843	1.0778
PRE	16	0.525000	0.08554	0.35030	0.6997

Std Error uses a pooled estimate of error variance

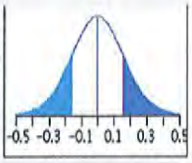
Oneway Analysis of 2 By undergrad/grad

Oneway Anova

t Test

Assuming equal variances

Difference	0.15625	t Ratio	0.98715
Std Err Dif	0.15828	DF	30
Upper CL Dif	0.47951	Prob > |t|	0.3315
Lower CL Dif	-0.16701	Prob > t	0.1657
Confidence	0.95	Prob < t	0.8343



Analysis of Variance

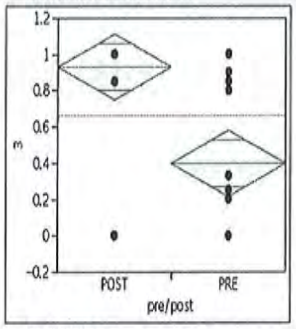
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.1464844	0.146484	0.9745	0.3315
Error	30	4.5096875	0.150323		
C. Total	31	4.6561719			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.675000	0.07914	0.51337	0.8366
Undergrad	8	0.831250	0.13708	0.55130	1.1112

Std Error uses a pooled estimate of error variance

Oneway Analysis of 3 By pre/post



Oneway Anova

Summary of Fit

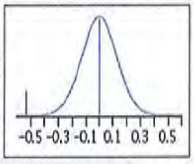
Rsquare	0.372617
Adj Rsquare	0.351704
Root Mean Square Error	0.356812
Mean of Response	0.661875
Observations (or Sum Wgts)	32

t Test

PRE-POST

Assuming equal variances

Difference	-0.53250	t Ratio	-4.2211
Std Err Dif	0.12615	DF	30
Upper CL Dif	-0.27486	Prob > |t|	0.0002*
Lower CL Dif	-0.79014	Prob > t	0.9999
Confidence	0.95	Prob < t	0.0001*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	2.2684500	2.26845	17.8177	0.0002*
Error	30	3.8194375	0.12731		
C. Total	31	6.0878875			

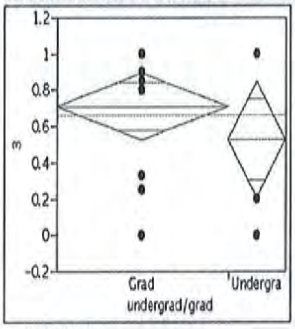
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.928125	0.08920	0.74595	1.1103
PRE	16	0.395625	0.08920	0.21345	0.5778

Std Error uses a pooled estimate of error variance

Oneway Analysis of 4 By pre/post

Oneway Analysis of 3 By undergrad/grad



Oneway Anova

Summary of Fit

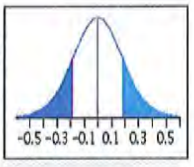
Rsquare	0.032825
Adj Rsquare	0.000586
Root Mean Square Error	0.443022
Mean of Response	0.661875
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Assuming equal variances

Difference	-0.18250	t Ratio	-1.00905
Std Err Dif	0.18086	DF	30
Upper CL Dif	0.18687	Prob > |t|	0.3210
Lower CL Dif	-0.55187	Prob > t	0.8395
Confidence	0.95	Prob < t	0.1605



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.1998375	0.199838	1.0182	0.3210
Error	30	5.8880500	0.196268		
C. Total	31	6.0878875			

Means for Oneway Anova

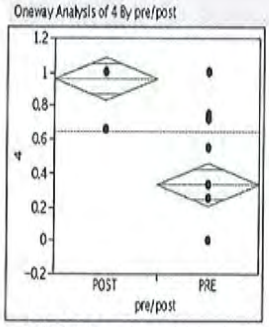
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.707500	0.09043	0.52281	0.89219
Undergrad	8	0.525000	0.15663	0.20512	0.84488

Std Error uses a pooled estimate of error variance

Oneway Analysis of 4 By undergrad/grad

Fit Y by X Group

Oneway Analysis of 4 By pre/post



Oneway Anova

Summary of Fit

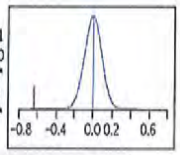
Rsquare	0.628339
Adj Rsquare	0.615951
Root Mean Square Error	0.249712
Mean of Response	0.643125
Observations (or Sum Wgts)	32

t Test

PRE-POST

Assuming equal variances

Difference	-0.62875	t Ratio	-7.12171
Std Err Dif	0.08829	DF	30
Upper CL Dif	-0.44845	Prob > |t|	<.0001*
Lower CL Dif	-0.80905	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*



Analysis of Variance

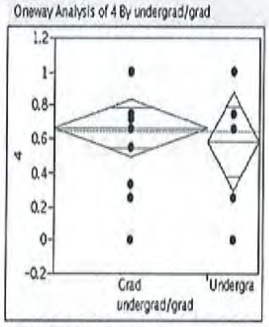
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	3.1626125	3.16261	50.7188	<.0001*
Error	30	1.8706750	0.06236		
C. Total	31	5.0332875			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.957500	0.06243	0.83001	1.0850
PRE	16	0.328750	0.06243	0.20126	0.4562

Std Error uses a pooled estimate of error variance

Oneway Analysis of 4 By undergrad/grad



Oneway Anova

Summary of Fit

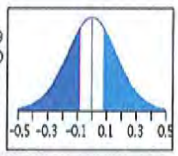
Rsquare	0.007789
Adj Rsquare	-0.02528
Root Mean Square Error	0.408007
Mean of Response	0.643125
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Assuming equal variances

Difference	-0.05083	t Ratio	-0.48529
Std Err Dif	0.10657	DF	30
Upper CL Dif	0.25934	Prob > |t|	0.6310
Lower CL Dif	-0.42101	Prob > t	0.6845
Confidence	0.95	Prob < t	0.3155



Analysis of Variance

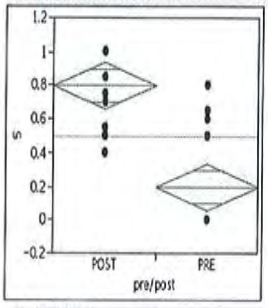
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.0392042	0.039204	0.2355	0.6310
Error	30	4.9940833	0.166469		
C. Total	31	5.0332875			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.663333	0.08328	0.49324	0.83342
Undergrad	8	0.582500	0.14425	0.28790	0.87710

Std Error uses a pooled estimate of error variance

Oneway Analysis of 5 By pre/post



Oneway Anova

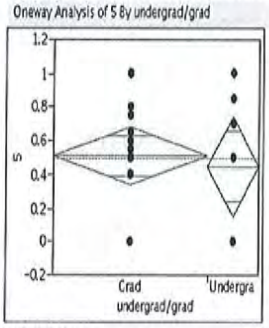
Summary of Fit

Rsquare	0.568314
Adj Rsquare	0.553924
Root Mean Square Error	0.271445
Mean of Response	0.492188
Observations (or Sum Wgts)	32

t Test

PRE-POST

Oneway Analysis of 5 By undergrad/grad



Oneway Anova

Summary of Fit

Rsquare	0.004887
Adj Rsquare	-0.02828
Root Mean Square Error	0.412129
Mean of Response	0.492188
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Fit Y by X Group

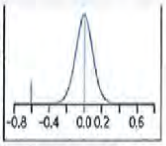
Oneway Analysis of 5 By pre/post

Oneway Anova

t Test

Assuming equal variances

Difference	-0.60313	t Ratio	-6.2845
Std Err Dif	0.09597	DF	30
Upper CL Dif	-0.40713	Prob > |t|	<.0001*
Lower CL Dif	-0.79912	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	2.9100781	2.91008	39.4949	<.0001*
Error	30	2.2104688	0.07368		
C. Total	31	5.1205469			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.793750	0.06786	0.65516	0.93234
PRE	16	0.190625	0.06786	0.05203	0.32922

Std Error uses a pooled estimate of error variance

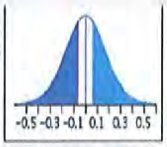
Oneway Analysis of 5 By undergrad/grad

Oneway Anova

t Test

Assuming equal variances

Difference	-0.06458	t Ratio	-0.38385
Std Err Dif	0.16825	DF	30
Upper CL Dif	0.27903	Prob > |t|	0.7038
Lower CL Dif	-0.40820	Prob > t	0.6481
Confidence	0.95	Prob < t	0.3519



Analysis of Variance

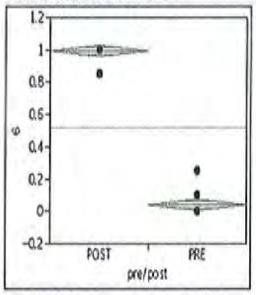
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.0250260	0.025026	0.1473	0.7038
Error	30	5.0955208	0.169851		
C. Total	31	5.1205469			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.508333	0.08413	0.33653	0.68014
Undergrad	8	0.443750	0.14571	0.14617	0.74133

Std Error uses a pooled estimate of error variance

Oneway Analysis of 6 By pre/post



Oneway Anova

Summary of Fit

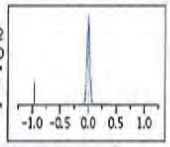
Rsquare	0.98195
Adj Rsquare	0.981348
Root Mean Square Error	0.066732
Mean of Response	0.514063
Observations (or Sum Wgts)	32

t Test

PRE-POST

Assuming equal variances

Difference	-0.9531	t Ratio	-40.3982
Std Err Dif	0.0236	DF	30
Upper CL Dif	-0.9049	Prob > |t|	0.0000*
Lower CL Dif	-1.0013	Prob > t	1.0000
Confidence	0.95	Prob < t	0.0000*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	7.2675781	7.26758	1632.018	<.0001*
Error	30	0.1335937	0.00445		
C. Total	31	7.4011719			

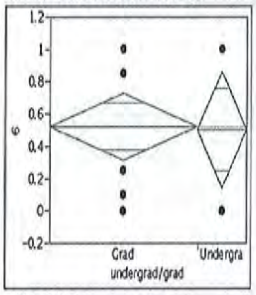
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.990625	0.01668	0.95655	1.0247
PRE	16	0.037500	0.01668	0.00343	0.0716

Std Error uses a pooled estimate of error variance

Oneway Analysis of 7 By pre/post

Oneway Analysis of 6 By undergrad/grad



Oneway Anova

Summary of Fit

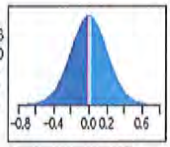
Rsquare	0.000285
Adj Rsquare	-0.03304
Root Mean Square Error	0.496624
Mean of Response	0.514063
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Assuming equal variances

Difference	-0.01875	t Ratio	-0.09246
Std Err Dif	0.20275	DF	30
Upper CL Dif	0.39531	Prob > |t|	0.9269
Lower CL Dif	-0.43281	Prob > t	0.5365
Confidence	0.95	Prob < t	0.4635



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.0021094	0.002109	0.0086	0.9269
Error	30	7.3990625	0.246635		
C. Total	31	7.4011719			

Means for Oneway Anova

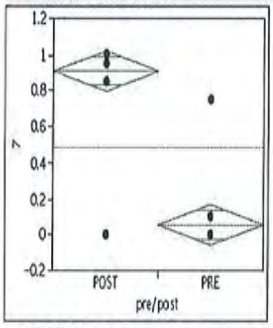
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.518750	0.10137	0.31172	0.72578
Undergrad	8	0.500000	0.17558	0.14141	0.85859

Std Error uses a pooled estimate of error variance

Oneway Analysis of 7 By undergrad/grad

Fit Y by X Group

Oneway Analysis of 7 By pre/post



Oneway Anova

Summary of Fit

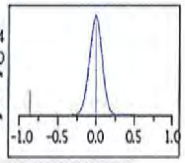
Rsquare	0.799882
Adj Rsquare	0.793211
Root Mean Square Error	0.220357
Mean of Response	0.479688
Observations (or Sum Wgts)	32

t Test

PRE-POST

Assuming equal variances

Difference	-0.8531	t Ratio	-10.9504
Std Err Dif	0.0779	DF	30
Upper CL Dif	-0.6940	Prob > |t|	<.0001*
Lower CL Dif	-1.0122	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*



Analysis of Variance

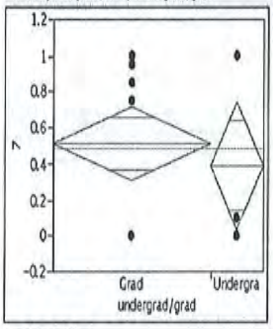
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	5.8225781	5.82258	119.9115	<.0001*
Error	30	1.4567187	0.04856		
C. Total	31	7.2792969			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.906250	0.05509	0.7937	1.0188
PRE	16	0.053125	0.05509	-0.0594	0.1656

Std Error uses a pooled estimate of error variance

Oneway Analysis of 7 By undergrad/grad



Oneway Anova

Summary of Fit

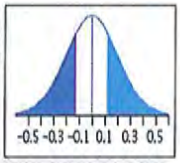
Rsquare	0.012453
Adj Rsquare	-0.02046
Root Mean Square Error	0.489512
Mean of Response	0.479688
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Assuming equal variances

Difference	-0.12292	t Ratio	-0.61507
Std Err Dif	0.19984	DF	30
Upper CL Dif	0.28522	Prob > |t|	0.5431
Lower CL Dif	-0.53105	Prob > t	0.7284
Confidence	0.95	Prob < t	0.2716



Analysis of Variance

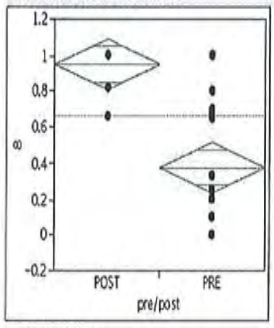
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.0906510	0.090651	0.3783	0.5431
Error	30	7.1886458	0.239622		
C. Total	31	7.2792969			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.510417	0.09992	0.30635	0.71448
Undergrad	8	0.387500	0.17307	0.03405	0.74095

Std Error uses a pooled estimate of error variance

Oneway Analysis of 8 By pre/post



Oneway Anova

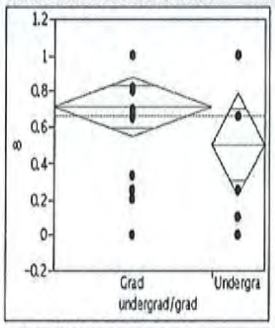
Summary of Fit

Rsquare	0.535425
Adj Rsquare	0.519939
Root Mean Square Error	0.276286
Mean of Response	0.659063
Observations (or Sum Wgts)	32

t Test

PRE-POST

Oneway Analysis of 8 By undergrad/grad



Oneway Anova

Summary of Fit

Rsquare	0.053893
Adj Rsquare	0.022356
Root Mean Square Error	0.394277
Mean of Response	0.659063
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Fit Y by X Group

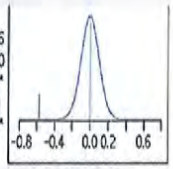
Oneway Analysis of 8 By pre/post

Oneway Anova

t Test

Assuming equal variances

Difference	-0.57438	t Ratio	-5.88006
Std Err Dif	0.09768	DF	30
Upper CL Dif	-0.37488	Prob > |t|	<.0001*
Lower CL Dif	-0.77387	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	2.6392531	2.63925	34.5751	<.0001*
Error	30	2.2900188	0.07633		
C. Total	31	4.9292719			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.946250	0.06907	0.80519	1.0873
PRE	16	0.371875	0.06907	0.23081	0.5129

Std Error uses a pooled estimate of error variance

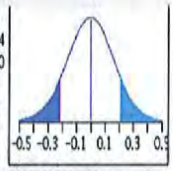
Oneway Analysis of 8 By undergrad/grad

Oneway Anova

t Test

Assuming equal variances

Difference	-0.21042	t Ratio	-1.30724
Std Err Dif	0.16096	DF	30
Upper CL Dif	0.11831	Prob > |t|	0.2011
Lower CL Dif	-0.53915	Prob > t	0.8995
Confidence	0.95	Prob < t	0.1005



Analysis of Variance

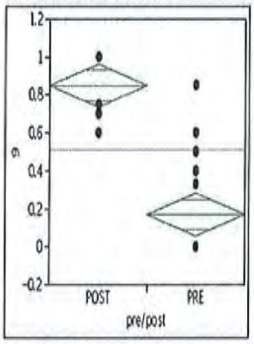
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.2656510	0.265651	1.7089	0.2011
Error	30	4.6636208	0.155454		
C. Total	31	4.9292719			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.711667	0.08048	0.54730	0.87603
Undergrad	8	0.501250	0.13940	0.21656	0.78594

Std Error uses a pooled estimate of error variance

Oneway Analysis of 9 By pre/post



Oneway Anova

Summary of Fit

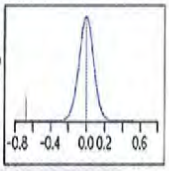
Rsquare	0.715964
Adj Rsquare	0.706496
Root Mean Square Error	0.220971
Mean of Response	0.507188
Observations (or Sum Wgts)	32

t Test

PRE-POST

Assuming equal variances

Difference	-0.67938	t Ratio	-8.696
Std Err Dif	0.07813	DF	30
Upper CL Dif	-0.51982	Prob > |t|	<.0001*
Lower CL Dif	-0.83893	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
pre/post	1	3.6924031	3.69240	75.6204	<.0001*
Error	30	1.4648438	0.04883		
C. Total	31	5.1572469			

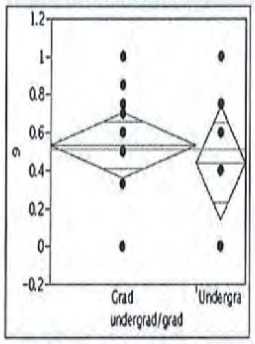
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
POST	16	0.846875	0.05524	0.73405	0.95970
PRE	16	0.167500	0.05524	0.05468	0.28032

Std Error uses a pooled estimate of error variance

Oneway Analysis of Avg By pre/post

Oneway Analysis of 9 By undergrad/grad



Oneway Anova

Summary of Fit

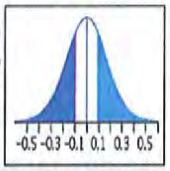
Rsquare	0.010044
Adj Rsquare	-0.02295
Root Mean Square Error	0.412531
Mean of Response	0.507187
Observations (or Sum Wgts)	32

t Test

Undergrad-Grad

Assuming equal variances

Difference	-0.09292	t Ratio	-0.55171
Std Err Dif	0.16841	DF	30
Upper CL Dif	0.25103	Prob > |t|	0.5852
Lower CL Dif	-0.43687	Prob > t	0.7074
Confidence	0.95	Prob < t	0.2926



Analysis of Variance

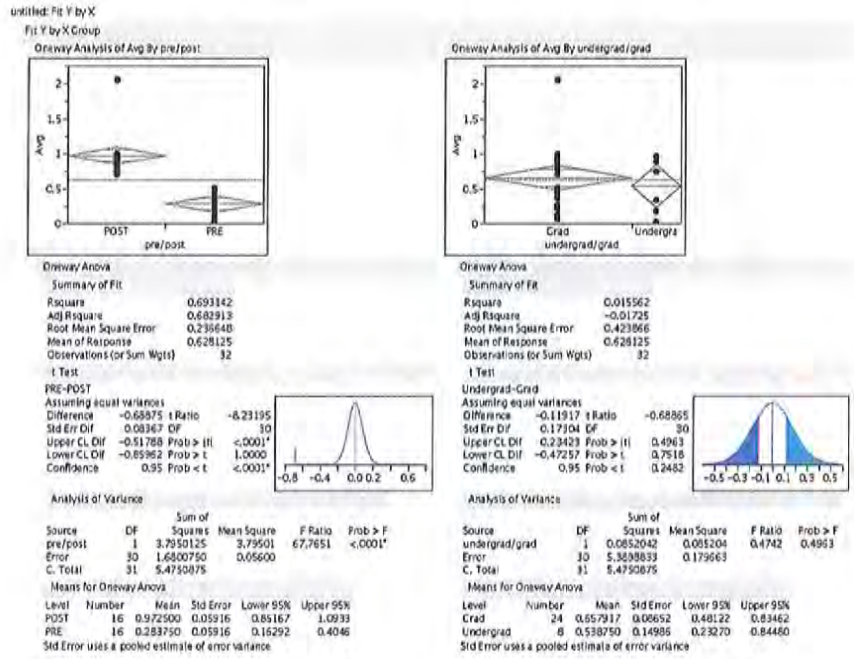
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
undergrad/grad	1	0.0518010	0.051801	0.3044	0.5852
Error	30	5.1054458	0.170182		
C. Total	31	5.1572469			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Grad	24	0.530417	0.08421	0.35844	0.70239
Undergrad	8	0.437500	0.14585	0.13963	0.73537

Std Error uses a pooled estimate of error variance

Oneway Analysis of Avg By undergrad/grad



Summary

Assessment of student outcomes is conducted by the School of Natural Resource Sciences annually for the bachelors, masters, and doctorate degree levels using the enclosed rubric. The courses designated for assessment in 2010-2011 were: ENT 350, General Entomology; ENT 790-1, Introduction to the Research Process; NRM 225/RNG 225, Natural Resources & Agroecosystems; NRM 150, Natural Resources Management Undergraduate Orientation; NRM 420/620, Scenarios in Natural Resources Management; NRM 421/621, Environmental Outreach Methods; NRM 431/631, NEPA and Environmental Impact Statements; NRM 453/RNG 453, Rangeland Resources Watershed Management; NRM 491/690, Natural Resources Management Undergraduate /Graduate Seminar; RNG 336, Introduction to Range Management; RNG 456/656, Range Habitat Management; SOIL 210, Introduction to Soil Science; SOIL 217, Introduction to Meteorology and Climatology; SOIL 322, Soil Fertility and Fertilizers; SOIL 410/610, Soils and Land Use; SOIL 444/644, Soil Genesis and Survey; SOIL 480/680, Soils and Pollution.

Improving assessment of student learning and the faculty's understanding of assessment tools within the School is a goal of the director, Don Kirby. The Director has provided examples of assessment tools, assessment reports, discussed these with faculty during the past year, and placed the assessment report on the School's webpage. Additionally website information provided by the Director of University Assessment has been presented to the faculty with the intent of improving understanding of assessment techniques and their uses. New faculty members get personalized instruction from the Director concerning the need for proper assessment of student learning activities. All faculty have been requested to provide intended student outcomes on the syllabus of the courses they instruct.

Simply put, faculty were asked to assess their courses using an assessment tool of their selection, then answer three specific questions for each course. The questions were: 1) What

did you do? 2) What did you learn? and 3) What will be done differently as a result of what was learned?

As was the case last year, numerous tools of assessment were adopted for use by the combined faculty of the School of Natural Resource Sciences. The pre- and post-test continued to be the work horse for assessment, but "fact sheet" exercises, muddiest point, correlations between the numbers of times a subject was covered and the mastery level shown of the subject, periodic teaching evaluations during the semester, weekly quizzes, periodic exams, case studies, use of national databases, computer simulations, exercises, and programs, and field trips and reports were all related as useful tools for assessing student outcomes. From the diversity of assessment activities, it is apparent that the combined faculty of the School have adopted assessment as an activity by which they can improve their courses, hence student leaning. Numerous adjustments were made during the year in course instruction as indicated by assessment activities. Course changes in the future were also noted by many instructors as a direct effect of assessment activities in 2009-2010.

ASSESSMENT OF STUDENT LEARNING:
SELF-REPORTING OF LEVELS OF IMPLEMENTATION

(This format contains modifications of the original published by NCA-CIHE)

Self-evaluation from: School of Natural Resource Sciences July 26, 2011

(NDSU Department or program) Date:

Completed by: Don Kirby, Director

To use this form: Circle the identifier to the left of the description that, in your opinion, most effectively describes the level of implementation for each individual category of achievement in evaluating student learning.

Collective/Shared Understanding of Assessment

1 A shared understanding of assessing student learning is not present
1+ . . . Is beginning to evolve
2 . . . Has developed and implementation is beginning
(2+) . . . Is expanding and the value system rewards faculty conducting assessments of student learning
3 . . . Has become a way of life and assessment has been included in the unit's PT&E document.

Mission and Goals Statements

1 Assessment of student learning is not a part of department/unit mission or goals statements
1+ . . . Is a minor part of mission and goals statements
2 . . . Is a modest part of mission and goals statements
(2+) . . . Is stated as a secondary objective in mission and goals statements of the department or unit
3 . . . Is a featured goal of the department or unit

Faculty Involvement

1 Faculty have not identified direct measures of student learning to be used and consider grades to be sufficient as an evaluator of learning
1+ . . . Are becoming familiar with the vocabulary of assessment of student learning. Direct and indirect measures of learning are used in less than 33% of the courses offered by the department or unit.
2 . . .Have developed learning objectives evaluated by direct and indirect measures of learning in approximately 50% of the courses
(2+) . . . Have highly-developed learning objectives primarily supported by direct measures of student learning for nearly all classes
3 . . . Have a depth of understanding of evaluating student learning such that they are serving as an assessment resource to faculty in other departments or other institutions.

Awareness of Students

1 Students know essentially nothing about evaluation of student learning (in contrast to their knowledge of course grading systems)

1+ . . . Are beginning to learn about measuring student learning

2 . . . Are beginning to understand the significance of evaluating student learning in their courses

(2+) . . . Are requesting more feedback about the general level of student learning in their courses and in previous offerings of courses

3 . . . Are actively involved in self-evaluation of their student learning through portfolios, capstone courses, or comparable activities

The Assessment Process: Development and Use of Results

1 The Chair developed the departmental or unit assessment program with no faculty involvement

1+ The Chair and the department's Curriculum or Assessment Committee are discussing assessment of student learning in courses for majors

2 The department Chair and the Curriculum or Assessment Committee share responsibility for overseeing assessment activities and the assessment report

2+ Assessment results have led to changes in some courses

(3) Assessment results are leading to a second cycle of changes in some classes

Proficiency in Assessment by the Department or Unit

1 Assessment has not progressed as an agenda item in the last three years

1+ Faculty discussions of the results of assessing student learning in their courses are increasing

2 Discussions of the results of assessing student learning are taking place during department meetings

(2+) Accomplishments in assessing student learning are highlighted in standard annual reports and in reports provided to the Program Review Committee

3 Sufficient evidence of student learning has been accumulated to justify using that information in recruiting students and faculty.

Thank you for completing this self-evaluation of your assessment practices. Include this form as part of your annual assessment report.

For more information, please contact your college representative to the University Assessment Committee or call the Office of Accreditation and Assessment at 231-8967.

Approved by the members of University Assessment Committee on February 22, 2001.