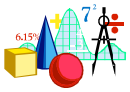
"This is going to be Hard and Boring"

Cindy van Es
Cornell University

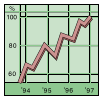
Background

Joined the Department of Applied Economics and Management of Cornell University in 1988.



Introductory Statistics

An introduction to statistical methods. Topics to be covered include the descriptive analysis of data, probability concepts and distributions, estimation and hypothesis testing, regression and correlation analysis. Applications from business, economics, and the biological sciences are used to illustrate the methods covered in the course.



Business Statistics

This course focuses on methods used to analyze data from marketing research, business, and economics. Topics studied include: experimental design, time series and forecasting, and contingency table analysis. Introductions to non-parametric methods and multivariate techniques are also presented. The course will involve a research project designed to give experience in collecting and interpreting data.

Decision Models

The course is focused on economic and statistical models of decision analysis and their application in large and small business settings. It will be shown how use of models can improve the decision process by helping the decision-maker: understand the structure of the decision, incorporate subjective probabilities as a way to portray risk, measure outcomes in a way that is consistent with attitudes toward risk, and understand the value of information.

The thing I remember best about successful people I've met all through the years is their obvious delight in what they are doing…

And it seems to have very little to do with worldly success. They just love what they're doing, and they love it in front of others.

Fred Rogers!

Have you ever met someone new and when they ask what kind of work you do, you get a pained expression when you say you are a Statistics teacher?

People always seem to remember their experience with a Statistics course as either a wonderful or a terrible experience. There is rarely ambivalence.

The learner's "Attitude" towards statistics is something that will probably last longer than their actual statistical knowledge.

As Gal and Ginsburg point out in their 1994 article "The Role of Beliefs and Attitudes in Learning Statistics: Towards an Assessment Framework",

"Many students are likely to have trouble with Statistics due to non-cognitive factors, such as negative attitudes or beliefs towards statistics. Such factors can impede learning of statistics, or hinder the extent to which students will develop statistical intuitions and apply what they have learned outside the classroom.

Some instructors use a preliminary test to assess student's attitudes towards their statistics class.

Popular instruments are:

- SAS - Statistical Attitude Survey (Roberts and Bilderback, 1980)
- ATS - Attitudes Towards Statistics (Wise, 1985)
- SATS - Survey of Attitudes towards Statistics (Schau, et. al, 1995)

Sample Questions from
Survey of Attitudes Toward Statistics Pre Test
(http://www.unm.edu/~cschau/viewsats.htm)

The responses range from 1 (strongly disagree) through 4 (neither disagree nor agree) to 7 (strongly agree).

1. I will like statistics
2. I will feel insecure when I have to do statistics problems.
3. I will have trouble understanding statistics because of how I think.

Sample Questions from
Survey of Attitudes Toward Statistics Pre Test

The responses range from 1 (strongly disagree) through 4 (neither disagree nor agree) to 7 (strongly agree).

4. Statistics formulas are easy to understand.
5. Statistics is worthless.
6. Statistics is a complicated subject.
10. Statistics is not useful to the typical profession.

Subscale Scores are obtained by summing responses to a subset of the questions.
Higher totals reflect a more positive attitude.

Affect:
1, 2, 11, 14, 15, 21
Cognitive Competence:
3, 9, 20, 23, 24, 27
Value:
5, 7, 8, 10, 12, 13, 16, 19, 25
Difficulty:
4, 6, 17, 18, 22, 26, 28

Sample Questions from
Survey of Attitudes Toward Statistics
Post Test

The responses range from 1 (strongly disagree) through 4 (neither disagree nor agree) to 7 (strongly agree).

1. I like statistics
2. I feel insecure when I have to do statistics problems.
3. I have trouble understanding statistics because of how I think.

Usage:

"You can examine class averages and distributions to determine the status of students' attitudes. If a class scores around or above neutral (e.g. a mean of 4 on a 7-point scale) on each scale, for instance, the instructor knows the class does not have an attitude problem. If the class falls much below neutral, the instructor may need to devote more time to dealing with the negative attitudes."

Gal, Ginsburg, Shau (1997)

While these may be useful, Gal and Ginsburg Point out the following caveats about students:

- May not have experience with "statistics".
- Do not distinguish between attitude toward statistics versus attitude towards "math".
- Do not distinguish between general test anxiety and statistics anxiety.
- Do not ask the students to explain their answers to the Likert-type items.

Alternatives:

- Interviews, focus groups, journals.
- Open-ended questions, either original or as follow-up to SATS.

  For example,
  Why did you respond as you did?
  What experiences form the basis of your response?

Alternatives:

- Guided-choice sentence-completion items. (Gal & Ginsburg, 1994) For example:

I think statistics is…(e.g. useful, interesting, boring, frightening)…because…..

I think statistics is about …(what topics? What skills?)

Alternatives:

- Guided-choice sentence-completion items. (Gal & Ginsburg, 1994) For example:

I expect for me, personally, statistics may be later useful for…(write "not at all" if you so feel)

When I think about this course, I'm concerned that… (write "not at all" if you so feel)

The Challenge:

How do we enhance the atmosphere for learning and create a positive atmosphere in our Statistics Class?

Seven Principles for Good Practice in Undergraduate Education

American Association of Higher Education

1.) Encourage Contact between Students and Faculty.

2.) Develop cooperation among students.

3.) Use active learning technique.

4.) Provide prompt feedback.

5.) Emphasize time on task.

Seven Principles for Good Practice in Undergraduate Education

American Association of Higher Education

6.) Communicate high expectations.

7.) Respect diverse talents and ways of learning.

Tomorrows-Professor Listserv:
Email : <Majordomo@lists.stanford.edu>
subscribe tomorrows-professor

Seven Principles

1.) Encourage Contact between Students and Faculty.

- Office Hours

Office Hours

Teaching this course is one of my highest priorities. I will make time to meet with any of you that require assistance, but I would like to ask for some courtesy on your part. *Interruptions, especially those that come right before class when I am preparing for lecture, are very difficult for me.* Instead of such interruptions, I prefer that you come to my scheduled office hours.

If something unexpected (or extenuating) arises and I will not be available for my scheduled office hours on a particular day, I will let you know in advance (if possible). If I know beforehand I will announce the change in class, and post it on our Web page. If you need to meet me at a different time than my office hours, please, let me know some time in advance. I will usually be able to accommodate you.

Concerns

It is very important that you let me know your concerns about any aspect of the class as soon as they arise. Please send me Email, call me, or talk to me in person (e.g., after class, or during my office hours). If you feel shy or embarrassed to talk, write. You can leave a note for me with my secretary.

I will accept anonymous notes and treat them seriously, as long as they are sincere and constructive. Please, make it clear whether your remarks express your personal opinion or perhaps the opinion of a larger group of students (let me know how many). Also, indicate whether and how you would like me to respond to it (in private, in class, by Email to everybody, etc.). I will try to answer all emails within 24 hours.

Seven Principles

1.) Encourage Contact between Students and Faculty.

- Office Hours
- Visit each Lab Section at least once
- Arrive Early/Stay Late
- Listserv
- Accept Invitations

Seven Principles

1.) Encourage Contact between Students and Faculty.

- Office Hours
- Visit each Lab Section at least once
- Arrive Early/Stay Late
- Listserv
- Accept Invitations
- Student Information Sheet

STUDENT INFORMATION SHEET

NAME:
PHONE NUMBER:
EMAIL ADDRESS:
STUDENT ID NO.:
MAJOR:
ADVISOR:
YEAR:

Will you need any special help in this course because if learning disabilities, language, physical disabilities, etc.?
Yes No
If yes, what sort of help should we arrange?

What are your tentative career plans?

What are your outside interests or hobbies?

Is there anything special we should know about you?

I think statistics is…(e.g. useful, interesting, boring, frightening)…because…..

I think statistics is about …(what topics? what skills?)

Seven Principles

1.) Encourage Contact between Students and Faculty.

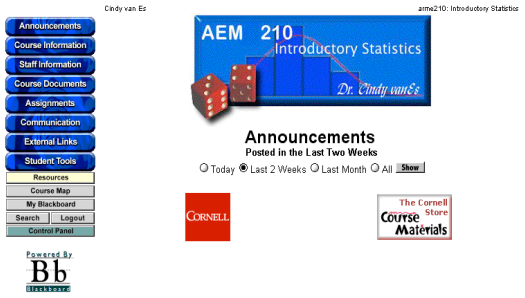
- Web Page Usage:

Communication:

Course Information

Staff Photos

Newsgroup



Seven Principles

1.) Encourage Contact between Students and Faculty.

- Web Page Usage:

Teaching and Learning:

Practice Questions

Tutorial

Surveys (study group)

Study Group Matching Questions

Name:

Email Address:

Phone Number:

Which area do you live in? Collegetown, North Campus, West Campus, Downtown Ithaca, Other

Study Group Matching Questions

What class are you in? Freshman, Sophomore, Junior, Senior, Graduate, Extramural

What are the best times for you to meet? Weekday afternoons, weekday nights, weekend days, weekend nights

Are there any other considerations that we should take into account?

Seven Principles

2.) Develop cooperation among students.

- Do not grade on a curve.

Class Rivalry

It is often the case that students view each other as competitors for good grades. I strongly believe that there is no reason for doing so. Students enrolled in this class should feel members of a team that is working towards the same goal and collaborate rather than compete. It is allowed and advised to discuss the material, the project, and the class assignments with each other.

Do as much as you can alone to develop independent thinking, but do not hesitate to ask questions of your fellow classmates, my staff, and myself. Never refuse to help your classmates. I will not manipulate your grades artificially (e.g., curve-fit the grades so that a certain percentage of you get A's and a certain percentage of you fail) and if all of you learn a lot, all of you can end up with excellent grades!

Seven Principles

2.) Develop cooperation among students.

- Do not grade on a curve.
- On-line survey to facilitate student study groups.
- Small group Lab Section Exercises
- Small group Classroom Exercises
- Group Project

Group Project

This course requires a group project where you will design your own experiment or observational study, and then complete a written analytical report. Details of this project are in the back of the packet. The project is worth 10% of your grade, and all partners are expected to participate equally. A "peer evaluation" sheet will be distributed to insure fairness.

PEER EVALUATION FORM

Your name: Team Number:

Please assume you have $10,000 to be divided among you and your fellow team members for your work. Indicate below how much you believe should be given to each team member.

Please consider things such as attendance, preparation, and willingness to contribute and share ideas, attitude, and overall performance.

Please be candid and fair. Your evaluation will be kept in the strictest of confidence. Thank you.

Seven Principles

2.) Develop cooperation among students.

- Do not grade on a curve.
- On-line survey to facilitate student study groups.
- Small group Lab Section Exercises
- Small group Classroom Exercises
- Group Project
- Class "Participation Points"

Class Participation

Class participation is a part of this course. Even though the class size is large, participation is strongly encouraged. There are many ways to do this, including raising questions in class, joining in class discussions, responding to questions raised during class, and being a part of classroom demonstrations.

(Please be sure and check with the professor or staff to make sure you get credit for these.) For the shyer students, there is also the opportunity to gain participation points by being present for classroom worksheets and exercises, (which will count for a large portion of your participation grade), posting questions or answers to the newsgroup on the Web site, bringing in "statistical" related stories or cartoons, etc.

Participation Points

- Asking/Answering Questions in Class
- Visual Demonstrations
- Participate in Experiments/Games
- Bring in Articles/Cartoons
- Post to Newsgroup
- Classroom Sheets

Seven Principles for Good Practice in Undergraduate Education

American Association of Higher Education

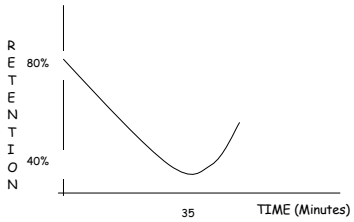
1.) Encourage Contact between Students and Faculty.

2.) Develop cooperation among students.

3.) Use active learning technique.

Seven Principles

3.) Use Active Learning Techniques



Seven Principles

3.) Use Active Learning Techniques

- Think/Pair/Share

Think/Pair/Share : a structure first developed by Professor Frank Lyman at the University of Maryland in 1981.

- Teacher poses a problem or question.
- Teacher gives the students "think time" and directs them to think about the question.
- Following the "think time" students turn to face their Learning Partner and work together, sharing ideas, discussing, clarifying and challenging.

Think/Pair/Share :

The pair then share their ideas with another pair, or with the whole class. It is important that students need to be able to share their partner's ideas as well as their own.

Seven Principles

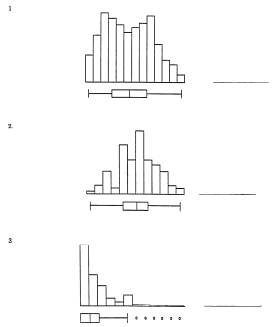
3.) Use Active Learning Techniques

- Think/Pair/Share
- Class Assessment sheets

Interpreting Histograms

1.) Match each of the following graphs to the variables listed below. Also, describe each distribution and any unusual features (e.g., Is the distribution skewed to the right? Is it symmetric? Are there any outliers? Why might this be so?)

a.) Scores on a fairly easy examination in statistics.
b.) Number of cycles required to achieve pregnancy for a same of women who attempted to get pregnant. Note that these data were self-reported from memory. (Data from S. Harlap and H. Baras (1984), "Conception-waits in fertile women after stopping oral contraceptives," *International Journal Fertility*, 29: 73-80.)
c.) Heights of a group of college students.
d.) Number of medals won by countries in the 1992 winter Olympics.
e.) SAT scores for a group of college students.



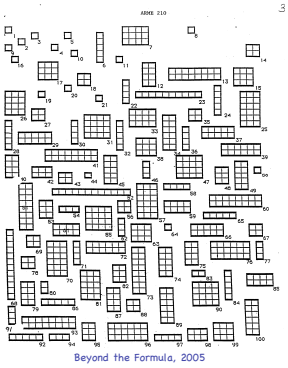
Sampling Distributions

1.) Randomly choose a sample of five rectangles from those listed on the following page. Record the number of your observation and the area of the rectangle:

Find the mean area for your sample: _____

Find the proportion of rectangles whose areas are less than or equal to 10: _____

2.) Use the random number table to select a sample of five rectangles from those listed on the following page. Record the random number and the area of the rectangle:



Seven Principles

3.) Use Active Learning Techniques

- Think/Pair/Share
- Class Assessment sheets
- Physical Examples

Seven Principles

3.) Use Active Learning Techniques

- Think/Pair/Share
- Class Assessment sheets
- Physical Examples
- "Literacy Moment"

Seven Principles

3.) Use Active Learning Techniques

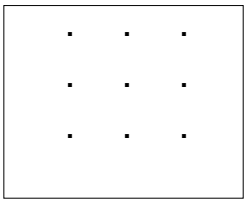
- Think/Pair/Share
- Class Assessment sheets
- Physical Examples
- "Literacy Moment"
- Student do example for the class

Seven Principles

3.) Use Active Learning Techniques

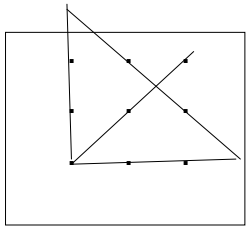
- Think/Pair/Share
- Class Assessment sheets
- Physical Examples
- "Literacy Moment"
- Student do example for the class
- "Half Time"

Annoyed
Annoyed



Annoyed
Annoyed

Paranoid



Thinking Outside the Box

Active Learning Resources

Web sites:

http://www.active-learning-site.com/ - Active Learning

http://www.amstat.org/publications/jse/ - Journal of Statistical Education

http://www.dartmouth.edu/~chance/ - Chance web site (Quantitative Literacy course)

http://data.gen.umn.edu/artist/index.html Artist: Assessment Resource Tools for Improving Statistical Thinking

Active Learning Resources

Books:

Workshop Statistics by Allan Rossman, Key College Publishing.
(http://www.rossmanchance.com/ws/)

Activity-Based Statistics by R.L. Scheaffer, M. Gnanadesikan, A. Watkins and J. A. Witmer, (1996), Springer-Verlag.

Seven Principles

3.) Use Active Learning Techniques

When all else fails - Do the Wave!

Seven Principles

1.) Encourage Contact between Students and Faculty.

2.) Develop cooperation among students.

3.) Use Active Learning Techniques.

4.) Provide prompt feedback.

Seven Principles

1.) Encourage Contact between Students and Faculty.

2.) Develop cooperation among students.

3.) Use Active Learning Techniques.

4.) Provide prompt feedback.

5.) Emphasize time on task.

Seven Principles

6.) Communicate high expectations.

7.) Respect diverse talents and ways of learning.

Teaching Methodology

- Lectures ("Chalk and Talk" and/or Power Point)

Teaching Methodology

- Lectures ("Chalk and Talk" and/or Power Point)
- Case Based Teaching
(http://www.hbsp.harvard.edu/hbsp/samples/index.asp)

Teaching Methodology

- Lectures ("Chalk and Talk" and/or Power Point)
- Case Based Teaching
(http://www.hbsp.harvard.edu/hbsp/samples/index.asp)
- Active Learning

Teaching Methodology

- Lectures ("Chalk and Talk" and/or Power Point)
- Case Based Teaching
(http://www.hbsp.harvard.edu/hbsp/samples/index.asp)
- Active Learning
- Videos

Teaching Methodology

- Lectures ("Chalk and Talk" and/or Power Point)
- Case Based Teaching
(http://www.hbsp.harvard.edu/hbsp/samples/index.asp)
- Active Learning
- Videos
- Java Applets (on web site)

Teaching Methodology

- Lectures ("Chalk and Talk" and/or Power Point)
- Case Based Teaching
(http://www.hbsp.harvard.edu/hbsp/samples/index.asp)
- Active Learning
- Videos
- Java Applets (on web site)
- Minitab Computer Demonstrations

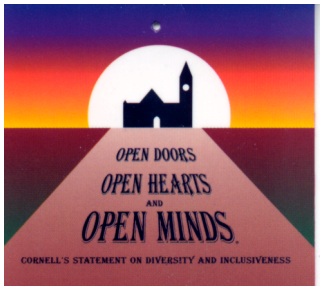
Teaching Methodology

- Lectures ("Chalk and Talk" and/or Power Point)
- Case Based Teaching
(http://www.hbsp.harvard.edu/hbsp/samples/index.asp)
- Active Learning
- Videos
- Java Applets (on web site)
- Minitab Computer Demonstrations
- Guest Speakers

Seven Principles

6.) Communicate high expectations.

7.) Respect diverse talents and ways of learning and people.



Selected Quotes from Student Nominations for Promoting Multicultural Diversity Award

- Involves oneself in promoting multicultural events and academic success
- Surrounds herself with an office of diverse staff and students
- Always presented the material from the point of view of the majority and minorities in order to enhance our understanding of the subject
- Is an active participant in student organizations that promote diversity, including the Minority Business Students Association

Selected Quotes from Student Nominations for Promoting Multicultural Diversity Award

- Takes great pains to have a diverse staff of Teaching Assistants and Graders
- Uses examples in classes of various foreign cultures and promotes the distinction between them and American attitudes
- Makes an effort to learn students names and asks if he pronounces ethnic names correctly.

http://www.diversityweb.org/ - An interactive resource hub for Higher Education

References

Gal, I., and Ginsburg, L. (1994), "The Role of Beliefs and Attitudes in Learning Statistics: Towards an Assessment Framework", *Journal of Statistics Education*, v.2, n.2

Gal, I., Ginsburg, L., and Schau, C. (1997), "Monitoring attitudes and beliefs in statistics education," in *The Assessment Challenge in Statistics Education*, eds. I. Gal and J. Garfield, Amsterdam: IOS Press, 37-51.

Roberts, D.M., and Bilderback, E.W. (1980), "Reliability and Validity of a Statistics Attitude Survey," *Educational and Psychological Measurement*, 40, 235 - 238.

Schau, C., Stevens, J., Dauphinee, T. L., & Del Vecchio, A. (1995). The development and validation of the Survey of Attitudes Toward Statistics. *Educational and Psychological Measurement, 55,* 868-875.

Wise, S.L. (1985), "The Development and Validation Of a Scale Measuring Attitudes Towards Statistics," *Educational and Psychological Measurement*, 45, 401 -405.