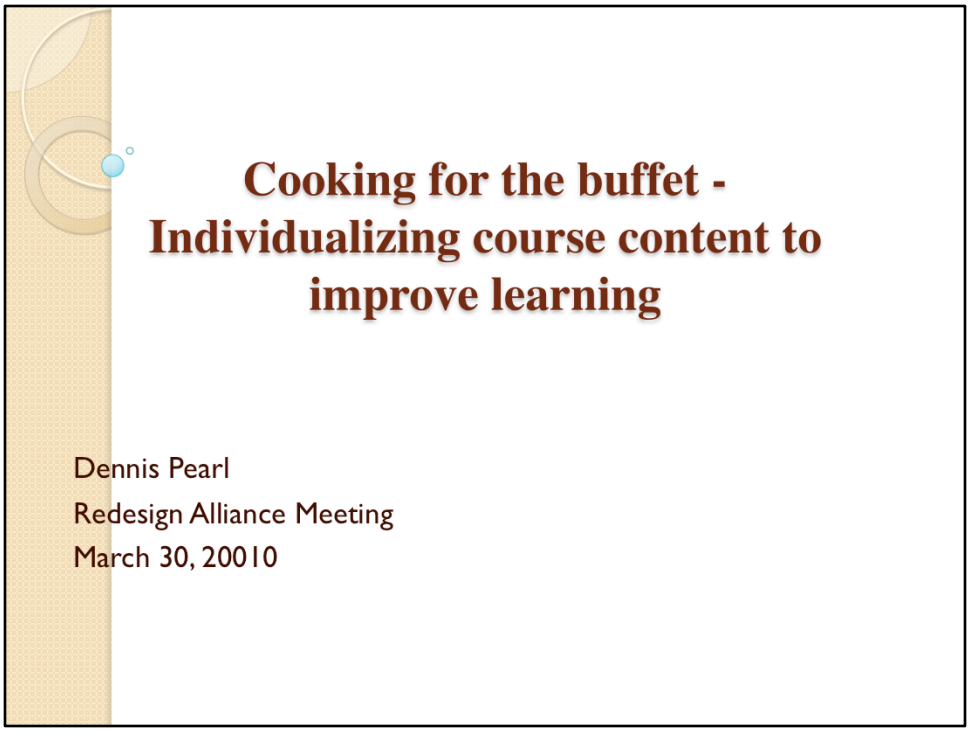
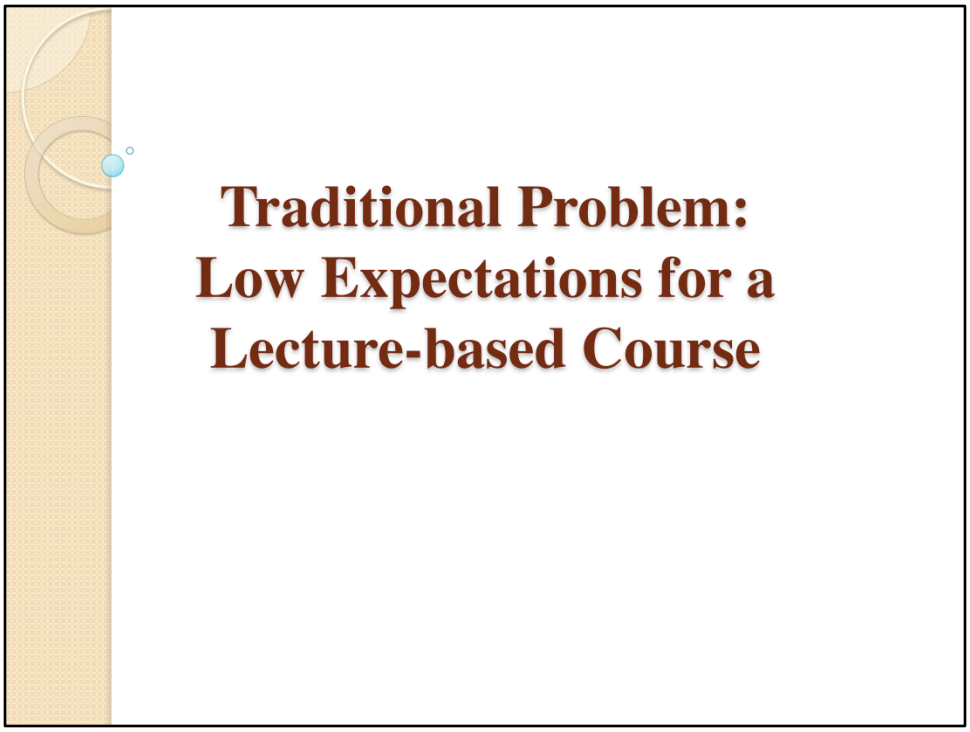


This project was initiated during NCAT's Pew Program in Course Redesign. Remember the two take home keywords from Kay McClenney's keynote ~~yesterday morning: "mandatory" (student's don't do optional) and~~ "personalized." Buffet = "Mandatory Personalization."

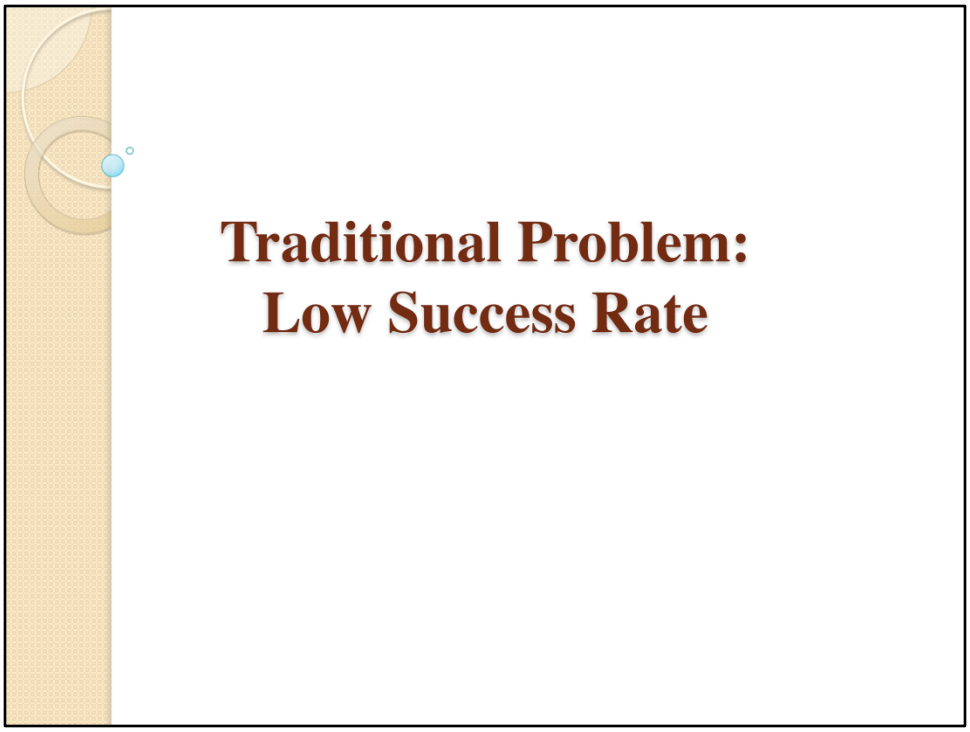
Tentative Agenda

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



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~~ …

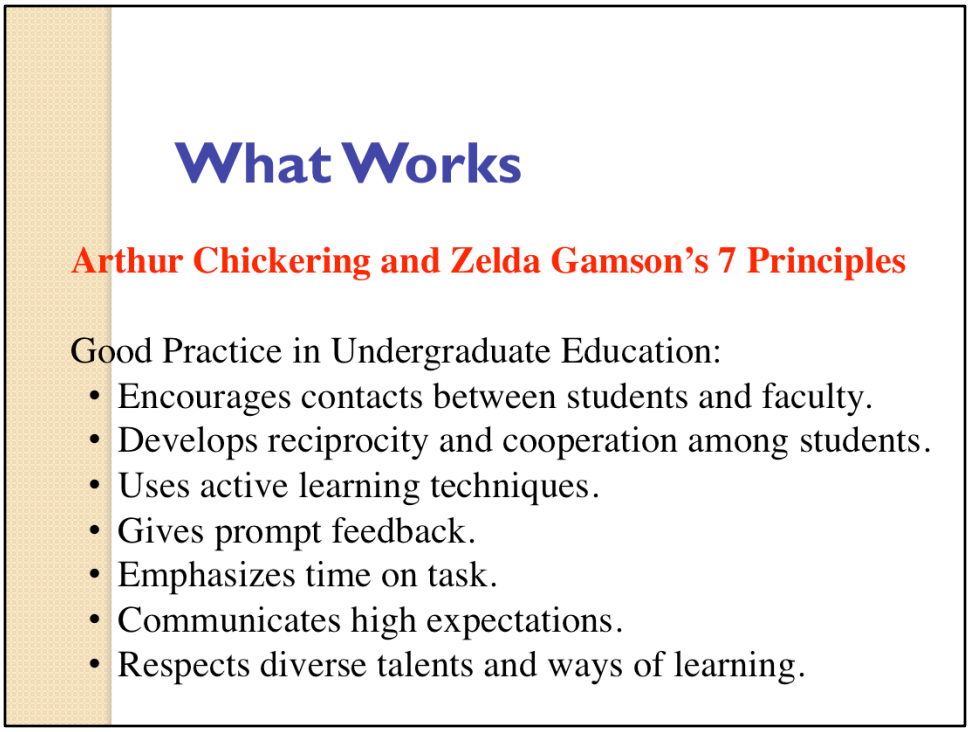
"I don't talk in my sleep. I'm a Statistics Lecturer. I talk in other people's sleep."



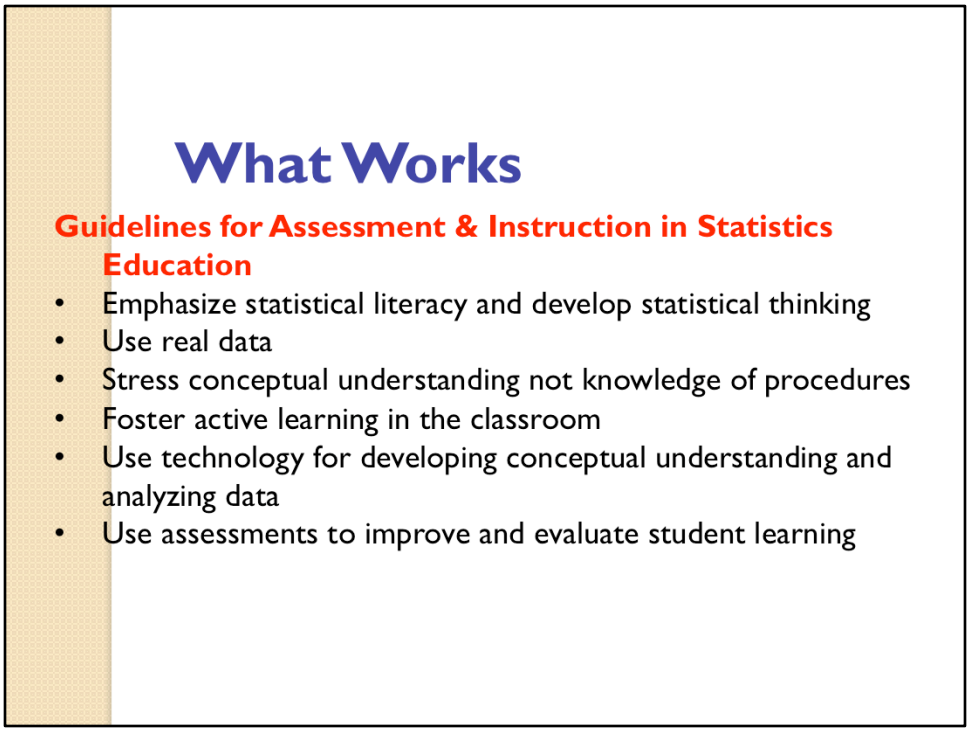
And students were not doing too well so that passing statistics was a barrier to graduation for many…

"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…

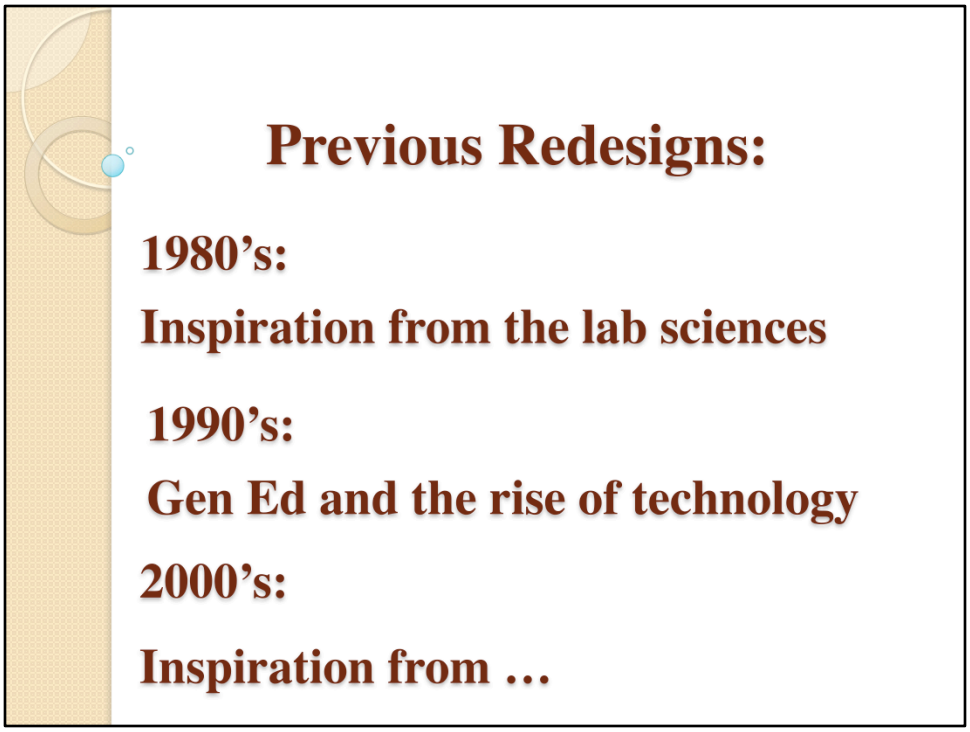


1987 Higher Ed Bulletin article. Time on task is number one in association with learning.
Pedagogical principles – also need to think about relation of pedagogy to content



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.



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

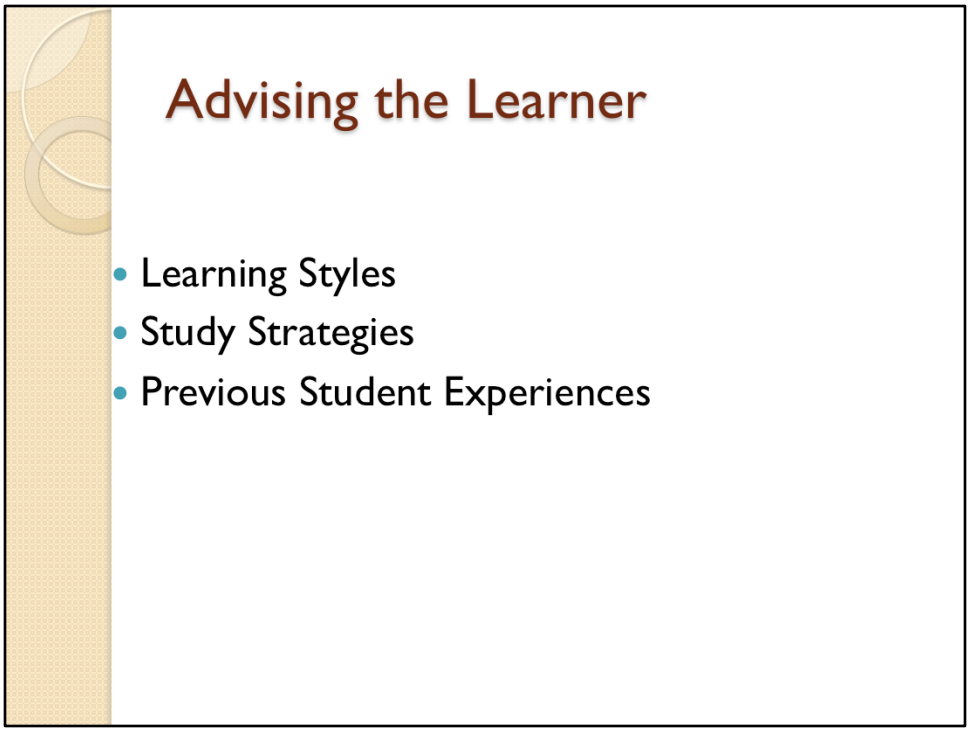
- A Las Vegas buffet

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

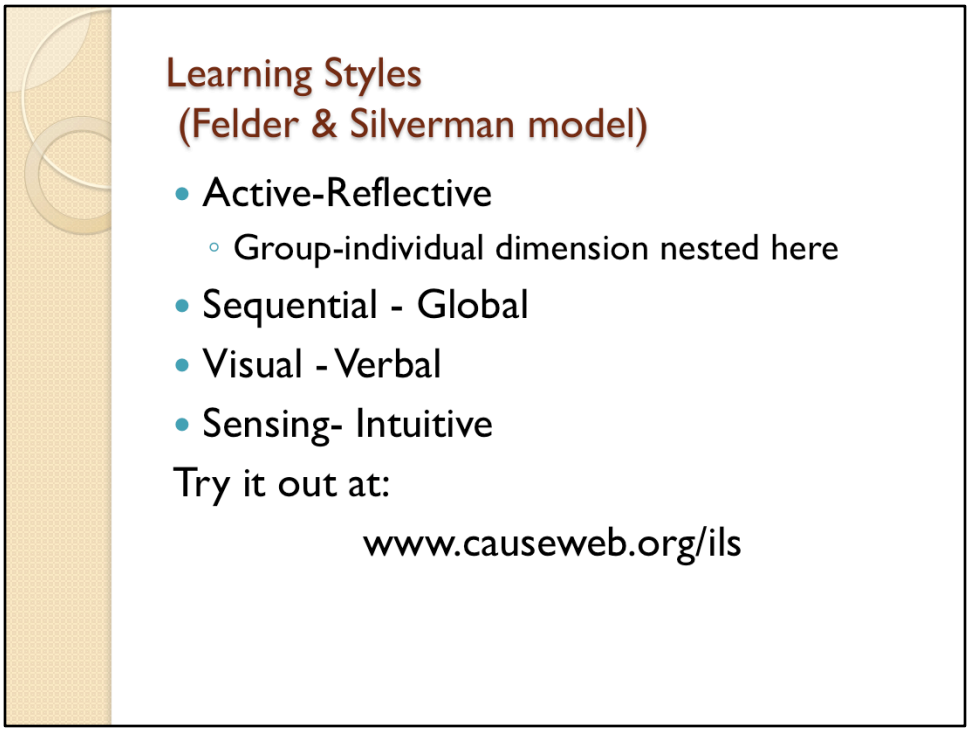
The Buffet Idea

- 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

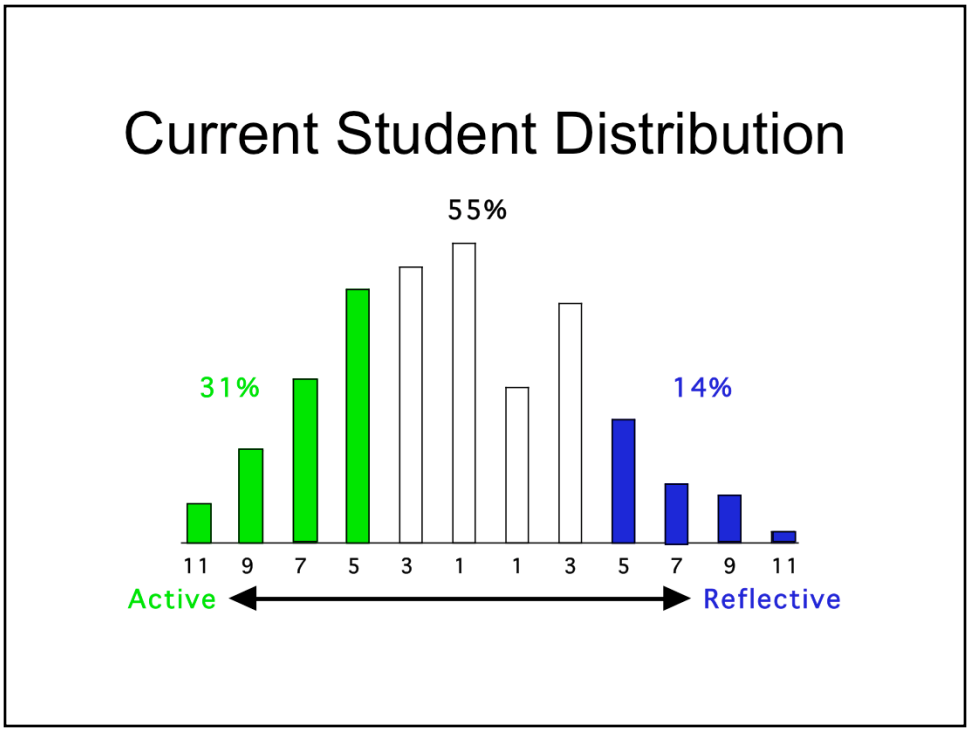
EEGP = Salad Bar … side-dish … main course … desert bar
Enhancing concept comprehension & retention Leah Savion &Joan Middendorf Indiana University 1994 article



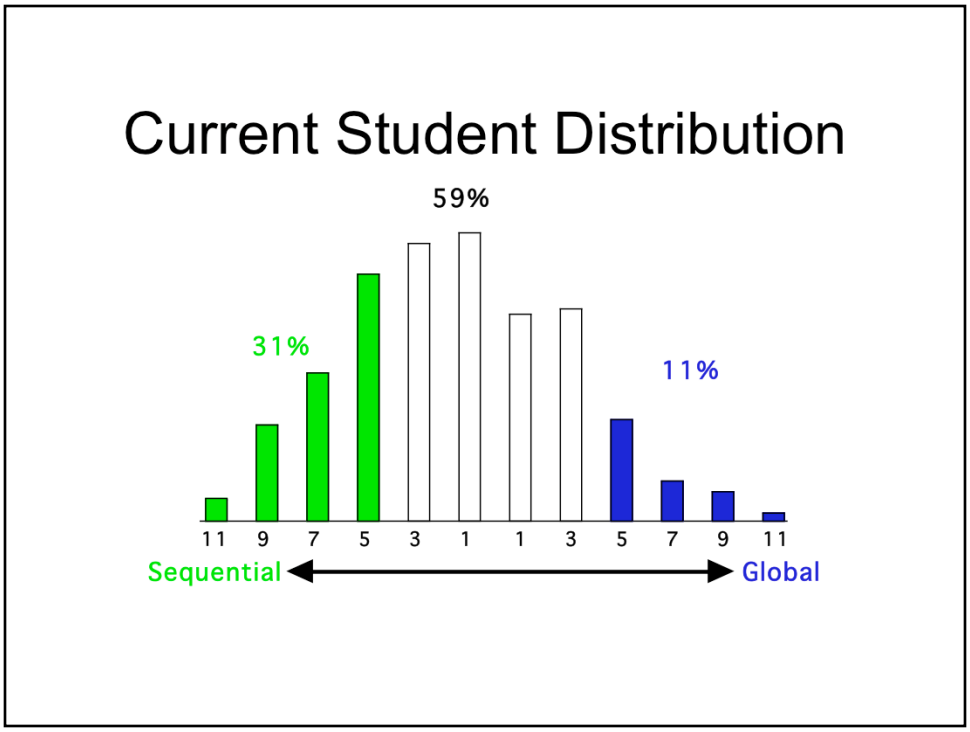
We want students to make appropriate choices based on sound reasons.



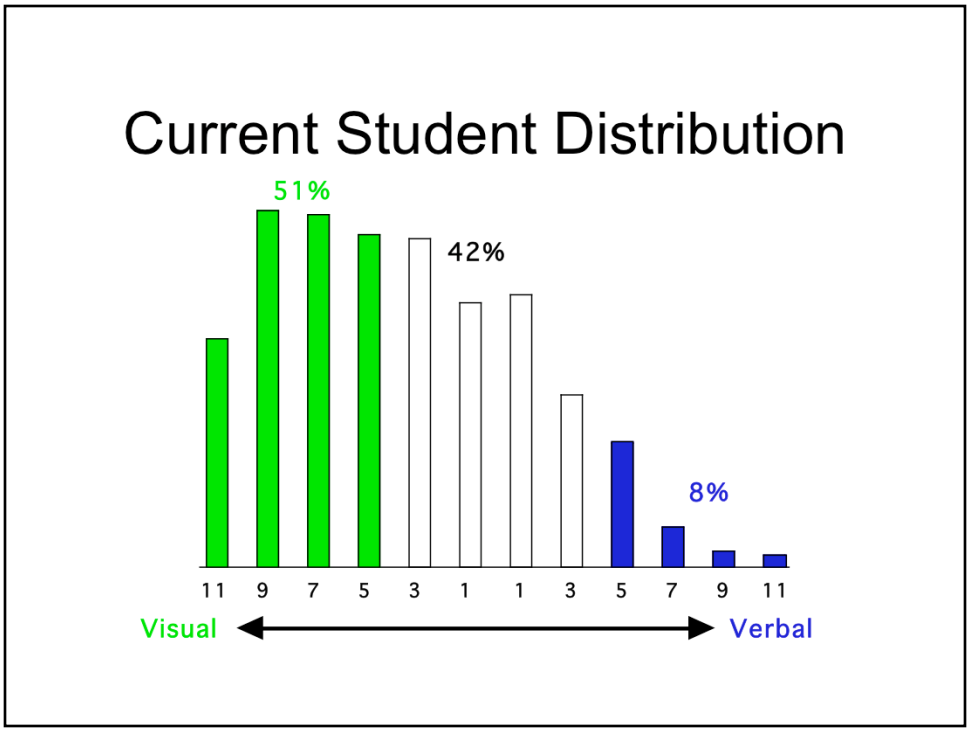
Felder's group is in Engineering education and this seems to be relevant to STEM disciplines.



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

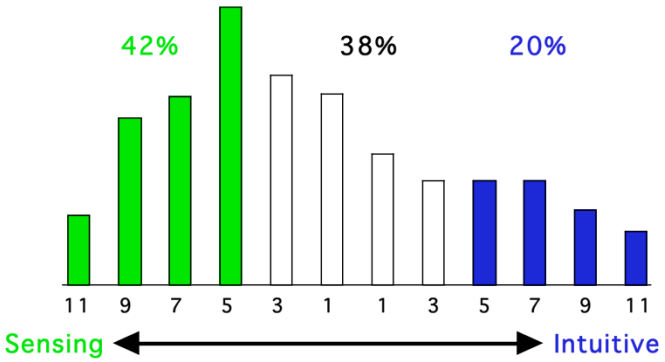


Sequential learners want to hear the details first and build up to the big picture. Global learners want to hear the big picture first, then fill in the details.

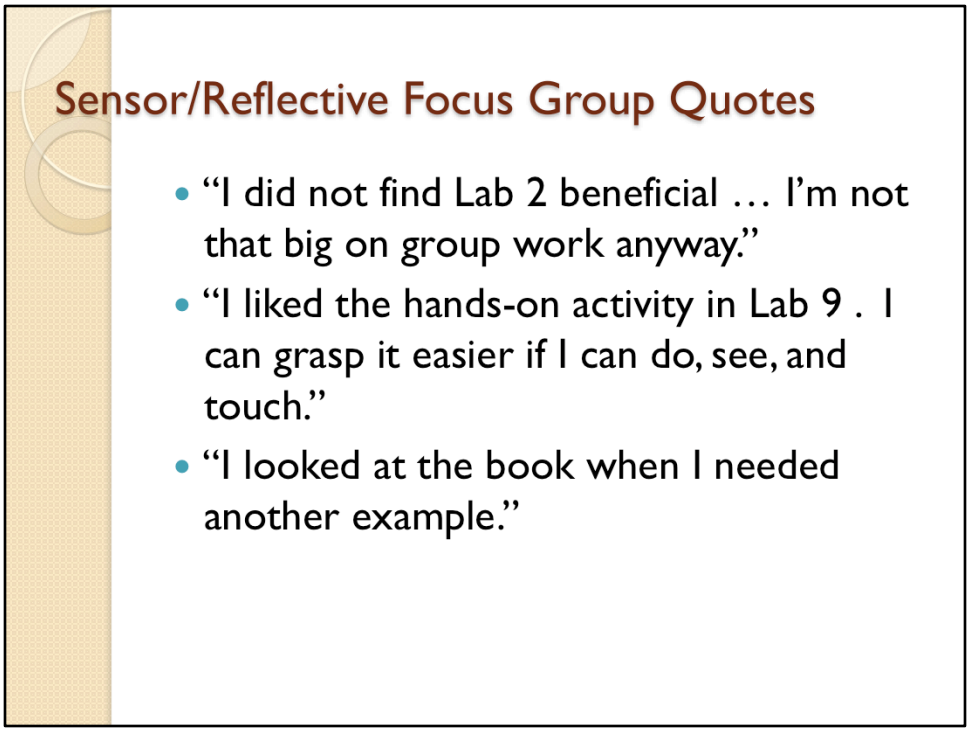


Visual learners remember things when they can see a picture. Verbal learners do well when they hear about it or read about it.

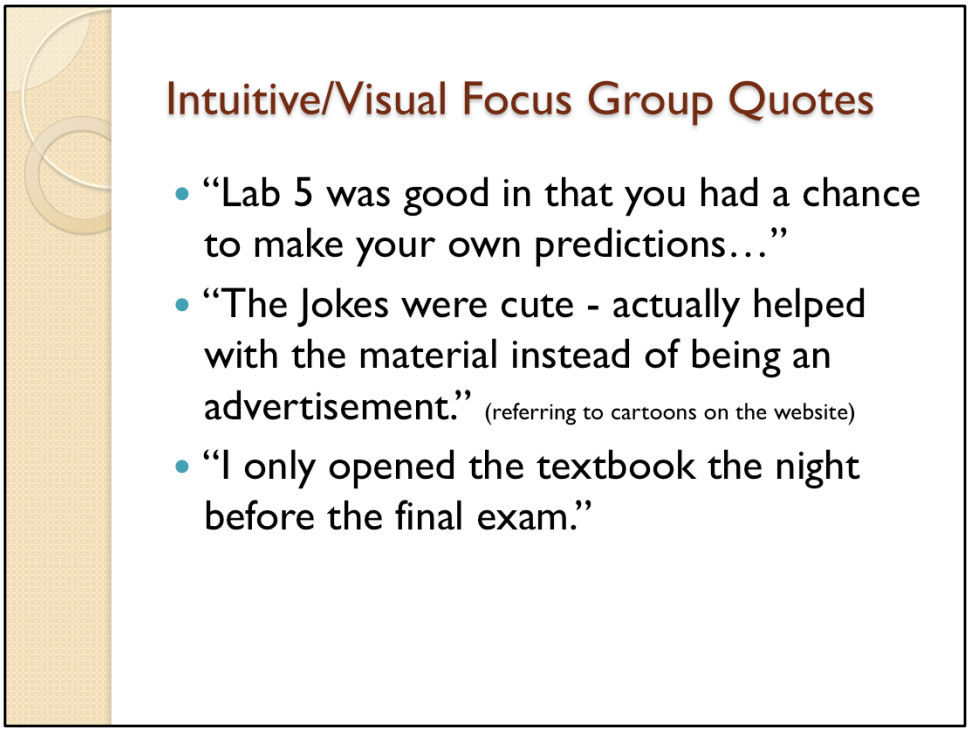
Current Student Distribution



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.



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).



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		

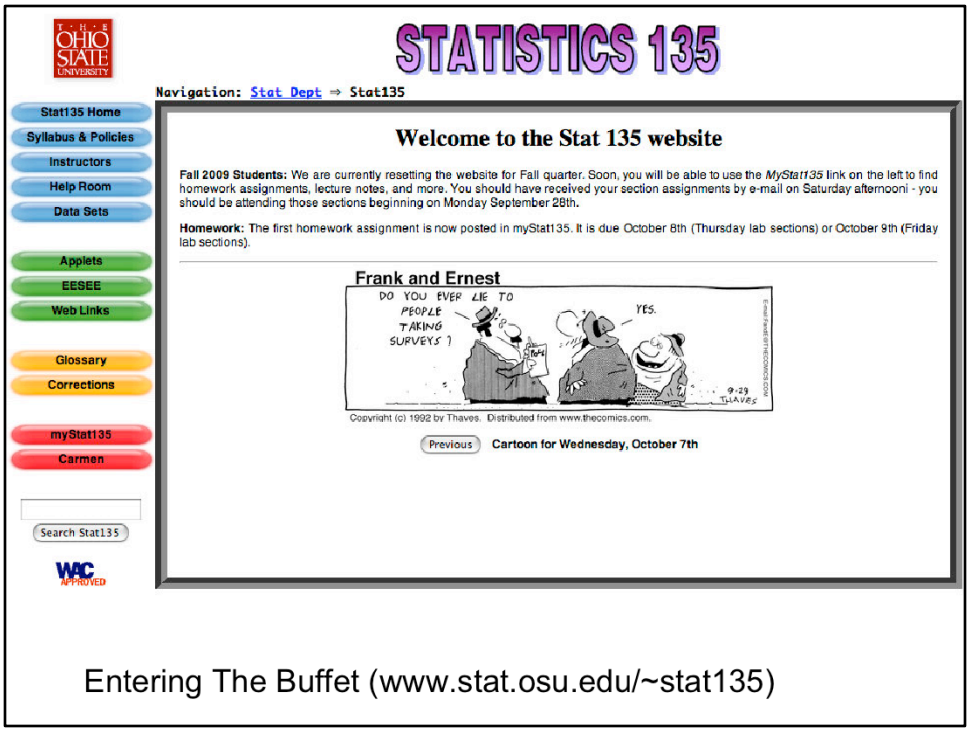
Problem solving may be replaced by out-of-class problem solving coupled with on-line mastery quizzing.

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.

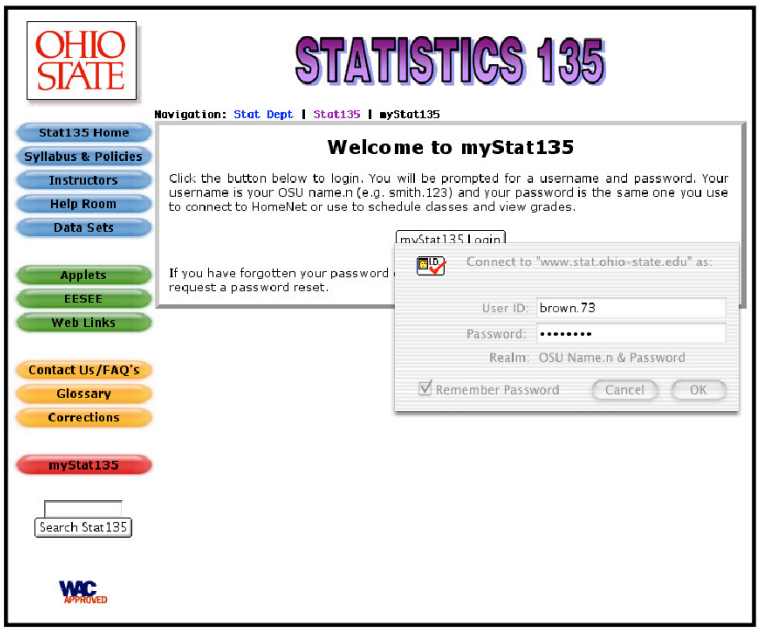
Small Group Options in a 3-choice Buffet

	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.

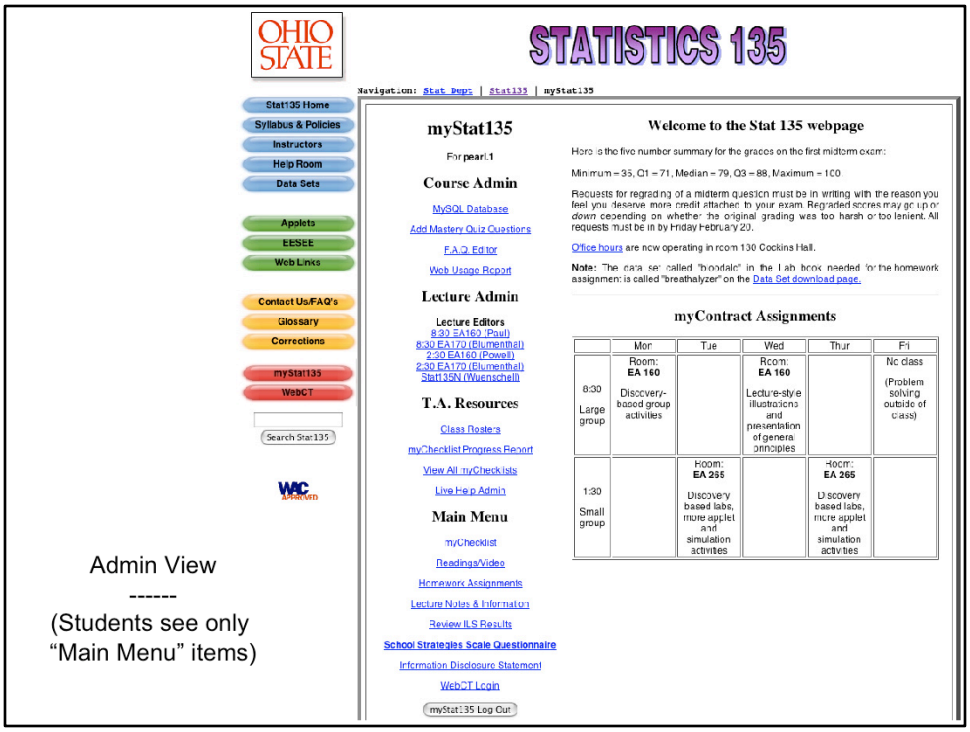


Entering The Buffet (www.stat.osu.edu/~stat135)



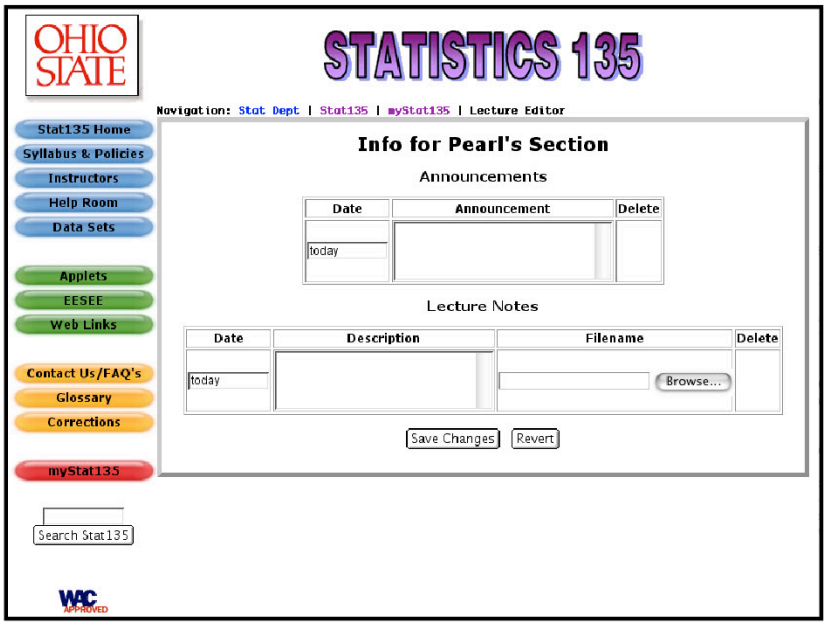
Log-in

Login uses university-wide e-mail and password



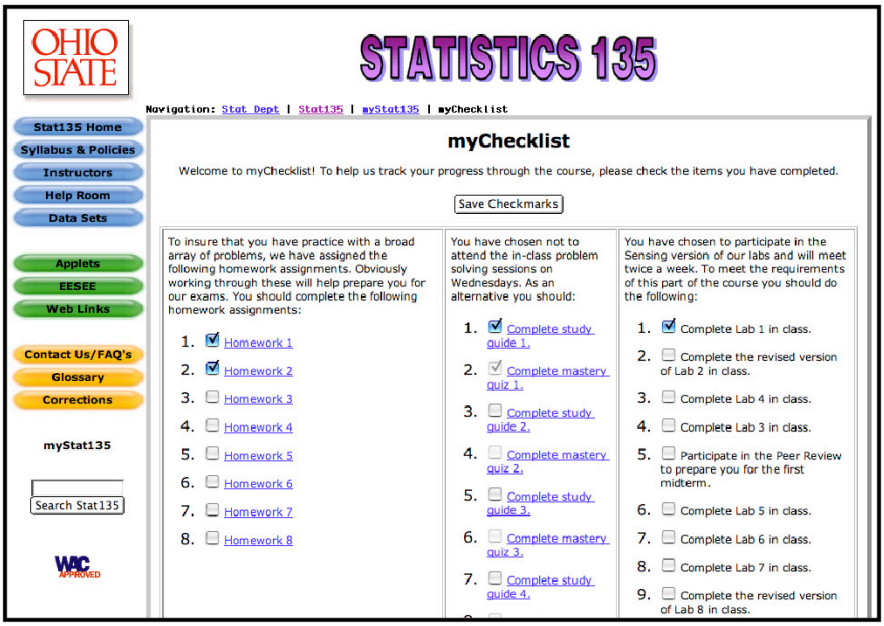
Admin View

(Students see only "Main Menu" items)



Preparing the Menu

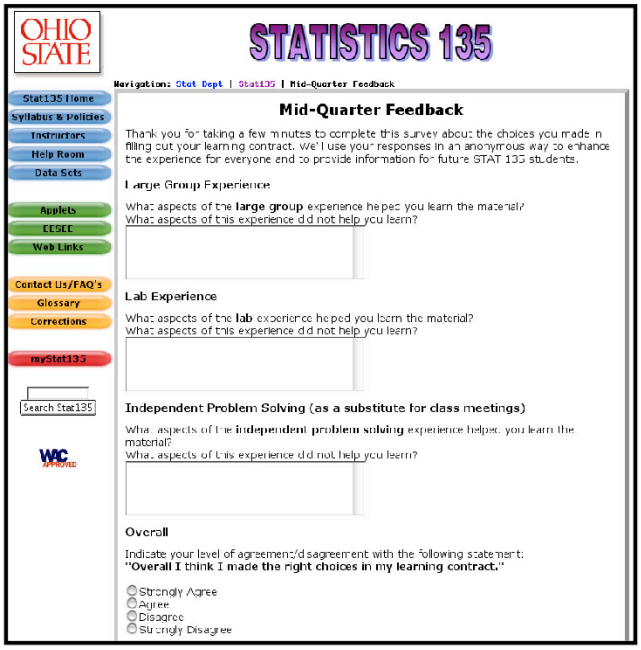
Behind the scenes - an instructor's interface. Here: to post announcements and lecture notes



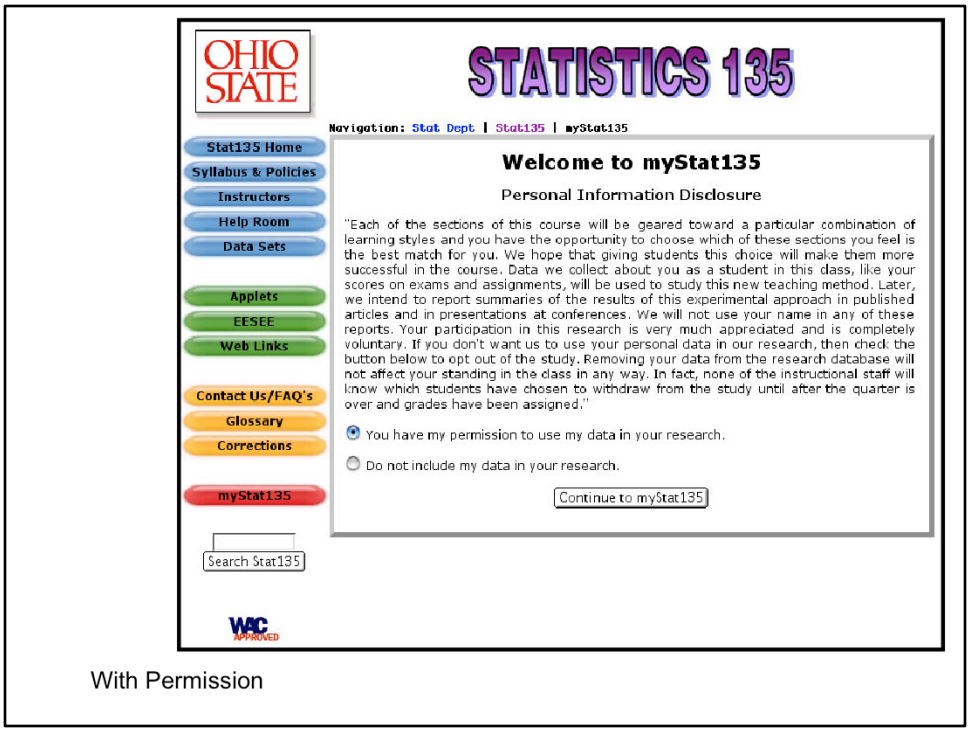
Individualized Student Checklist

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

Gathering Testimony



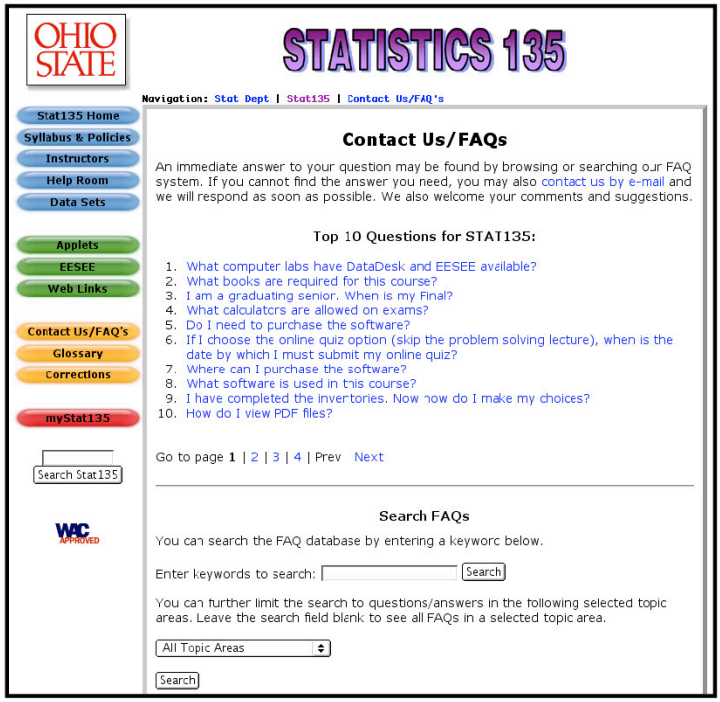
Testimony helps guide course improvements and provides advice to future students.



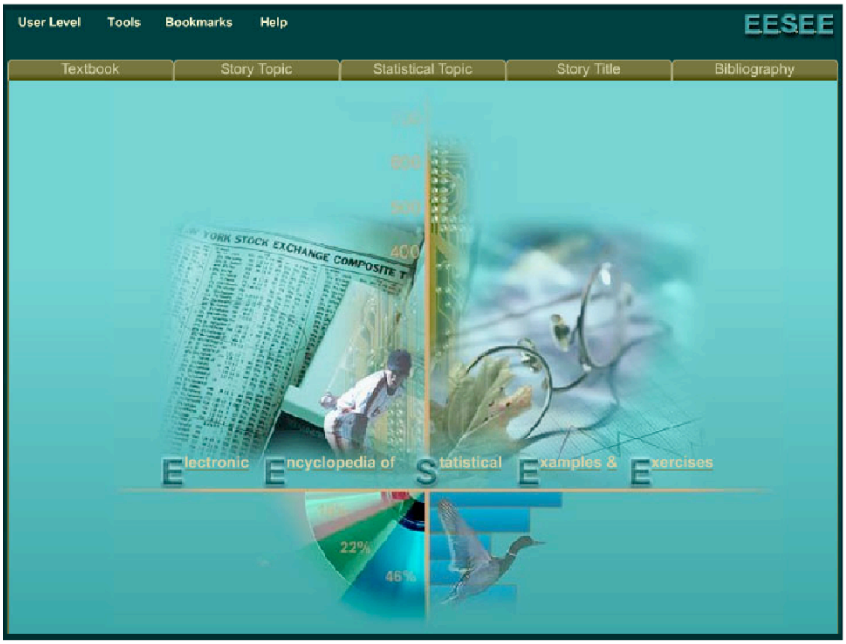
With Permission

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

Answering Questions



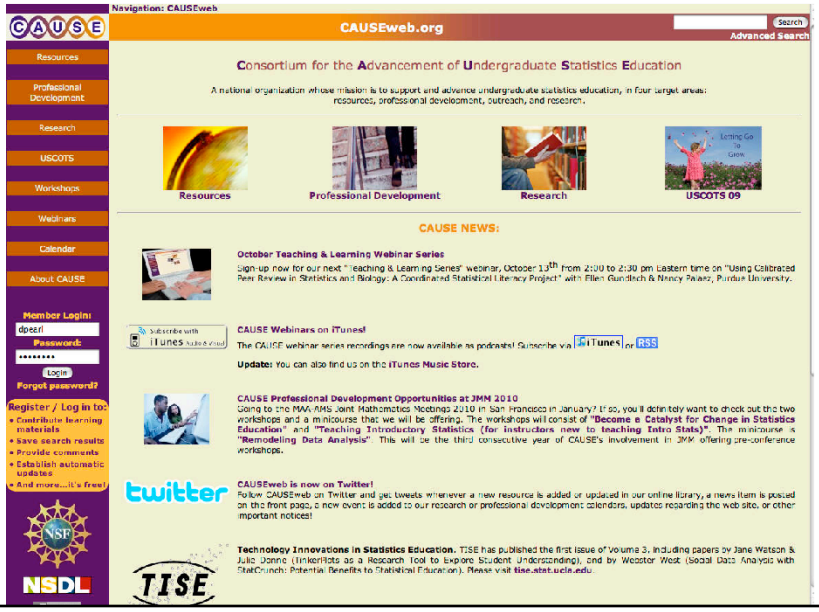
The FAQ system sorts by most common questions (default), by broad topic area, or by relationship to keyword. E-mail is generated if the question is not in the system.



Providing Resources

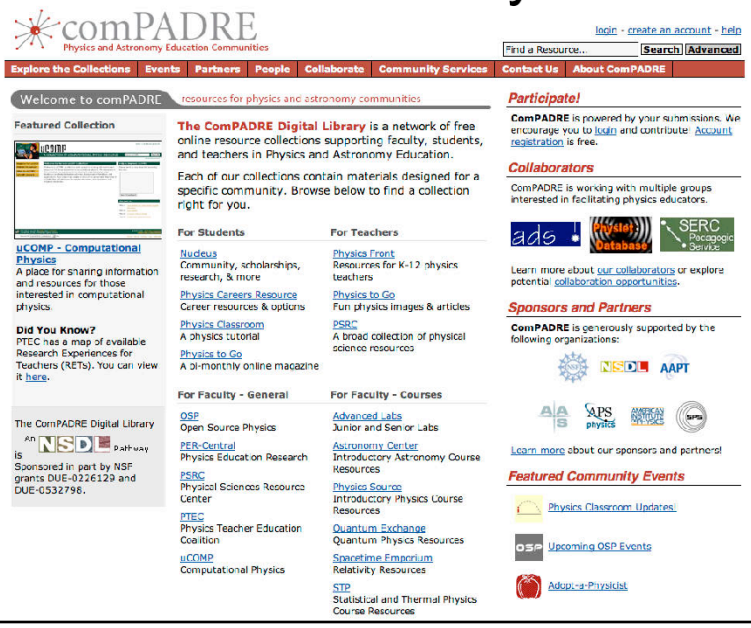
The Electronic Encyclopedia of Statistical Examples and Exercises (EESEE) has approximately 150 stories from the scientific literature and the popular press - with background information, the protocol, datasets, and questions on statistical issues.

Resources: Statistics

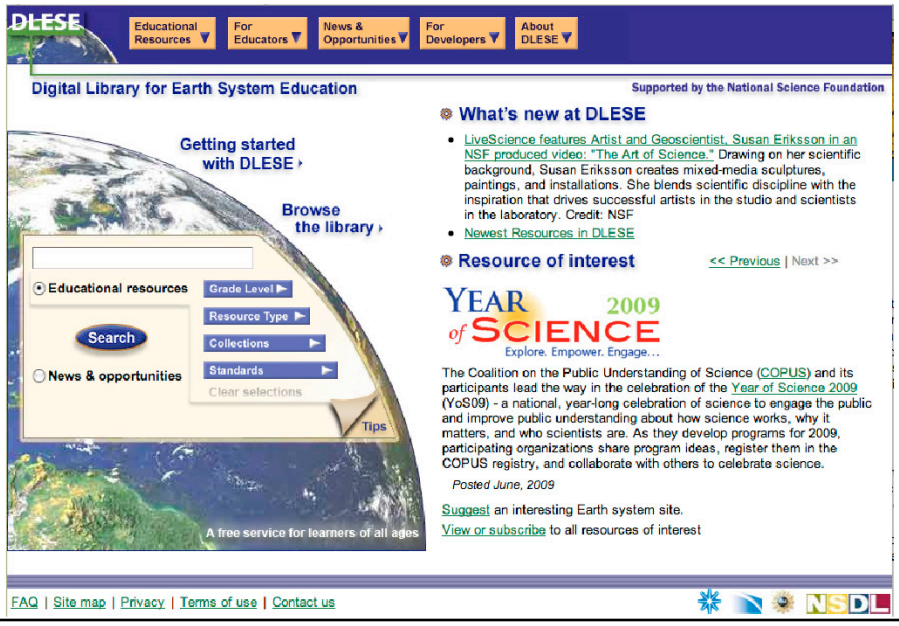


Digital libraries of resources for teachers are now available for most every discipline. Our site for statistics is at www.causeweb.org

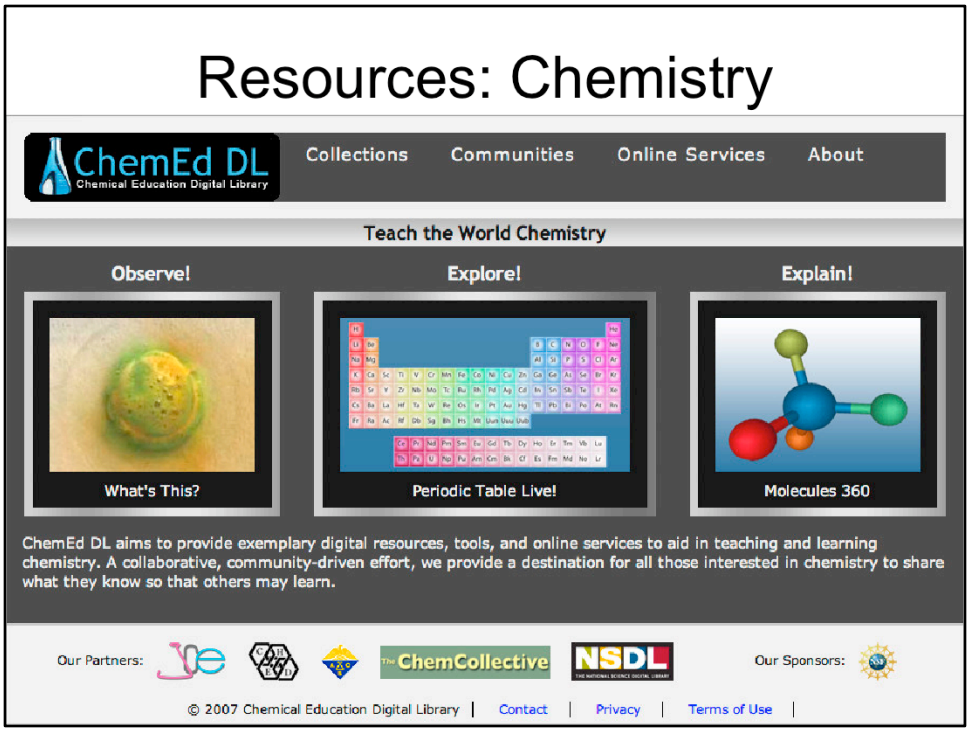
Resources: Physics



Resources: Earth Sciences



Resources: Chemistry



Resources: Biology

Resources: Mathematics

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

Resources: that are relevant

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.

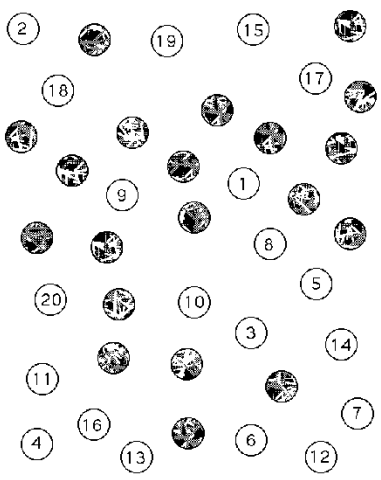
61. Understand that the regression method is used to estimate the average value of y when you know x.

Here are #59 to 61 for regression topic

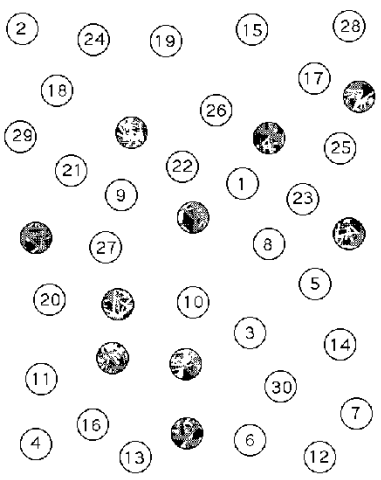
Nuts and bolts issues

- Common coverage of learning objectives
  - 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
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.

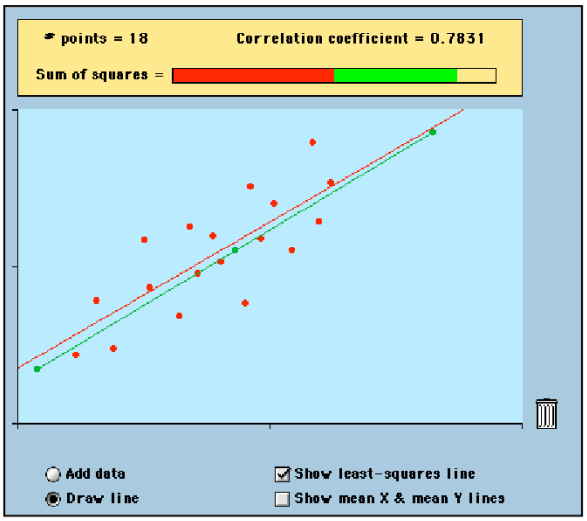


Circle maze x = 20



Circle maze x = 30

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



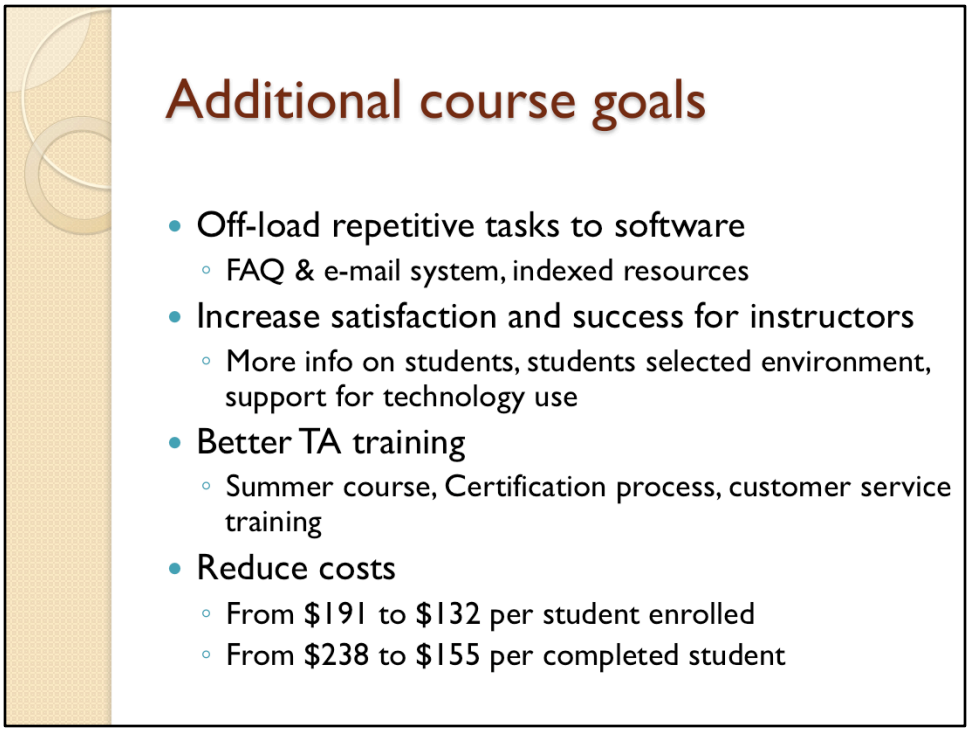
David Moore's Regression applet

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

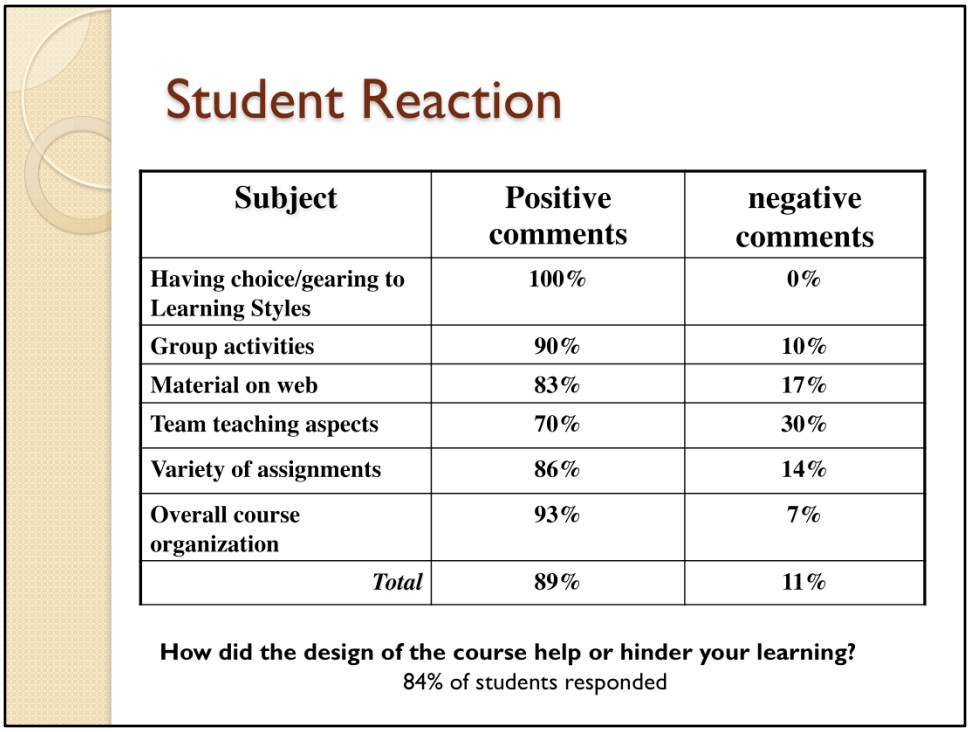
Nuts and bolts issues

- 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



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



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 Dayime	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

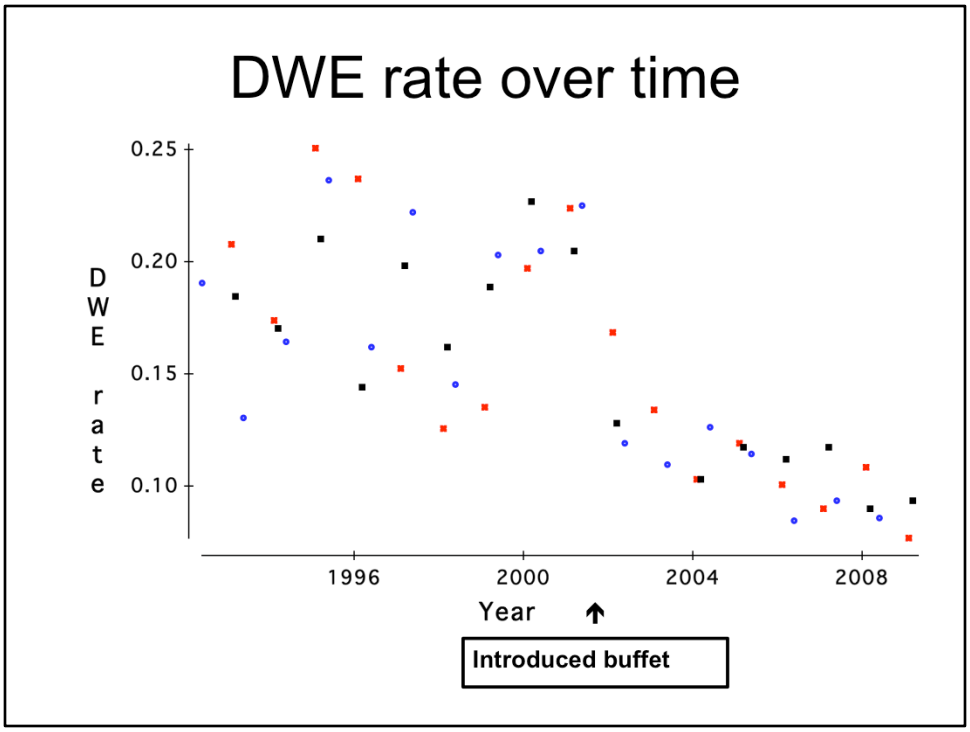
Note: class-to-class variability during 2003-2009 under the buffet model has been ≈ 1.5%

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
Withdrawls	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.

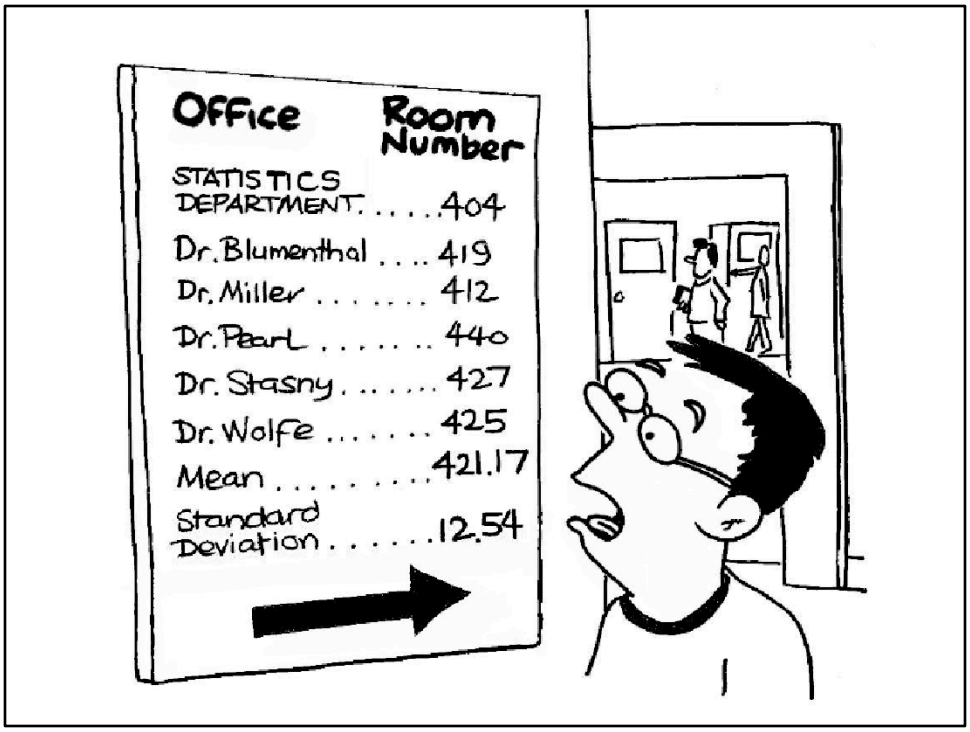


Note trend in recent years may be due to incremental course improvements OR students getting better (but summer sections not under buffet still at 20% level much higher rate of DWE so evidence is fairly strong)

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?

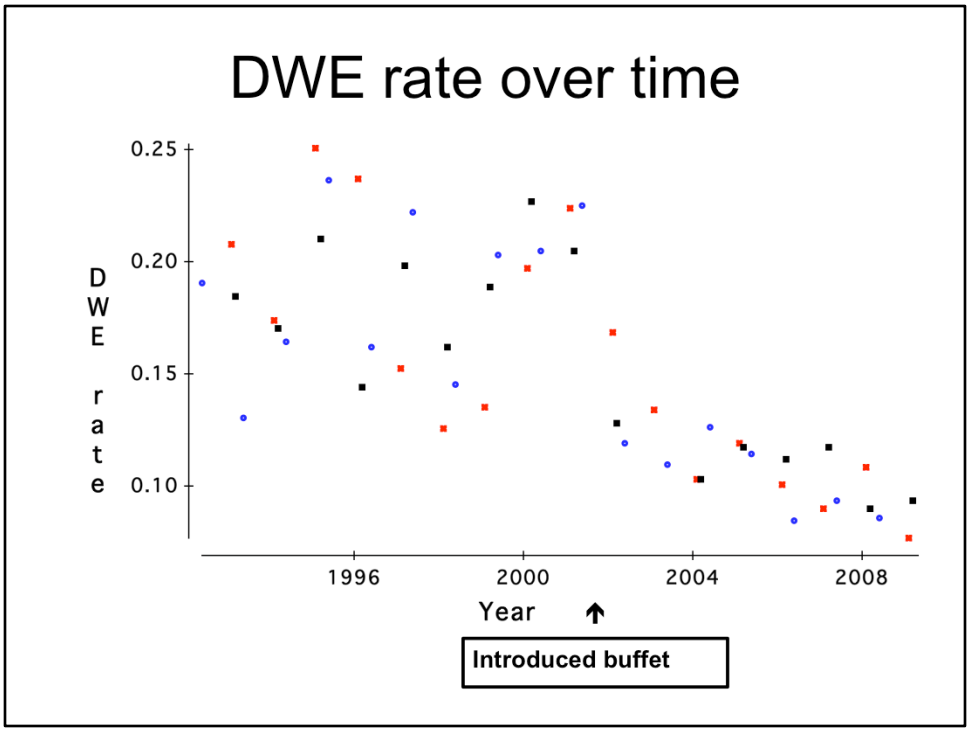


I am happy to report that my office number 440 is more than one and a half standard deviations above average!

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)

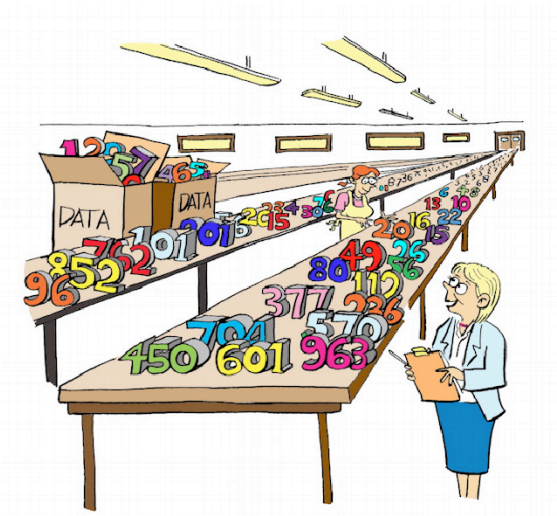


Note trend in recent years may be due to course improvements OR students getting better (but summer sections still at much higher rate of DWE)

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 leas 5 minutes (Spring 2009 switched to making it part of grade 3 points out of 670 and response rates have gone up considerably)

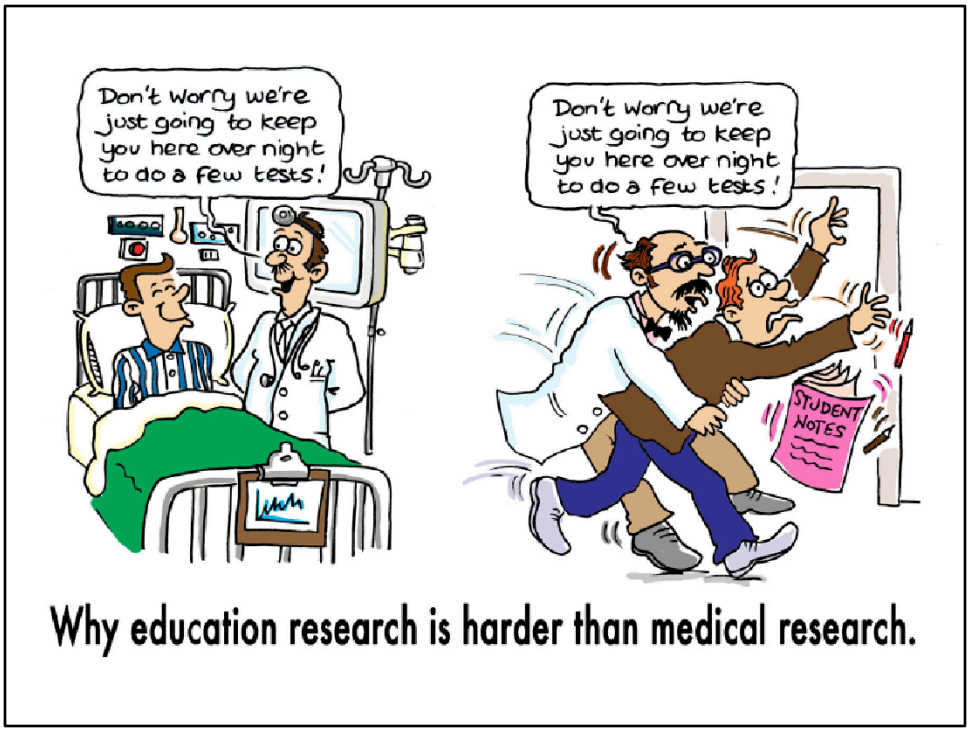


By collecting data on multiple endpoints and key explanatory variables we can get a better picture…

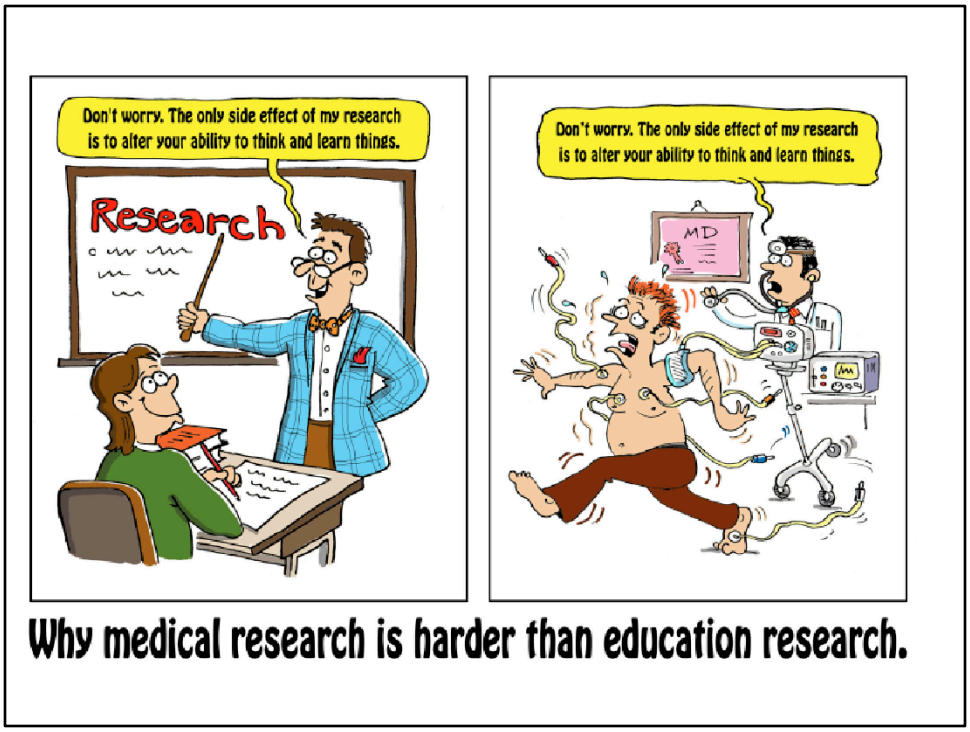
Rank Correlations

	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 EFECT TO MY RESEARCH IS TO ALTER THE WAY YOU THINK AND LEARN!

Summary: Components of Success

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

Summary: Components of Success

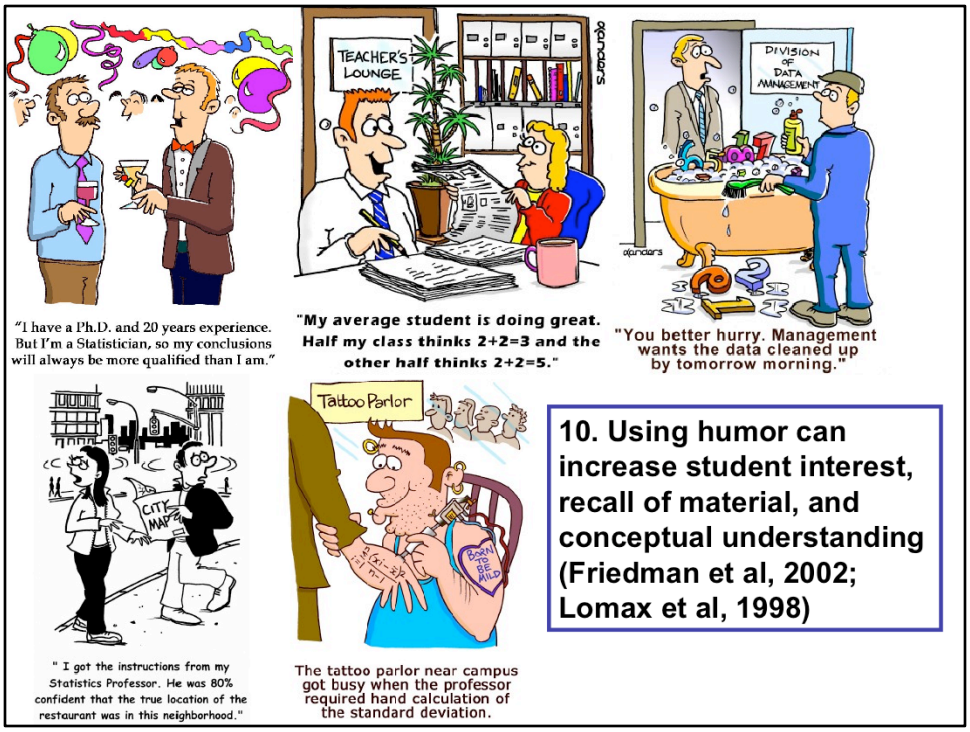
3. Increase self-awareness
   - learning styles
   - school strategies
4. Explicit learning objectives
   - integrate components of course
   - appropriately direct feedback
5. Test what's important
   - "test to the teach"

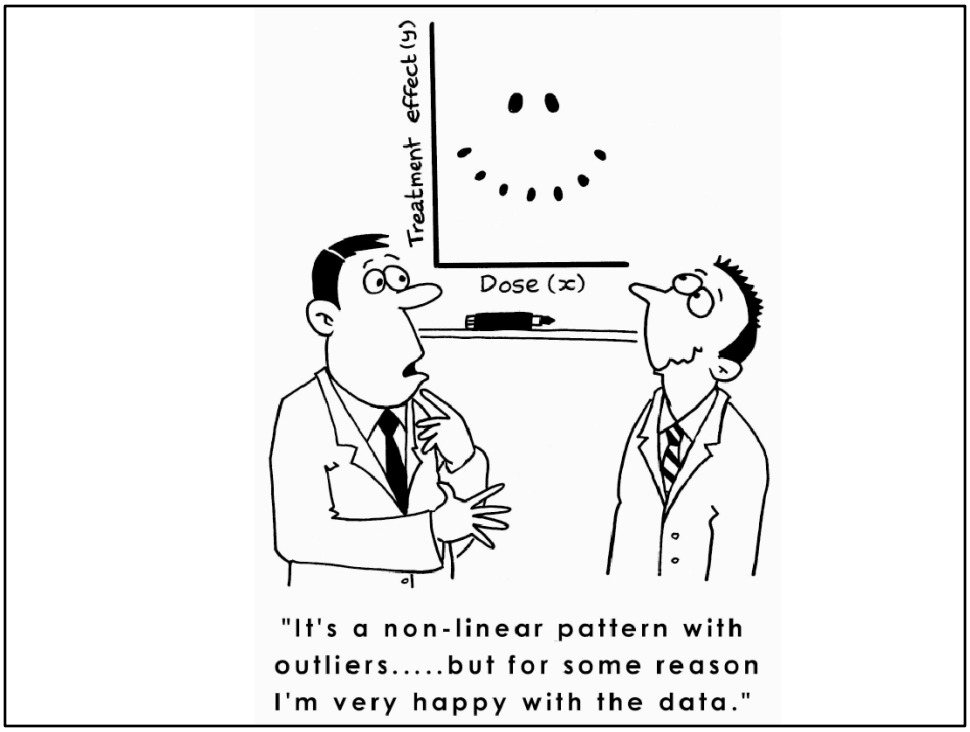
Summary: Components of Success

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."
TEACHER'S LOUNGE
"My average student is doing great. Half my class thinks 2+2=3 and the other half thinks 2+2=5."
DIVISION OF DATA MANAGEMENT
"You better hurry. Management wants the data cleaned up by tomorrow morning."
CITY MAP
" I got the instructions from my Statistics Professor. He was 80% confident that the true location of the restaurant was in this neighborhood."
Tattoo Parlor
BORN TO BE WILD
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

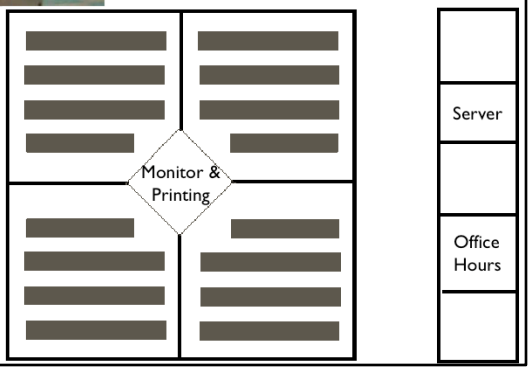
Drivers and Goals of the Next Redesign

- 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

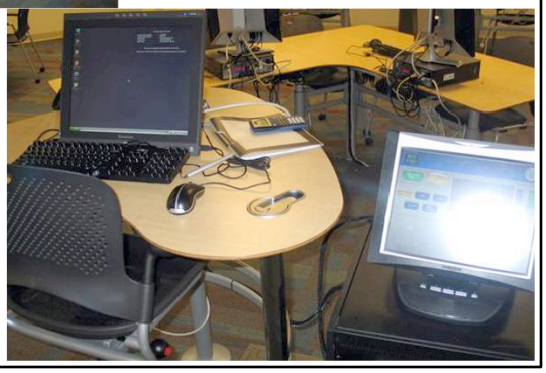
- Displays inside tables for clear view of whiteboard
- Instructor screen projection

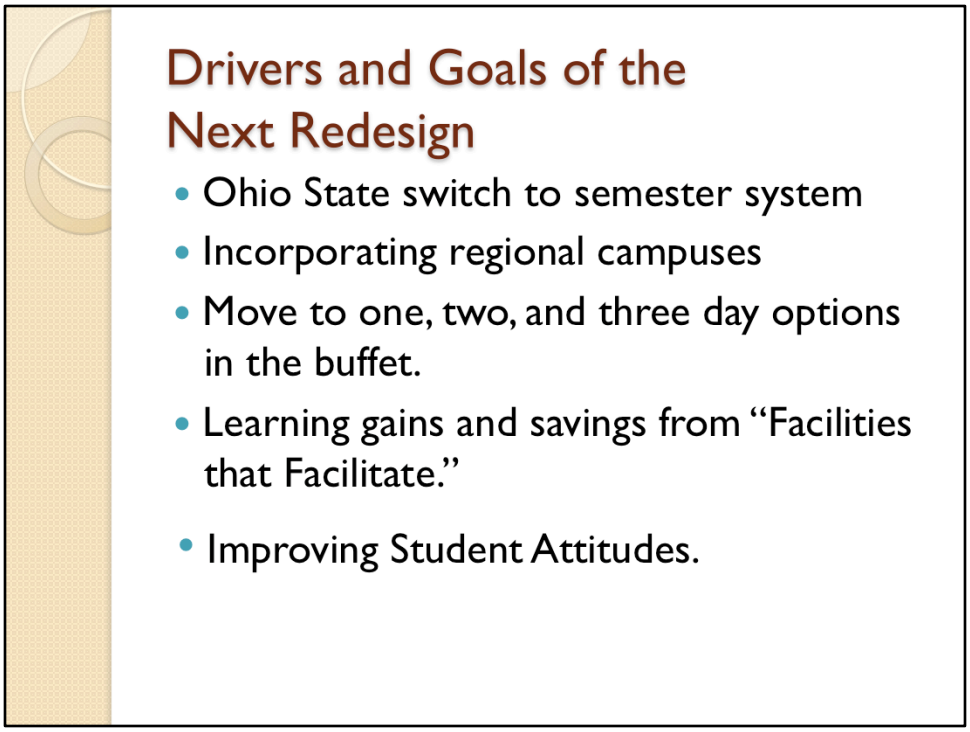
- One TA serves 29 students
- Single monitor can view 4 rooms during open hours
- Networked to share data



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





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

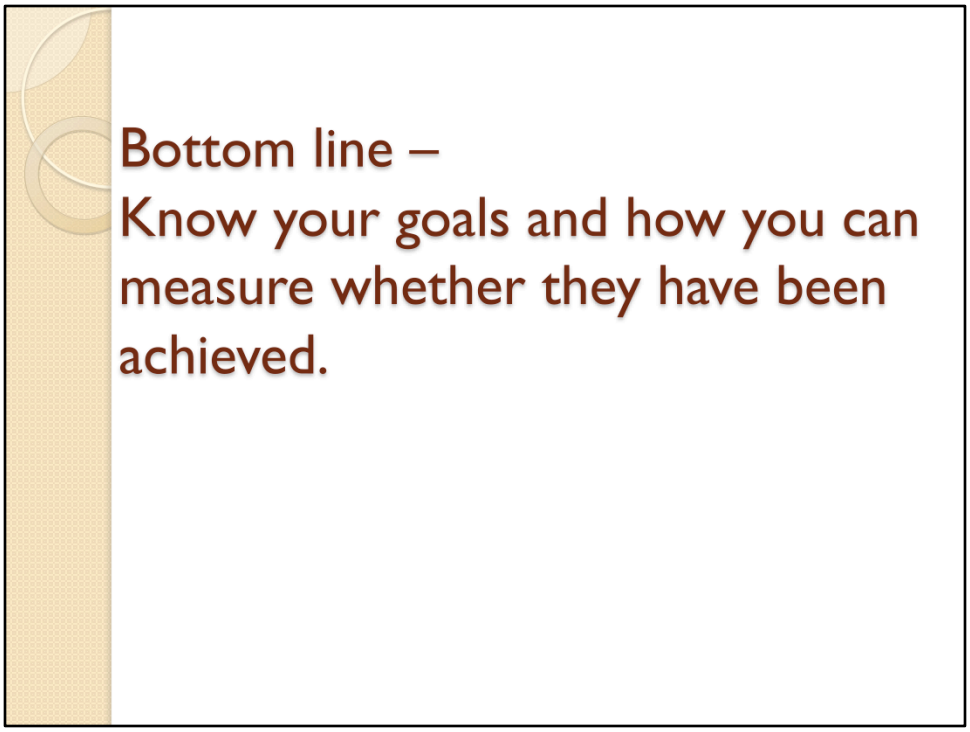
Percent Change in three dimensions of the Student Attitudes Towards Statistics (SATS) inventory

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

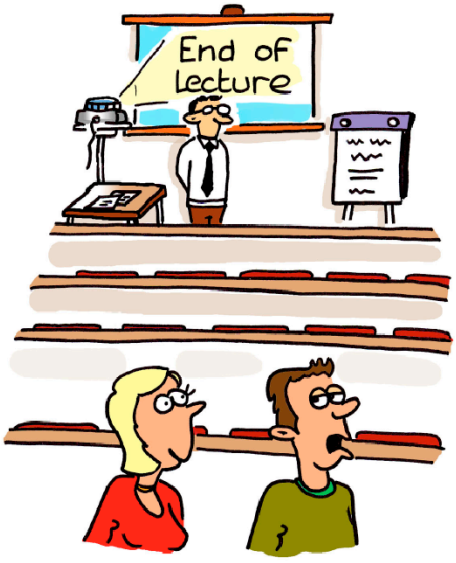
Value – importance for other classes, future work, in life (DO I NEED TO LEARN IT)
Interest – DO I WANT TO LEARN IT?
Cognitive Competence – CAN I LEARN IT? Values are almost identical to published norms nationally
To deal with issue now tracking during the term to see effect of different content – need 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…



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!



"He always allows time for questions. Someday he'll allow time for answers."