

Cooking for the buffet - Individualizing course content to improve learning

Dennis Pearl
Redesign Alliance Meeting
March 30, 2010

This project was initiated during NCAT's Pew Program in Course Redesign. Remember the two take home keywords from Kay McClenney's keynote yesterday morning: "mandatory" (student's don't do optional) and "personalized." Buffet = "Mandatory Personalization."



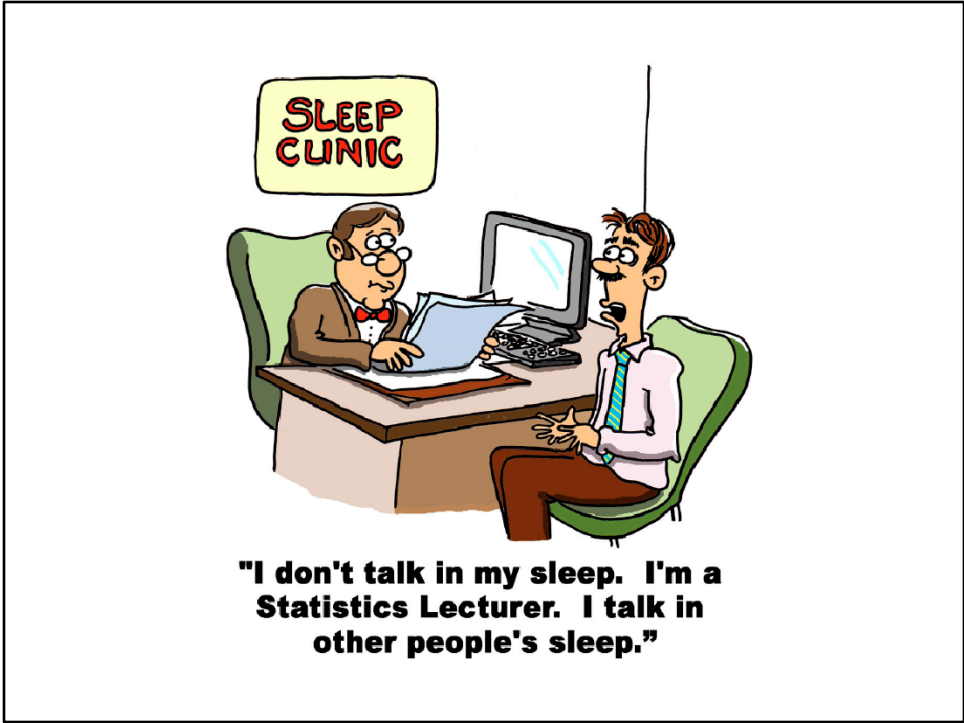
Tentative Agenda

- The Statistics Buffet
 - The History of the idea
 - The implementation
 - The assessment
- The Next Step



Traditional Problem: Low Expectations for a Lecture-based Course

When I arrived at Ohio State in the early 80's course was traditional lecture and recitation (where TAs go over problems with students) and we faced traditional problems ...





Traditional Problem: Low Success Rate

And students were not doing too well so that passing statistics was a barrier to graduation for many...



"In my thirty years of teaching statistics
I've given exams to over 50,000 students.
Now I travel free using frequent crier miles."

But we know what works...

What Works

Arthur Chickering and Zelda Gamson's 7 Principles

Good Practice in Undergraduate Education:

- Encourages contacts between students and faculty.
- Develops reciprocity and cooperation among students.
- Uses active learning techniques.
- Gives prompt feedback.
- Emphasizes time on task.
- Communicates high expectations.
- Respects diverse talents and ways of learning.

1987 Higher Ed Bulletin article. Time on task is number one in association with learning.

Pedagogical principles – also need to think about relation of pedagogy to content

What Works

Guidelines for Assessment & Instruction in Statistics Education

- Emphasize statistical literacy and develop statistical thinking
- Use real data
- Stress conceptual understanding not knowledge of procedures
- Foster active learning in the classroom
- Use technology for developing conceptual understanding and analyzing data
- Use assessments to improve and evaluate student learning

Endorsed by American Statistical Association
(similar guidelines in other disciplines). Overall, keep students engaged and on track



Just telling students to work hard because it's good for them doesn't do it. You've got to build into your pedagogy Mandatory Engagement that feels useful and personalized.



Previous Redesigns:

1980's:

Inspiration from the lab sciences

1990's:

Gen Ed and the rise of technology

2000's:

Inspiration from ...

Introduced hands-on activities and computer labs for analysis in the 1980's. In the 1990's Gen Ed requirement for Data Analysis introduced with computer lab ~~now also to illustrate concepts and analyses built in. Course grew dramatically~~ from 1000 to 3000 so funds available for new add-ons. In 2000's inspiration comes from an unlikely source - Mary Smith's Diner in Pickerington Ohio.

Goal: successful student choice

“This is not Burger King™, You don’t get it your way. You take it our way or you don’t get the damn thing.”

- sign in Mary Smith’s diner in Pickerington, Ohio



Education has too long always normed for the group rather than working for every individual. Mary’s Diner was a successful business for decades by serving a niche as a good meat and potatoes diner. But you can serve the best roast beef in the world and a vegetarian won’t be very happy.

Goal: successful student choice

“This is not Burger King™, You don’t get it your way. You take it our way or you don’t get the damn thing.”

- sign in Mary Smith’s diner in Pickerington, Ohio



- A Las Vegas buffet

How do you serve a large diverse group of customers and make everyone happy? The model is... A Las Vegas buffet.

The Buffet Idea

- Full complement of nutrition (meet all instructional needs)
- Serve individual tastes to encourage consumption
- EEGP-example from life experience, example outside, generalize, practice
- On-line contract and student tracking

EEGP = Salad Bar ... side-dish ... main course ... desert bar
Enhancing concept comprehension & retention Leah Savion &Joan Middendorf
Indiana University 1994 article



Advising the Learner

- Learning Styles
- Study Strategies
- Previous Student Experiences

We want students to make appropriate choices based on sound reasons.



Learning Styles (Felder & Silverman model)

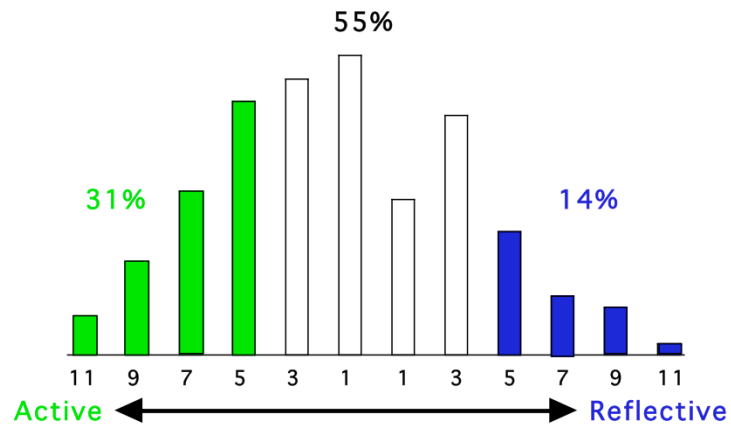
- Active-Reflective
 - Group-individual dimension nested here
- Sequential - Global
- Visual - Verbal
- Sensing- Intuitive

Try it out at:

www.causeweb.org/ils

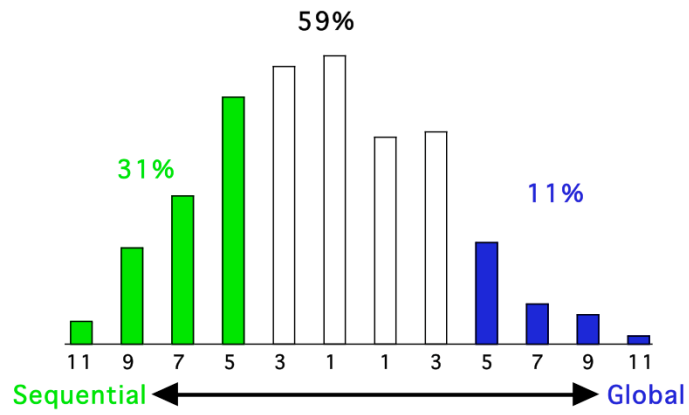
Felder's group is in Engineering education and this seems to be relevant to STEM disciplines.

Current Student Distribution



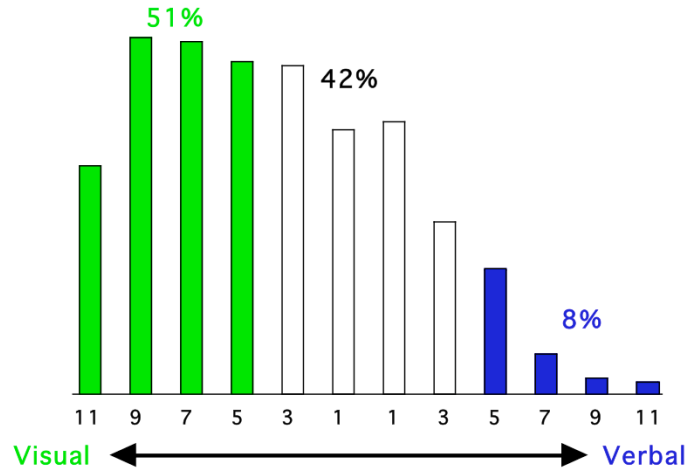
Active learners want to try it out first. Reflective learners want to think it through first.

Current Student Distribution



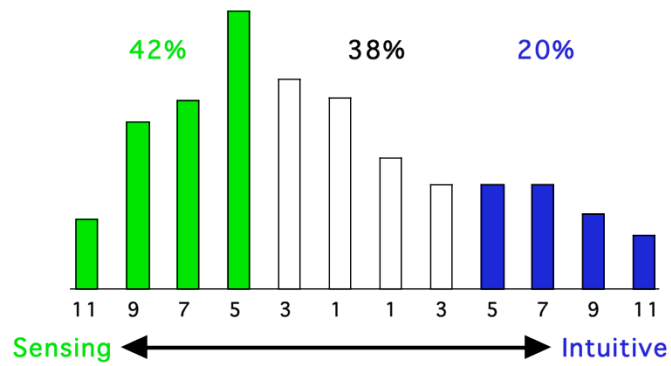
Sequential learners want to hear the details first and build up to the big picture. Global learners want to hear the big picture first, then fill in the details.

Current Student Distribution



Visual learners remember things when they can see a picture. Verbal learners do well when they hear about it or read about it.

Current Student Distribution



Sensors like activities with hands-on manipulatives. Intuitors think hands-on data generation is busy work would rather use simulations or have the data directly to get to concepts.

Sensor/Reflective Focus Group Quotes

- “I did not find Lab 2 beneficial ... I’m not that big on group work anyway.”
- “I liked the hands-on activity in Lab 9 . I can grasp it easier if I can do, see, and touch.”
- “I looked at the book when I needed another example.”

Quotes from students who were strongly sensing (in lab 2 students designed their own experiment. In lab 9 students counted m&m candies to estimate the percentage that are brown).



Intuitive/Visual Focus Group Quotes

- “Lab 5 was good in that you had a chance to make your own predictions...”
- “The Jokes were cute - actually helped with the material instead of being an advertisement.” (referring to cartoons on the website)
- “I only opened the textbook the night before the final exam.”

Quotes from students who are strongly intuitive and strongly visual. In lab five used applet for correlation guessing game.



Intuitive/Verbal Focus Group Quotes

- “I liked Lab 2 the most because it required original thinking.”
- “I enjoy group work and discussion. Good to know other students have questions; I’m not the only one.”
- “The textbook was quite helpful ... clearly established concepts and formulae.”

2nd comment from strongly active student

Large Group Options in a 3-choice Buffet

	Monday	Wednesday	Friday
Option A Global & Reflective	Illustrations and presentation of general principles aided by individual reflection opportunities.		Problem solving session
Option B Sequential & Active	Illustrations and presentation of general principles aided by group based activities		

Problem solving may be replaced by out-of-class problem solving coupled with on-line mastery quizzing.

Worked through NCATs planning tool = spreadsheet to determine if goals align with effort and expenditures.

Most money paying five faculty to give redundant lectures three times

About 2/3 of lectures was introducing new concepts with examples and about 1/3 solving problems.

Small Group Options in a 3-choice Buffet

	Tuesday/Thursday
Option A sensors	More hands-on data generation
Option B intuitive	More applet and simulation activities

Note - individual TA always sees the same type of students and can be matched as a specialist.



STATISTICS 135

Navigation: [Stat Dept](#) ⇒ [Stat135](#)

- [Stat135 Home](#)
- [Syllabus & Policies](#)
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- [Corrections](#)
- [myStat135](#)
- [Carmen](#)

Search Stat135



Welcome to the Stat 135 website

Fall 2009 Students: We are currently resetting the website for Fall quarter. Soon, you will be able to use the *MyStat135* link on the left to find homework assignments, lecture notes, and more. You should have received your section assignments by e-mail on Saturday afternoon! - you should be attending those sections beginning on Monday September 28th.

Homework: The first homework assignment is now posted in myStat135. It is due October 8th (Thursday lab sections) or October 9th (Friday lab sections).

Frank and Ernest



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[Previous](#) [Cartoon for Wednesday, October 7th](#)

Entering The Buffet (www.stat.osu.edu/~stat135)

The screenshot shows the myStat135 website interface. At the top left is the Ohio State logo. The main title is "STATISTICS 135". Below the title is a navigation bar with links for "Stat Dept.", "Stat135", and "myStat135". A sidebar on the left contains various menu items: "Stat135 Home", "Syllabus & Policies", "Instructors", "Help Room", "Data Sets", "Applets", "EESSE", "Web Links", "Contact Us/FAQ's", "Glossary", "Corrections", and "myStat135". A search box labeled "Search Stat135" is at the bottom left. The main content area has a "Welcome to myStat135" heading and instructions for logging in. A "Log-in" button is visible. A modal dialog box titled "myStat135 Login" is open, showing a "Connect to 'www.stat.ohio-state.edu' as:" prompt, a "User ID" field with "brown.73", a "Password" field with masked characters, and a "Realm" field with "OSU Name.n & Password". There are "Remember Password", "Cancel", and "OK" options at the bottom of the dialog.

Log-in

Login uses university-wide e-mail and password



STATISTICS 135

Navigation: [Stat Page](#) | [Stat135](#) | [myStat135](#)

- [Stat135 Home](#)
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- [Glossary](#)
- [Corrections](#)
- [myStat135](#)
- [WebCT](#)



Admin View

(Students see only
"Main Menu" items)

myStat135

For pear.1

Course Admin

- [MySQL Database](#)
- [Add Mastery Quiz Questions](#)
- [FAQ Editor](#)
- [Web Usage Report](#)

Lecture Admin

- Lecture Editors**
- [8:30 EA160 \(Paul\)](#)
- [2:30 EA160 \(Powers\)](#)
- [2:30 EA170 \(Blumenthal\)](#)
- [Stat135N \(Wuenschell\)](#)

T.A. Resources

- [Class Dates](#)
- [myChecklist Progress Report](#)

Main Menu

- [View All myChecklists](#)
- [Live Help Admin](#)
- [myChecklist](#)
- [Readings/Video](#)
- [Homework Assignments](#)
- [Lecture Notes & Information](#)
- [Review ILS Results](#)
- [School Strategies Scale Questionnaire](#)
- [Information Disclosure Statement](#)
- [WebCT Login](#)
- [myStat135 Log Out](#)

Welcome to the Stat 135 webpage

Here is the five number summary for the grades on the first midterm exam:
Minimum = 35, Q1 = 71, Median = 79, Q3 = 88, Maximum = 100

Requests for regrading of a midterm question must be in writing with the reason you feel you deserve more credit attached to your exam. Regraded scores may go up or down depending on whether the original grading was too harsh or too lenient. All requests must be in by Friday February 23.

[Office hours](#) are now operating in room 130 Cockins Hall.

Note: The case set called "broadale" in the Lab book needed for the homework assignment is called "breathalyzer" on the [Data Set download page](#).

myContract Assignments

	Mon	Tue	Wed	Thur	Fri
8:30 Large group	Room: EA 160 Discovery-based group activities		Room EA 160 Lecture-style illustrations and presentation of general principles		No class (Problem solving outside of class)
1:30 Small group		Room: EA 265 Discovery based labs, more applet and simulation activities		Room: EA 265 Discovery based labs, more applet and simulation activities	

Navigation: Stat Dept | Stat135 | myStat135 | Lecture Editor

Info for Pearl's Section

Announcements

Date	Announcement	Delete
today		

Lecture Notes

Date	Description	Filename	Delete
today		<input type="text"/> Browse...	


Save Changes Revert

Search Stat135

WVC APPROVED

Preparing the Menu

Behind the scenes - an instructor's interface. Here: to post announcements and lecture notes



STATISTICS 135


Navigation: [Stat. Dept.](#) | [Stat135](#) | [myStat135](#) | [myChecklist](#)

- Stat135 Home
- Syllabus & Policies
- Instructors
- Help Room
- Data Sets

- Applets
- EESSE
- Web Links

- Contact Us/FAQ's
- Glossary
- Corrections

myStat135



myChecklist

Welcome to myChecklist! To help us track your progress through the course, please check the items you have completed.

To insure that you have practice with a broad array of problems, we have assigned the following homework assignments. Obviously working through these will help prepare you for our exams. You should complete the following homework assignments:

1. [Homework 1](#)
2. [Homework 2](#)
3. [Homework 3](#)
4. [Homework 4](#)
5. [Homework 5](#)
6. [Homework 6](#)
7. [Homework 7](#)
8. [Homework 8](#)

You have chosen not to attend the in-class problem solving sessions on Wednesdays. As an alternative you should:

1. [Complete study guide 1.](#)
2. [Complete mastery quiz 1.](#)
3. [Complete study guide 2.](#)
4. [Complete mastery quiz 2.](#)
5. [Complete study guide 3.](#)
6. [Complete mastery quiz 3.](#)
7. [Complete study guide 4.](#)

You have chosen to participate in the Sensing version of our labs and will meet twice a week. To meet the requirements of this part of the course you should do the following:

1. Complete Lab 1 in class.
2. Complete the revised version of Lab 2 in class.
3. Complete Lab 4 in class.
4. Complete Lab 3 in class.
5. Participate in the Peer Review to prepare you for the first midterm.
6. Complete Lab 5 in class.
7. Complete Lab 6 in class.
8. Complete Lab 7 in class.
9. Complete the revised version of Lab 8 in class.

Individualized Student Checklist

A checklist of things to do that is individualized for the student.

Gathering
Testimony

The image shows a screenshot of a web page for "STATISTICS 135" at Ohio State. The page is titled "Mid-Quarter Feedback" and contains several sections for user input. On the left side, there is a navigation menu with links for "Stat135 Home", "Syllabus & Prerequisites", "Instructors", "Help Room", "Data Sets", "Applets", "ESETC", "Web Links", "Contact Us/FAQ's", "Glossary", "Corrections", and "myStat135". Below the menu is a search bar labeled "Search Stat135" and the "WVC" logo. The main content area includes a "Navigation" bar with links to "Stat Dept", "Stat135", and "Mid-Quarter Feedback". The "Mid-Quarter Feedback" section starts with a thank-you message and a survey introduction. It then asks for feedback on three types of experiences: "Large Group Experience", "Lab Experience", and "Independent Problem Solving (as a substitute for class meetings)". Each section has a text input field for the user's response. The "Overall" section asks for the user's level of agreement with the statement "Overall I think I made the right choices in my learning contract." and provides four radio button options: "Strongly Agree", "Agree", "Disagree", and "Strongly Disagree".


Testimony helps guide course improvements and provides advice to future students.

The screenshot shows the Ohio State Statistics 135 website. On the left is a navigation menu with links for Home, Syllabus & Policies, Instructors, Help Room, Data Sets, Applets, EESEE, Web Links, Contact Us/FAQ's, Glossary, Corrections, and myStat135. The main content area is titled 'Welcome to myStat135' and 'Personal Information Disclosure'. It contains a paragraph of text explaining that data collected from students will be used for research and that participation is voluntary. Below the text are two radio button options: 'You have my permission to use my data in your research.' (which is selected) and 'Do not include my data in your research.'. A 'Continue to myStat135' button is located below the options. At the bottom left of the page is a search bar and a 'WAC APPROVED' logo.

With Permission

Ethics demand that students give permission for the use of their personal data in research.


Answering Questions



STATISTICS 135

Navigation: [Stat Dept](#) | [Stat135](#) | [Contact Us/FAQ's](#)

- Stat135 Home
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- Contact Us/FAQ's
- Glossary
- Corrections
- myStat135



Contact Us/FAQs

An immediate answer to your question may be found by browsing or searching our FAQ system. If you cannot find the answer you need, you may also [contact us by e-mail](#) and we will respond as soon as possible. We also welcome your comments and suggestions.

Top 10 Questions for STAT135:

1. [What computer labs have DataDesk and EESEE available?](#)
2. [What books are required for this course?](#)
3. [I am a graduating senior. When is my final?](#)
4. [What calculators are allowed on exams?](#)
5. [Do I need to purchase the software?](#)
6. [If I choose the online quiz option \(skip the problem solving lecture\), when is the date by which I must submit my online quiz?](#)
7. [Where can I purchase the software?](#)
8. [What software is used in this course?](#)
9. [I have completed the inventories. Now how do I make my choices?](#)
10. [How do I view PDF files?](#)

Go to page [1](#) | [2](#) | [3](#) | [4](#) | [Prev](#) [Next](#)

Search FAQs

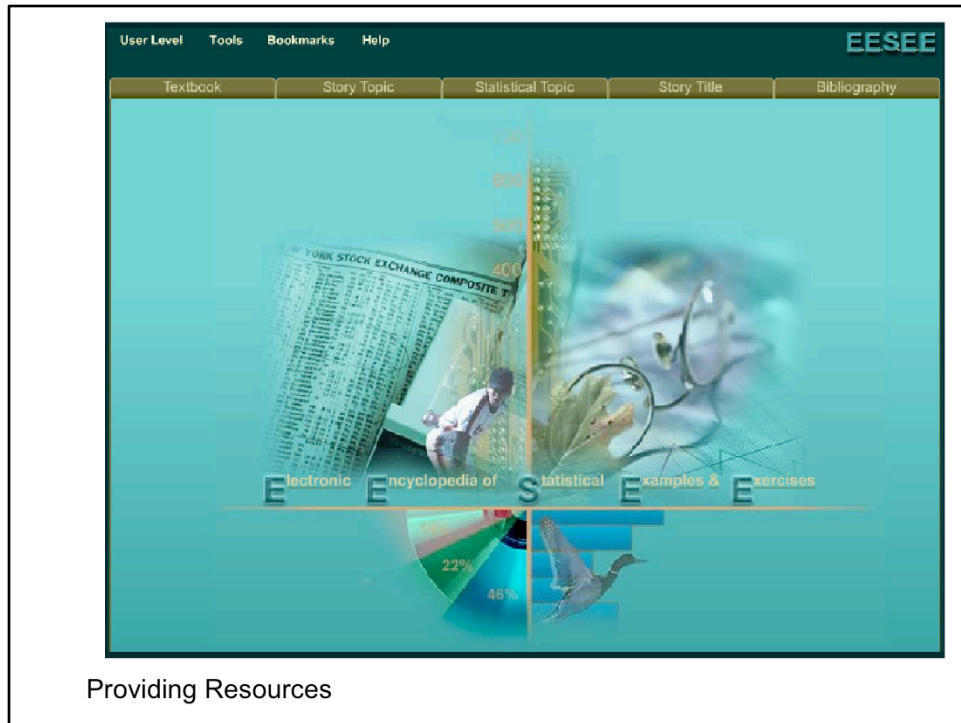
You can search the FAQ database by entering a keyword below.

Enter keywords to search:

You can further limit the search to questions/answers in the following selected topic areas. Leave the search field blank to see all FAQs in a selected topic area.

All Topic Areas

The FAQ system sorts by most common questions (default), by broad topic area, or by relationship to keyword. E-mail is generated if the question is not in the system.



Providing Resources

The Electronic Encyclopedia of Statistical Examples and Exercises (EESEE) has approximately 150 stories from the scientific literature and the popular press - with background information, the protocol, datasets, and questions on statistical issues.

Resources: Statistics

Navigation: CAUSEweb

CAUSEweb.org

Search

Advanced Search

Resources

Professional Development

Research

USCOTS

Workshops

Webinars

Calendar

About CAUSE

Member Login

Username: [input]

Password: [input]

Login

Forgot password?

Register / Log in to:

- Create/submit learning materials
- Save search results
- Provide comments
- Establish automatic updates
- And more... it's free!

NSF

NSDL

TISE

Consortium for the Advancement of Undergraduate Statistics Education

A national organization whose mission is to support and advance undergraduate statistics education, in four target areas: resources, professional development, outreach, and research.

Resources

Professional Development

Research

USCOTS 09

CAUSE NEWS:

October Teaching & Learning Webinar Series

Sign up now for our next "Teaching & Learning Series" webinar, October 1st from 2:00 to 2:30 pm Eastern time on "Using Calibrated Peer Review in Statistics and Biology: A Coordinated Statistical Literacy Project" with Ellen Gundlach & Nancy Pagan, Purdue University.

CAUSE Webinars on iTunes

The CAUSE webinar series recordings are now available as podcasts! Subscribe via [iTunes](#) or [RSS](#).

Update: You can also find us on the iTunes Music Store.

CAUSE Professional Development Opportunities at JMM 2010

Going to the MAA/IMS Joint Mathematics Meetings 2010 in San Francisco in January? If so, you'll definitely want to check out the two workshops and a minicourse that we will be offering. The workshops will consist of "Become a Catalyst for Change in Statistics Education" and "Teaching Introductory Statistics (for instructors new to teaching Intro Stats)". The minicourse is "Remodeling Data Analysis". This will be the third consecutive year of CAUSE's involvement in JMM offering pre-conference workshops.

CAUSEweb is now on Twitter!

Follow CAUSEweb on Twitter and get tweets whenever a new resource is added or updated in our online library, a new item is posted on the front page, a new event is added to our research or professional development calendars, updates regarding the web site, or other important notices!

Technology Innovations in Statistics Education: TISE has published the first issue of Volume 3, including papers by Jane Watson & Julie Janine (ThinkRats as a Research Tool to Explore Student Understanding), and by Webster West (Social Data Analysis with TagClouds: Perceived Benefits to Statistical Fluency). Please visit [tise-stat.edu](#).

Digital libraries of resources for teachers are now available for most every discipline. Our site for statistics is at www.causeweb.org

Resources: Physics



[login](#) - [create an account](#) - [help](#)

Find a Resource...

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Welcome to comPADRE resources for physics and astronomy communities

Featured Collection



uCOMP - Computational Physics
A place for sharing information and resources for those interested in computational physics.

Did You Know?
PTEC has a map of available Research Experiences for Teachers (RETs). You can view it [here](#).

The ComPADRE Digital Library is an **NSDI** pathway. Sponsored in part by NSF grants DUE-0226129 and DUE-0532798.

The **ComPADRE Digital Library** is a network of free online resource collections supporting faculty, students, and teachers in Physics and Astronomy Education.

Each of our collections contain materials designed for a specific community. Browse below to find a collection right for you.

- | | |
|--|--|
| <p>For Students</p> <ul style="list-style-type: none"> Nucleus
Community, scholarships, research, & more Physics Careers Resource
Career resources & options Physics Classroom
A physics tutorial Physics to Go
A bi-monthly online magazine | <p>For Teachers</p> <ul style="list-style-type: none"> Physics Front
Resources for K-12 physics teachers Physics to Go
Fun physics images & articles PSRC
A broad collection of physical science resources |
| <p>For Faculty - General</p> <ul style="list-style-type: none"> OSP
Open Source Physics PER-Central
Physics Education Research PSRC
Physical Sciences Resource Center MTEC
Physics Teacher Education Coalition uCOMP
Computational Physics | <p>For Faculty - Courses</p> <ul style="list-style-type: none"> Advanced Labs
Junior and Senior Labs Astronomy Center
Introductory Astronomy Course Resources Physics Source
Introductory Physics Course Resources Quantum Exchange
Quantum Physics Resources Spacetime Emorium
Relativity Resources STP
Statistical and Thermal Physics Course Resources |

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- [Upcoming OSP Events](#)
- [Adaptica-Physicist](#)

Resources: Earth Sciences

DLESE Educational Resources For Educators News & Opportunities For Developers About DLESE

Digital Library for Earth System Education Supported by the National Science Foundation

Getting started with DLESE > Browse the library >

Search

● Educational resources Grade Level ▶ Resource Type ▶ Collections ▶ Standards ▶ Clear selections

○ News & opportunities

Tips

A free service for learners of all ages

What's new at DLESE

- [LiveScience features Artist and Geoscientist, Susan Eriksson in an NSF produced video: "The Art of Science."](#) Drawing on her scientific background, Susan Eriksson creates mixed-media sculptures, paintings, and installations. She blends scientific discipline with the inspiration that drives successful artists in the studio and scientists in the laboratory. Credit: NSF
- [Newest Resources in DLESE](#)

Resource of interest << Previous | Next >>

YEAR of SCIENCE 2009
Explore. Empower. Engage...

The Coalition on the Public Understanding of Science (COPUS) and its participants lead the way in the celebration of the [Year of Science 2009](#) (YoS09) - a national, year-long celebration of science to engage the public and improve public understanding about how science works, why it matters, and who scientists are. As they develop programs for 2009, participating organizations share program ideas, register them in the COPUS registry, and collaborate with others to celebrate science.

Posted June, 2009

[Suggest](#) an interesting Earth system site.
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Resources: Chemistry



[Collections](#)

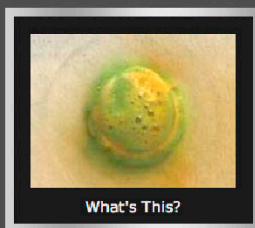
[Communities](#)

[Online Services](#)

[About](#)

Teach the World Chemistry

Observe!



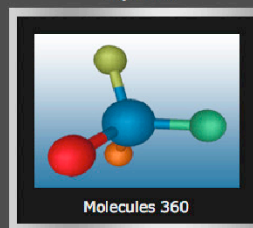
What's This?

Explore!



Periodic Table Live!

Explain!



Molecules 360

ChemEd DL aims to provide exemplary digital resources, tools, and online services to aid in teaching and learning chemistry. A collaborative, community-driven effort, we provide a destination for all those interested in chemistry to share what they know so that others may learn.

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Resources: Biology

The screenshot shows the homepage of the BEN (BioSciEdNET) website. At the top, there is a navigation bar with links for HOME, ABOUT, K-12 EDUCATORS, COLLEGE FACULTY, CONTRIBUTORS, and SIGN IN. The main header features the BEN logo (a red starburst) and the text "ben BIOSCIEdNET DIGITAL LIBRARY PORTAL FOR TEACHING AND LEARNING IN THE BIOLOGICAL SCIENCES". Below the header is a search bar with a dropdown menu set to "All Audience Levels" and buttons for "FREE records only" and "Visual media only". A "SIGN IN" link and "Advanced Search" button are also present.

USING BEN

- BROWSE BY SUBJECT
- BROWSE BY RESOURCE TYPE
- BROWSE BY AUDIENCE / LEVEL
- BEN SCHOLARS
- BEN TECHNOLOGY WIKI
- ISOVERADL WIKI
- CALENDAR

WELCOME

Welcome to the BEN portal, the National Science Digital Library (NSDL) Pathway for biological sciences education. The BEN Portal provides access to education resources from BEN Collaborators and is managed by the American Association for the Advancement of Science (AAAS). Over 14,265 reviewed resources covering 77 biological sciences topics are available. BEN resources can help you engage student interest, shorten lesson preparation time, provide concept updates, and develop curricula that are in line with national standards for content, use of animals and humans, and student safety.

Currently, registration is not required in exchange for access to the wealth of information freely available through the BEN Portal. Users retain the option to **Register** and/or **Login** to join our community of 10,396 biological science educators. Our **privacy policy** provides detailed explanation on what information is collected, protected, and used for users desiring to exercise their option of registration.

NEW RESOURCES

VISUAL MEDIA LIBRARY

Teaching STRATEGIES

MicroRNA Journal Club
Adapt the traditional journal club format to the classroom -
- introduce students to the process of discussing and evaluating primary research lit.
Sci. STKE 2005 (300), 124.

SITE MAP | CONTACT | POLICIES

At the bottom of the page, there are logos for AAAS, NSDL, and a sun icon.

Resources: Mathematics

The screenshot shows the MathDL website homepage. At the top, there is a blue banner with the text "MathDL" in large yellow letters and "The MAA Mathematical Sciences Digital Library" below it. To the right of the banner are logos for "NSDL" and "The Mathematical Association of America". Below the banner is a search bar with the text "Search Partner Resources" and buttons for "Register" and "Sign In".

On the left side, there is a vertical menu with the following items: "MAA Reviews and Classroom Capsules and Notes", "Search NSDL", "A New MathDL!", "Goals of MathDL", "RSS Feeds", "About MathDL", "Contact Us", "Copyright and Fair Use Information", "Privacy Policy", "MathDL Partners", and "The MathResource". Below this menu is a "Register" button and a short paragraph: "Register with the MathDL to receive access to My Library. Make your own resource list; start discussions with your friends."

The main content area is divided into several sections:

- MATH IN THE NEWS**: A section with a date "October 7, 2009" and a headline "Mathematics Job Opening at NSF". The text describes a job opening at the National Science Foundation. There are links for "more...", "Browse News Archives", and "Search News Archives".
- ON THIS DAY ...**: A section with a date "October 7th," and two historical entries: "1601 Baptismal date of Florimond de Beaune. His fame rests on the two brief notes ..." and "1893 Khayyam's tree transplanted. When the poet/mathematician Omar Khayyam died in ...". There is a link "See all details for today or pick a different day."
- MAA Writing Awards**: A section with a description: "On this site you will find pdf copies of the articles that have won MAA journal writing awards over the years and short bios of the authors." There is a "Go to MAA Writing Awards" button and a small image of a book cover.
- LoCI**: A section with a description: "Welcome to LoCI, the online publication of MathDL. LoCI is the continuation of three former MathDL publications: The Journal of Online Mathematics and its Applications (JOMA), Digital Classroom Resources (DCR), and Convergence." There is a "Go to LoCI" button and a small image of a robot.

And mathematics. These digital libraries are well indexed by topic, by type, even by pedagogical method ...

Resources: that are relevant

The screenshot shows the 'Pedagogy in Action' website, which is the SERC portal for Educators. At the top, there is a search bar with the text 'Search the Site ='. Below the header, the website is organized into several sections:

- The Library -- Connecting Theory to Classroom Practice:**
 - Teaching Methods:** The What, Why and How.
 - Activities:** Direct from the Classroom.
 - Research on Learning:** A Bibliography of the Print and Web Literature.
- The Pedagogic Service -- Create, Contribute, Customize:**
 - Share Your Community's Expertise
 - Contribute an Individual Activity
 - Integrate the Library into your
 - Digital Library
 - Campus Learning Initiative
 - Education Project
- News:**
 - Guided Discovery Problems:** A new set of web pages about teaching with [Guided Discovery Problems](#) offers a wealth of information on using this teaching method, along with several detailed [examples](#) ready to use in the classroom.
 - Teaching Urban Students:** A module about [Teaching Urban Students](#) provides detailed background information about the characteristics of urban students, insights into effective teaching practices and [examples](#) of classroom approaches well suited to engage and support all urban students.
 - New Pedagogic Modules:** New modules on using [ConceptTests](#), [Lecture Tutorials](#), and [Structured Academic Controversy](#) are now available. Each module includes information about the method, how to use it in your classroom, references, and a collection of example activities.

Science Education Resource Center at Carleton College. Digital portal aligned with pedagogical method. Want an activity that uses cooperative learning to teach molecular biology? Or an activity using Game-based learning to teach statistics?...



Commercial Resources:

Well-supported &
Sometimes well integrated


For examples see NCAT
Corporate partners

Today Course Management Systems have multiple ways to provide students with individualized content. So technology and resources are there – so how do we handle the course logistics?

Nuts and bolts issues

- Common coverage of learning objectives
 - common list of ≈ 10 objectives per week
- Equalize difficulty
 - to remove as decision metric
- Support equitable testing
 - makes up about $2/3$ of grade

Key idea: Keeping it fair to all. Learning objectives = List of 91 things we want them to know index everything by that



Example Learning Objectives:

59. Be able to use the computer to calculate regression estimates and know how to interpret the resulting output in relation to how it answers questions about real data.

60. Understand that the regression method is inappropriate when there is a nonlinear association, when an outlier will drive the results, or when there is a desire to extrapolate outside the range of the data.

61. Understand that the regression method is used to estimate the average value of y when you know x .

Here are #59 to 61 for regression topic

Nuts and bolts issues

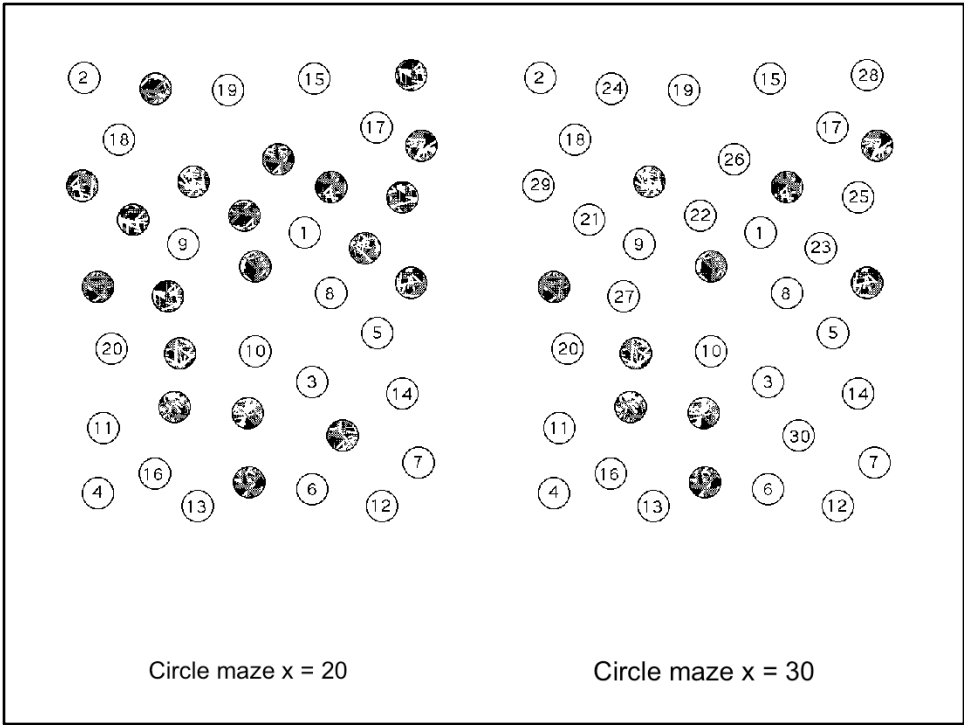
- Common coverage of learning objectives
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Key idea: Keeping it fair to all

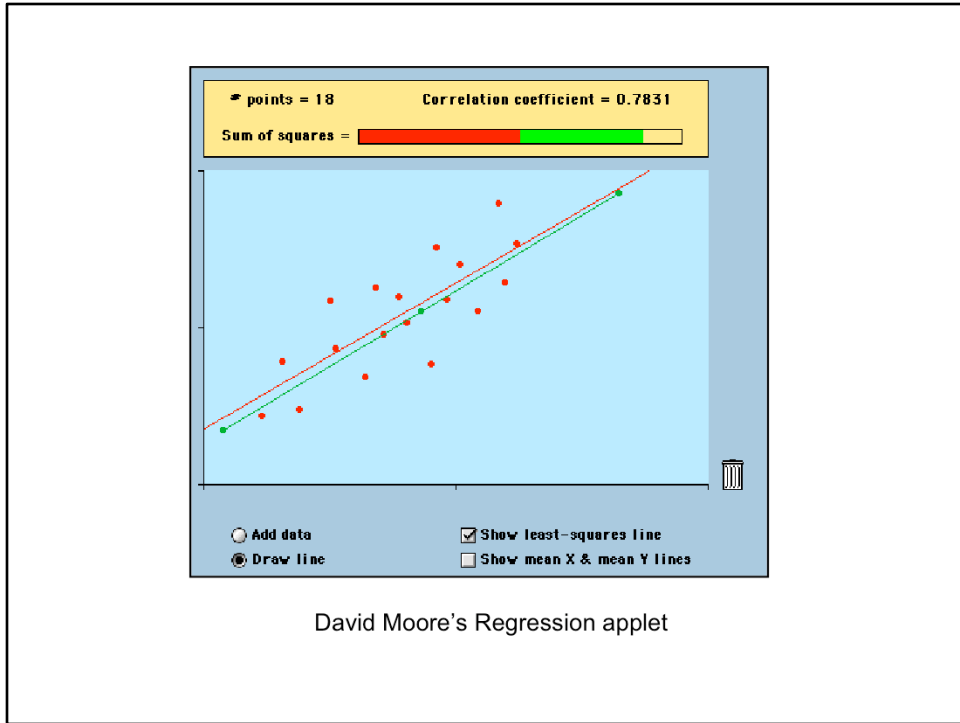
Don't want choices based on easiest path so all assignments for grades are the same.

Example of lab report.

Old problem of integration of material across segments of the course addressed.



One lab does data generation connect the dots maze competition and compare time to complete (Y) with length of maze (x)



David Moore's Regression applet

While another lab does applet activity but all staple their lab work to lab report that answers three questions
 HOW WAS A SPECIFIC LEARNING OBJECTIVE ILLUSTRATED IN LECTURE,
 IN LAB, AND IN HOMEWORK

Nuts and bolts issues

- Common coverage of learning objectives
 - common list of ≈ 10 objectives per week
- Equalize difficulty
 - to remove as decision metric
- Support equitable testing
 - makes up about $2/3$ of grade

Key idea: Keeping it fair to all. Common midterms and finals

Additional course goals

- Off-load repetitive tasks to software
 - FAQ & e-mail system, indexed resources
- Increase satisfaction and success for instructors
 - More info on students, students selected environment, support for technology use
- Better TA training
 - Summer course, Certification process, customer service training
- Reduce costs
 - From \$191 to \$132 per student enrolled
 - From \$238 to \$155 per completed student

Main cost reductions due to personnel substitution, no Friday lecture for most students, and help room structure

Student Reaction

Subject	Positive comments	negative comments
Having choice/gearing to Learning Styles	100%	0%
Group activities	90%	10%
Material on web	83%	17%
Team teaching aspects	70%	30%
Variety of assignments	86%	14%
Overall course organization	93%	7%
<i>Total</i>	89%	11%

How did the design of the course help or hinder your learning?
84% of students responded

Summary of open ended responses shows high satisfaction with the buffet model.

Student Performance

Class	# of students	Midterm Exam		Final Exam	
		Median	% < 70	Median	% < 70
Buffet	297	84	11.9	81	23.6
Traditional Daytime	121	81	22.9	76	32.8
Evening	93	83	13.7	79.5	26.9
Prior Year Day	403	78	19.6	72.7	41.8
Prior Year Evening	97	84.5	11.3	79	30.1

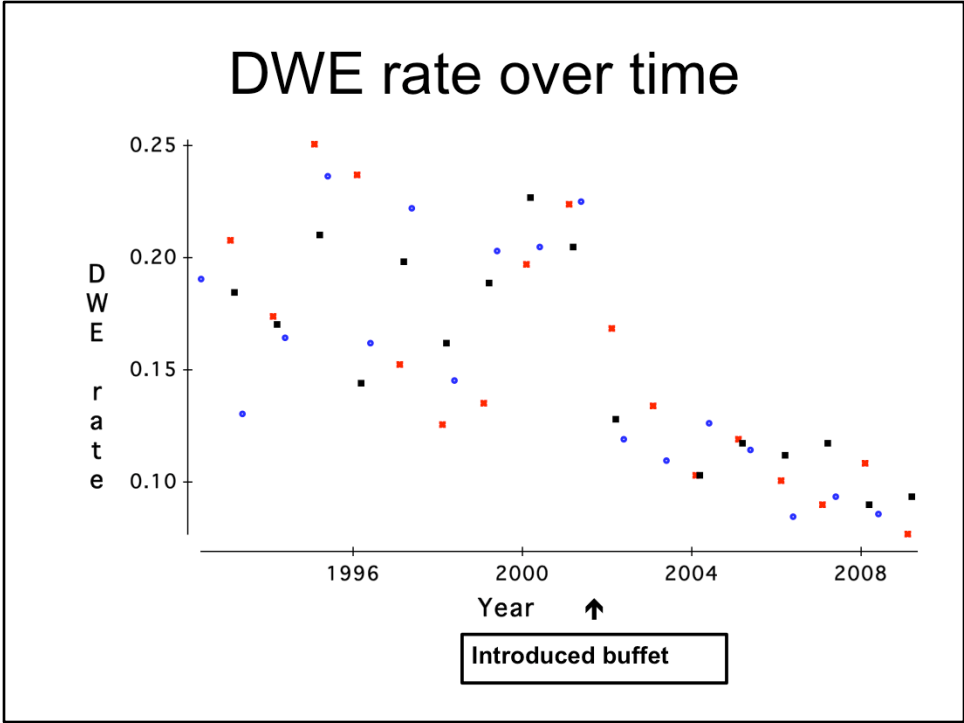
Note: class-to-class variability during 2003-2009 under the buffet model has been $\approx 1.5\%$

Evening classes have older students in smaller classes who had done better than daytime students for the previous decade. Students in the first buffet course did better on the same final exam as other students in Spring 2002. A revision of the orientation process now ensures that all students are able to make a choice.

Student Retention – year before and after implementation

Issue	4 Quarters prior to Buffet	Under Buffet
Withdrawals	11%	8%
Grade E or fails to meet requirement	7%	3%
Incompletes	2%	1%
Total	20%	12%

Note: fewer course repetitions means enrollment no longer includes 240 students per year who would be taking the course for the second or third time.

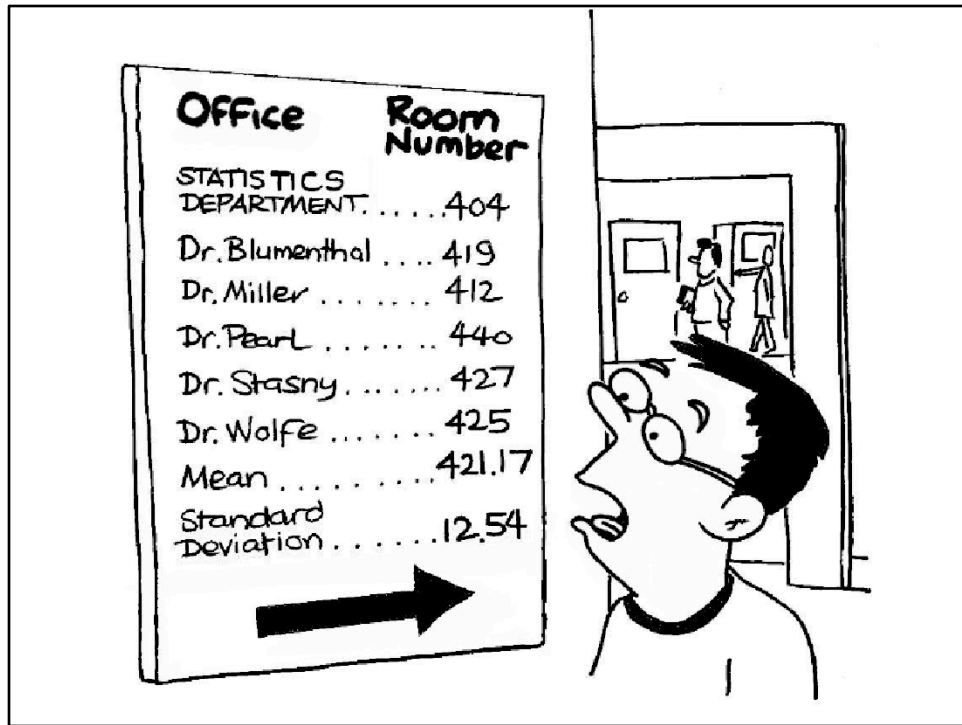


Note trend in recent years may be due to incremental course improvements OR students getting better (but summer sections not under buffet still at 20% level much higher rate of DWE so evidence is fairly strong)

Strength of the Evidence

- Have I shown that the new method was effective in my situation?
- Have I shown that the results of this study would generalize to other situations?

Are the numbers meaningful?

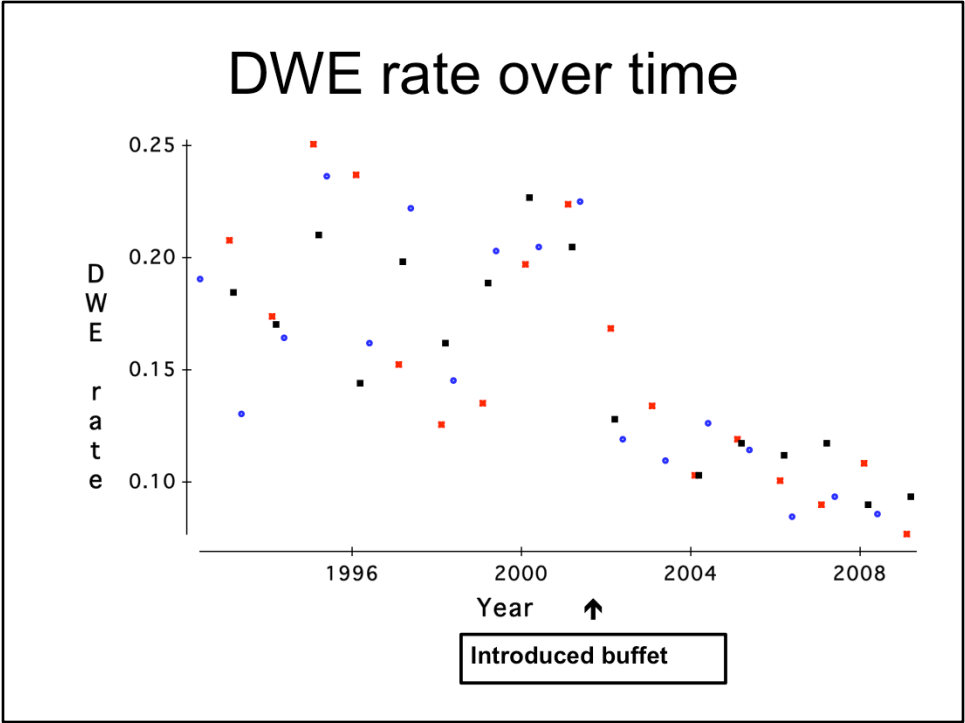


I am happy to report that my office number 440 is more than one and a half standard deviations above average!
Now realize I need to collect more relevant data.



To study the effectiveness of the next redesign

- Learning Styles (Felder & Silverman)
- School Strategies Scale (Tuckman)
- Student Attitudes Towards Statistics (Schau)
- Student Characteristics
- Statistics Thinking And Reasoning Test (START: Garfield, delMas, & Chance)



Note trend in recent years may be due to course improvements OR students getting better (but summer sections still at much higher rate of DWE)

Fold-Increase in odds of knowing concept on the Statistical Thinking And Reasoning Test (START)

Term	Fold Increase	95% CI
Winter 2008	1.48	(1.24, 1.72)
Spring 2008	1.64	(1.43, 1.87)
Fall 2008	1.74	(1.53, 1.97)
Winter 2009	1.78	(1.55, 2.03)
Spring 2009	1.72	(1.56, 1.90)
Fall 2009	1.63	(1.48, 1.78)

By comparing to a nationally normed concepts inventory we get an independent view of “value added” of the course. Here compare pre-course results to end of course results. Data for students who spent at least 5 minutes (Spring 2009 switched to making it part of grade 3 points out of 670 and response rates have gone up considerably)

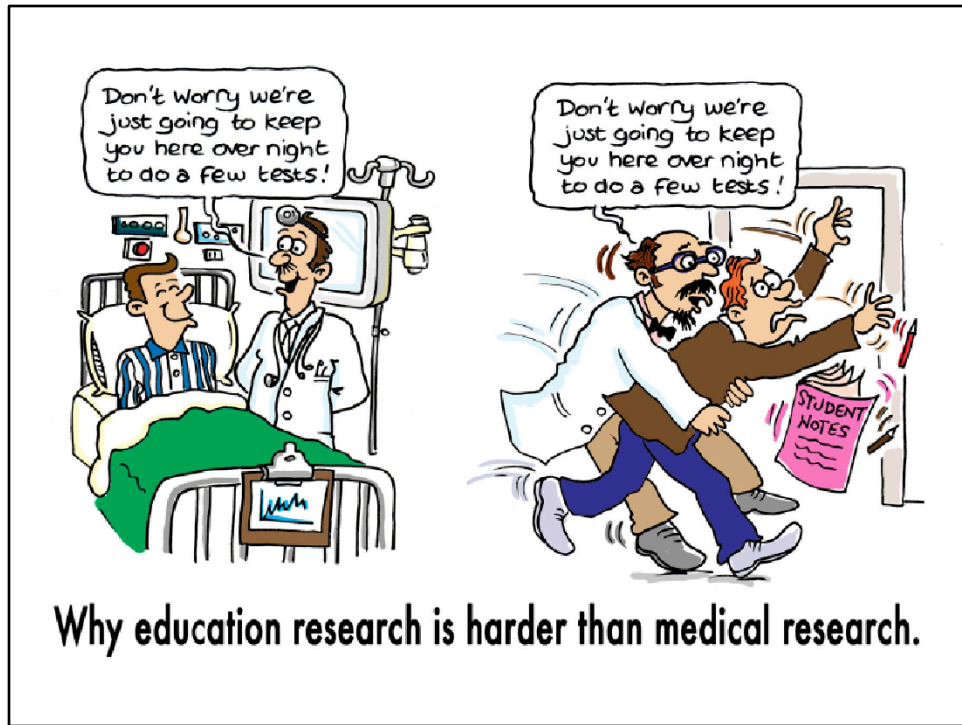


By collecting data on multiple endpoints and key explanatory variables we can get a better picture...

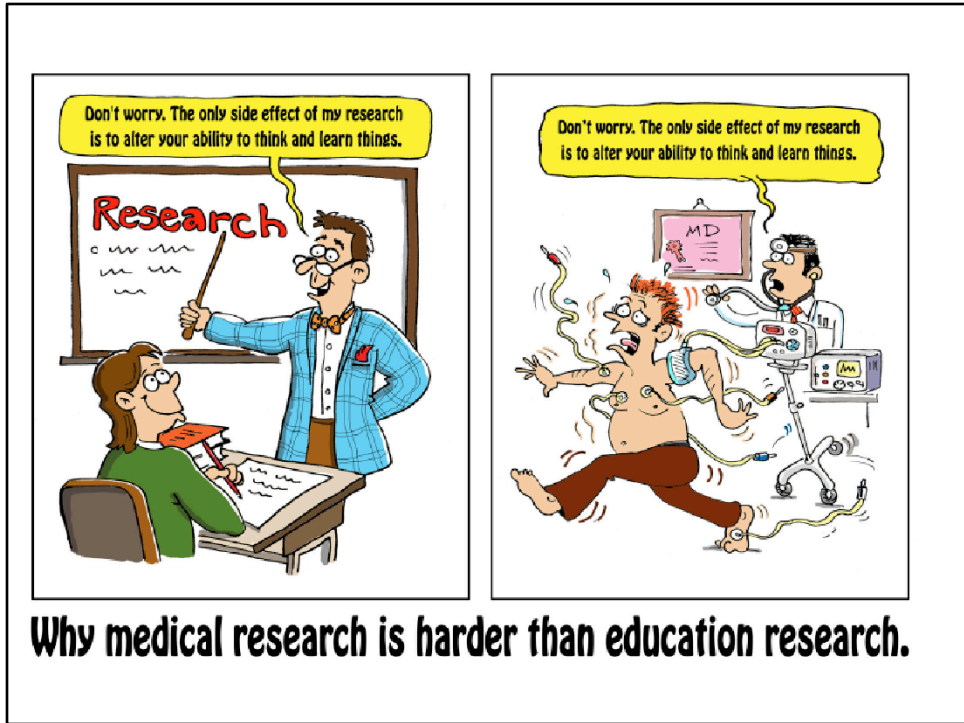
Rank Correlations

	ACT	GPA	SSS	SATS	Final	START
ACT math	1.000					
GPA	0.238	1.000				
Test composure (SSS)	0.140	0.143	1.000			
Cognitive Competence (SATS)	-0.233	-0.174	-0.296	1.000		
Final Exam	0.511	0.575	0.126	-0.292	1.000	
START	0.246	0.319	0.224	-0.251	0.402	1.000

But the picture may never be sharp. Education data like other Social science data is often frustrating to those used to the reliable data of laboratories in the physical and natural sciences.



DON'T WORRY WE'RE JUST GOING TO KEEP YOU HERE OVERNIGHT TO DO A FEW TESTS.



DON'T WORRY THE ONLY SIDE EFFECT TO MY RESEARCH IS TO ALTER THE WAY YOU THINK AND LEARN!



Summary: Components of Success

1. **Individualizing presentations**
 - Explains \approx just under 60% of the benefit
2. **Fostering commitment**
 - student contracts
 - checklists
 - calendars



Summary: Components of Success

3. Increase self-awareness

- learning styles
- school strategies

4. Explicit learning objectives

- integrate components of course
- appropriately direct feedback

5. Test what's important

- “test to the teach”



Summary: Components of Success

6. Build peer-to-peer community

- global help room
- collaborative learning activities

7. Staff training

- customer service training for course assistants
- Summer teaching course



Summary: Components of Success

8. Campus-wide collaboration

- **EEGP**

9. Feedback

- **3-minute papers**
- **Mid-term feedback**
- **e-mail focus groups**
- **Testimony to inform future students**

"I have a Ph.D. and 20 years experience. But I'm a Statistician, so my conclusions will always be more qualified than I am."

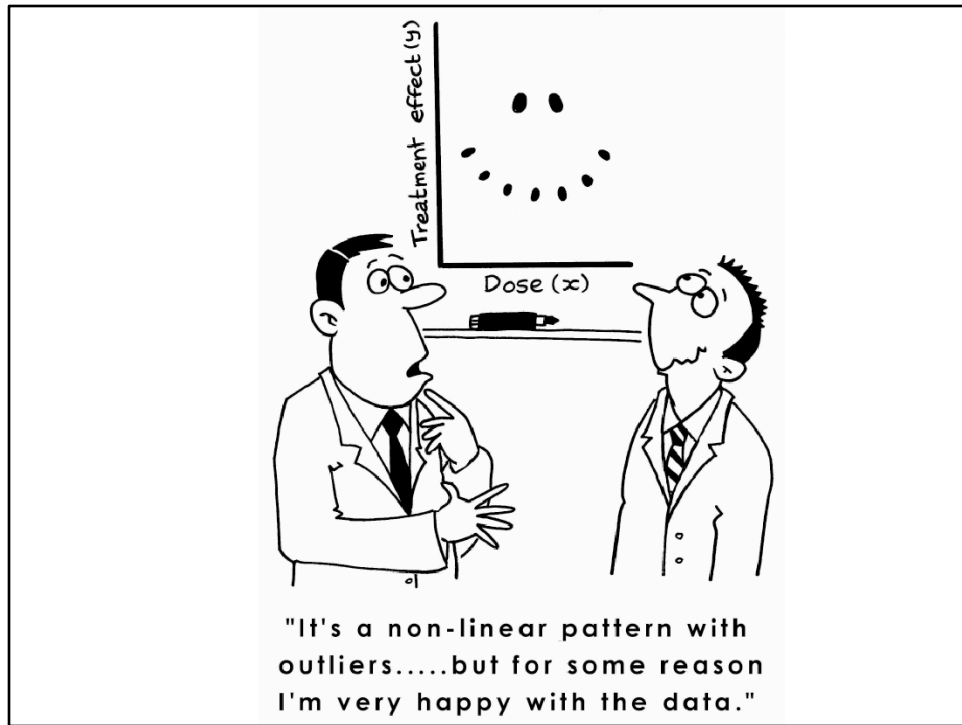
"My average student is doing great. Half my class thinks $2+2=3$ and the other half thinks $2+2=5$."

"You better hurry. Management wants the data cleaned up by tomorrow morning."

"I got the instructions from my Statistics Professor. He was 80% confident that the true location of the restaurant was in this neighborhood."

The tattoo parlor near campus got busy when the professor required hand calculation of the standard deviation.

10. Using humor can increase student interest, recall of material, and conceptual understanding (Friedman et al, 2002; Lomax et al, 1998)



Recognizing the caveats in my data but still feel as though the redesign helped with student learning



Drivers and Goals of the Next Redesign

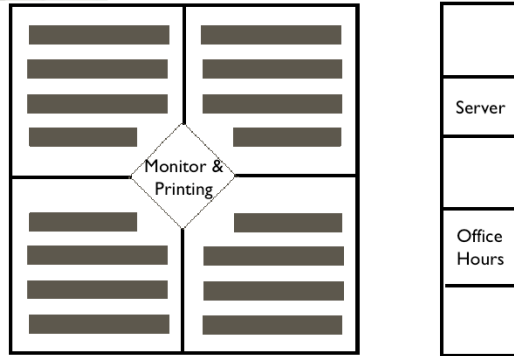
- Ohio State switch to semester system
- Incorporating regional campuses
- Move to one, two, and three day options in the buffet.
- Learning gains and savings from “Facilities that Facilitate.”



1990 Computer Lab design
by Pearl

- Displays inside tables for clear view of whiteboard
- Instructor screen projection

- One TA serves 29 students
- Single monitor can view 4 rooms during open hours
- Networked to share data





2008 Computer Lab design
by Rumsey & Silva

- U-shaped tables encourage student interaction
- Improved learning at reduced cost

- Instructor can see and share any screen
- Tablet allows “handwritten” annotations





Drivers and Goals of the Next Redesign

- Ohio State switch to semester system
- Incorporating regional campuses
- Move to one, two, and three day options in the buffet.
- Learning gains and savings from “Facilities that Facilitate.”
- Improving Student Attitudes.

We saw positive student reaction to the buffet pedagogy – but positive attitudes toward the pedagogy are less important to me than attitudes about statistics

Percent Change in three dimensions of the Student Attitudes Towards Statistics (SATS) inventory

Dimension	% Change
Value	-1.03%
Interest	-15.1%
Competence	-2.61%

Value – importance for other classes, future work, in life (DO I NEED TO LEARN IT)

Interest – DO I WANT TO LEARN IT?

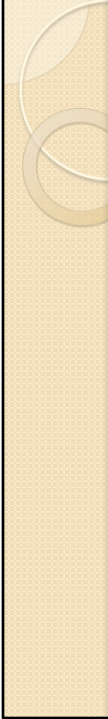
Cognitive Competence – CAN I LEARN IT? Values are almost identical to published norms nationally

To deal with issue now tracking during the term to see effect of different content – need to better integrate content seen.

Final Word – Statistics at the Border



Coming back from a Carnegie Cluster meeting on building faculty communities in the Scholarship of teaching and learning...



**Bottom line –
Know your goals and how you can
measure whether they have been
achieved.**

Then plug into the infrastructure that let's you do that. For my next redesign I want to continue to make improvements in student learning and pedagogical efficiency but also to show gains in student attitudes. Students should leave course saying Yes I can learn, Yes I need to learn, Yes I want to learn this topic. I want the Journalism major to realize she needs to be able to interpret data fro surveys, I want the nursing major to realize he wants to be able to converse about statistical issues in biomedical experiments and I want the criminology major to realize he **REALLY NEEDS STATISTICS** because he might get a job as a guard at the Canadian border!

