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Using Writing to Assess and Improve Student Learning

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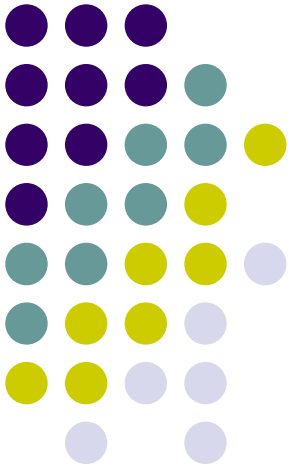


Agenda

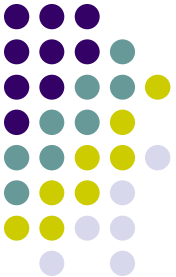
- Background on using writing in statistics
- Background on assessment
- Why use writing?
- How use writing?
- Case study examples

Background on "Writing"

Early Work:

- Radke Sharpe, N. (1991). *Writing as a component of statistics education*.
- Iversen, G. (1991). *Writing papers in a statistics course.*
- Smith, C., Miller, D. and Robertson, A. (1992). *Using writing assignments in teaching statistics: An empirical study.*
- Samsa, G. and Oddone, E. Z. (1994). *Integrating scientific writing into a statistics curriculum: A course in statistically based scientific writing*

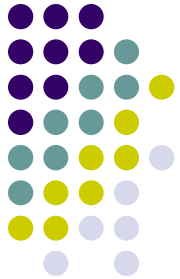
Background on "Writing" (cont.)



Recent Work:

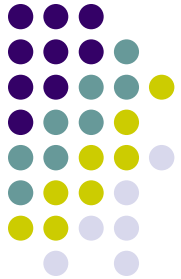
- Coakley, C.W. (1996). *Suggestions for your nonparametric statistics course*
- Stromberg, A. J. and Ramanathan, S.(1996). *Easy implementation of writing in introductory statistics courses*
- Radke Sharpe, N. (2000). *Curriculum in context: Teaching with case studies in statistics courses*
- Spurrier, J.D. (2001). *A capstone course for undergraduate statistics majors*

Background on "Assessment"



- Gal, I. and Ginsburg, L. (1994). *The role of beliefs and attitudes in learning statistics: Towards an assessment framework*
- Konold, C. (1995). *Issues in assessing conceptual understanding in probability and statistics*
- Hubbard, R. (1997). *Assessment and the process of learning statistics*
- O'Connell, A.A. (2002). *Student perceptions of assessment strategies in a multivariate statistics course*

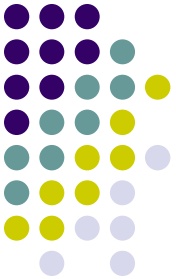
Highlighted Work on Assessment



Garfield, J. (1994) *Beyond testing and grading: Using assessment to improve student learning*

- Summarized trends in assessment
- Observed "mismatch between traditional assessment and desired student outcomes."
- Presented framework for "categorizing and developing appropriate assessment instruments and procedures"

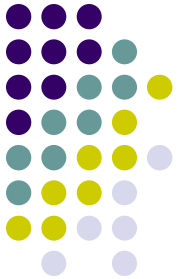
Highlighted Work on Assessment (cont.)



Chance, B. (1997) *Experiences with Authentic assessment techniques in an introductory statistics course*

- Presented techniques of assessment used in introductory statistics courses
- Used projects, “technical reports” and journals
- Stressed importance of “communication skills”
- Provided essential features of effective assessment techniques

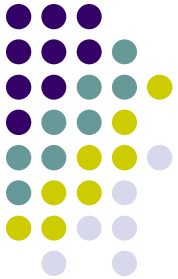
Highlighted Work on Assessment (cont.)



Garfield, J. et al. (2002) *First courses in statistical science: The status of educational reform efforts*

- Conducted survey of teachers of first statistics course
- Teachers did not mention using "writing," although at least one reported asking students to keep "journals of both statistical problems and reactions to the course."
- Authors recommended the need for "high quality assessments to ..determine how well the 'new' courses are preparing students to think, reason, and communicate, using statistics."

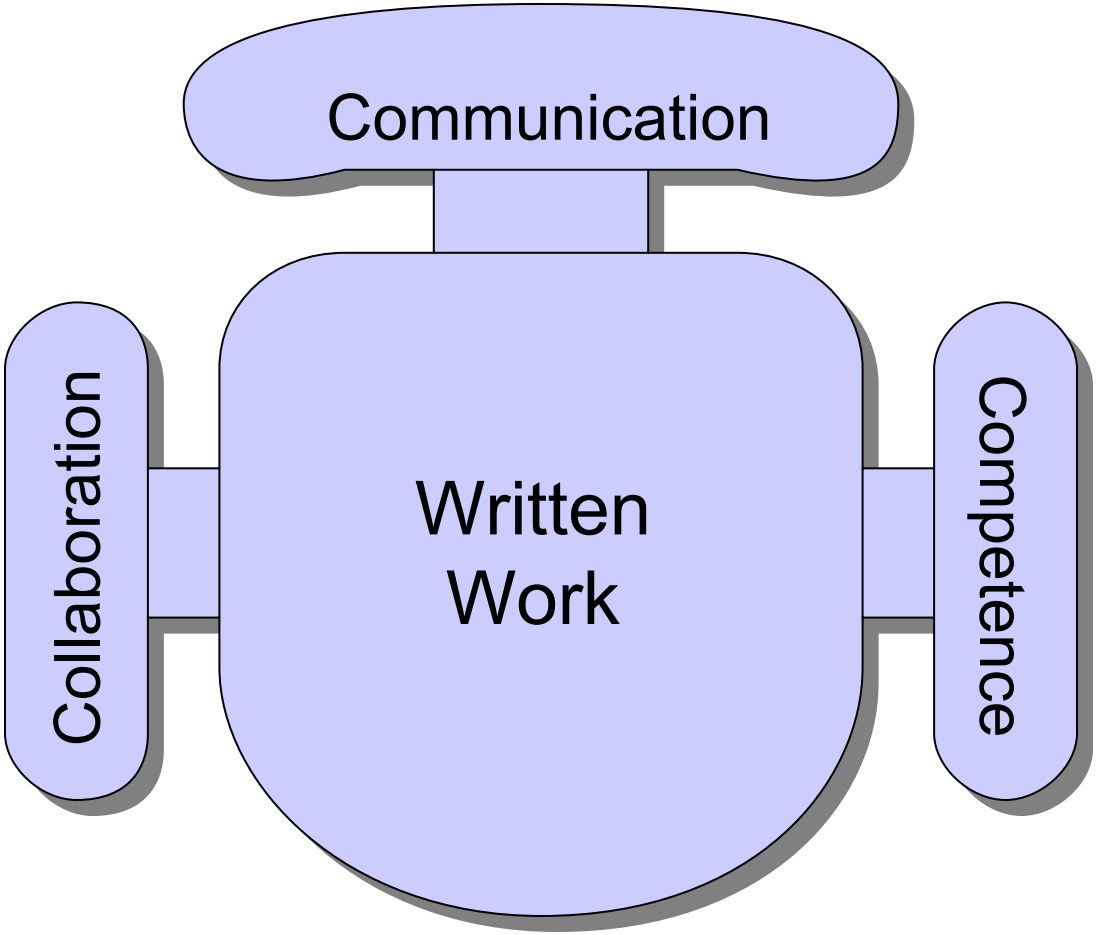
Why do we assess students?



- To evaluate:[1]
  - Knowledge of material
  - Independent thinking ability
  - Communication skills
  - Competence (conceptual, computational, and technological)
  - Collaborative skills

[1]From: Radke Sharpe, N. (1997) Assignments and Assessment, Invited Talk at *Assessment in Statistics Courses Conference*.

Why use writing?

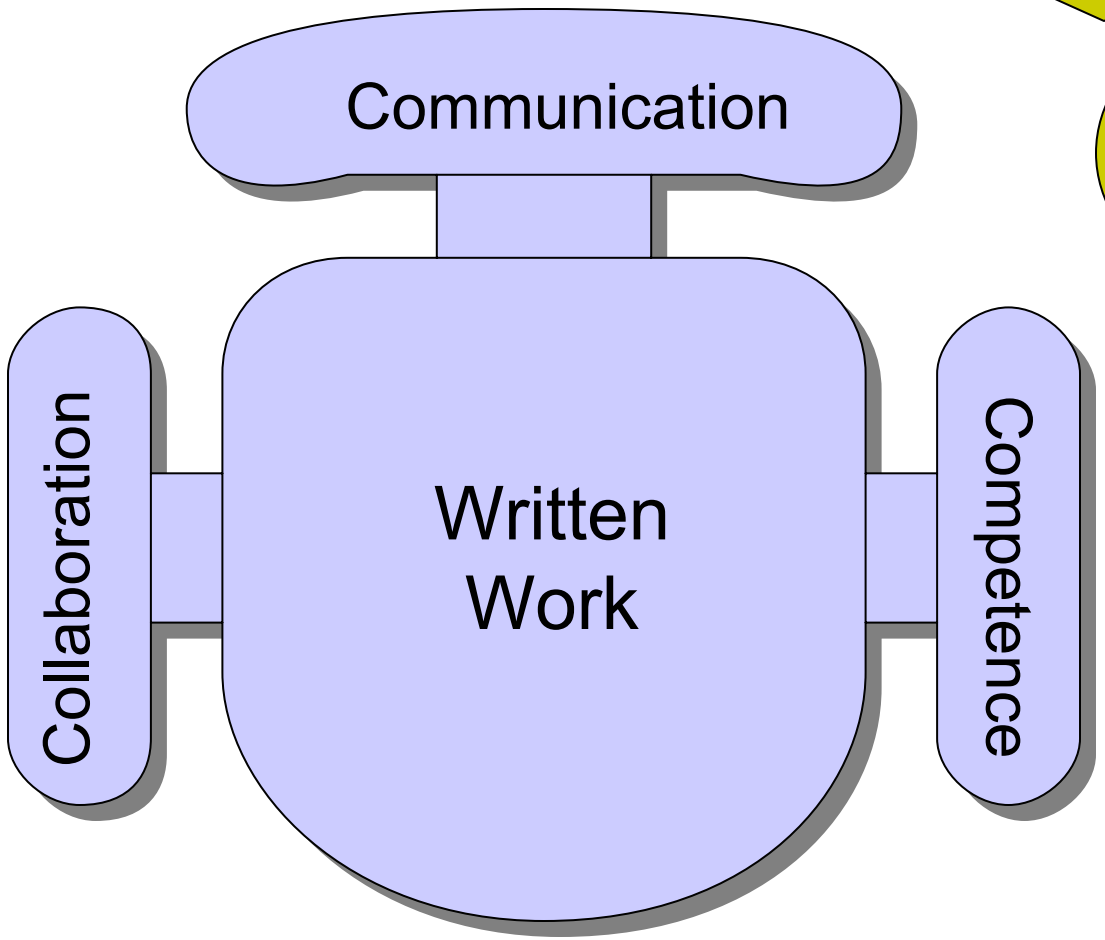


Purposes of Assessment?

- To improve student learning and to provide information to students and instructors on:[1]
  - How well students understand topics
  - Students' perceptions and reactions to material
  - Students' success in achieving course goals
  - Students' strengths and weaknesses

[1]From: Garfield, J. (1994), Journal of Statistics Education, Vol 2, N. 1

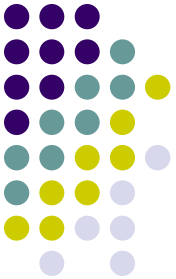
Why use writing?



Reveals student perceptions and understanding of material

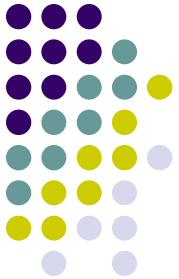
Are we achieving course goals? What are weaknesses?

Questions addressed with writing



- What are student perceptions of concepts?
  - ➔ (e.g., confidence, variability, normalization?)
- What are student strengths?
  - ➔ (e.g., implementation? Selecting appropriate analyses?)
- What are student weaknesses?
  - ➔ (e.g., interpretation? Application to real data?)
- Are we achieving course goals?
  - ➔ (e.g., conceptual learning? collaborative learning? Appreciation of ethical treatment of data?)

What makes a good writing assignment?

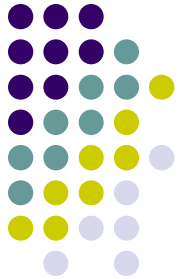


Assignments should be:[1]

- Linked to course objectives
- Sequenced from less complex to more complex
- Well-defined (stating topic, purpose, audience, and deliverable
- Assigned with clear evaluation criteria
- Integrated into context of course
- Structured with progress reports and/or drafts

[1]From: Radke Sharpe, N. (1997) Assignments and Assessment, Invited Talk at *Assessment in Statistics Courses Conference*.

More thoughts on good assignments…

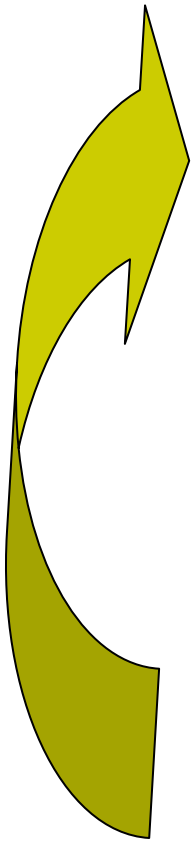


Assignments should:[1]

- Provide students with timely, constructive, regenerative feedback
- Promote self-reflection and higher-order thinking
- Provide students with guidelines of what is expected
- Be consistent and fair
- Make goals of evaluation clear
- Be well-integrated into the course

[1]From: Chance, B. (1997). Journal of Statistics Education, Vol. 5, N. 3.

Sample Approach



- Set expectations early

➔ Emphasize importance of writing on 1st day

- Assign weekly lab/case reports

➔ Begin with week 1 or 2 and be consistent

- Provide clear structure

➔ Introduction; Methods; Results; Recommendations

- Provide template of exemplary work
- Give clear/specific feedback
- Repeat Process

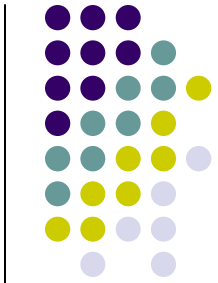
Sample Introductory Statistics Outline

Week	Topic	Written Assignments	Suggested Cases
1	Data collection		Decisions in New Product
			Development (NPD) (A)
2	Data description/presentation	Written Report #1 due	NPD (B) or Space Shuttle Challenger
3	Categorical data	Written Report #2 due	
4	Probability		NPD(B2) or Drug and Disease Testing
5	Discrete RV's	Written Report #3 due	
6	Normal distribution		
7	Sampling dist's		CLT for Census Data
8	Estimation: t-dist; CI's	Written Report #4 due	Risk and Return in World Markets
9	Hypothesis Testing	Written Report #5 due	NPD (C)
10	Chi-Square Test	Written Report #6 due	NPD (D) or Air Bags
11	Simple Linear Regression	Written Report #7 due	Mutual Fund Flows
12	Review	Written Report #8 due	

Added information

- Students work in pairs
- Students are required to use technology each week
- Students are given opportunity to rewrite reports
- Students are expected to follow guidelines for figures, tables, graphs, and exhibits
- Written assignments often accompanied by weekly oral presentations (each team presents once)

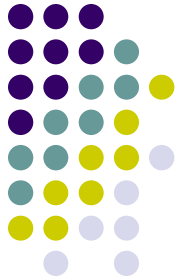
How to avoid assessment overload[1]



- Give team assignments
- Design assignments carefully
- Distribute examples of prior work
- Include assessment criteria
- Use peer feedback for revisions
- Use grading standards
- Resist over marking and editing
- Focus comments on main points

[1]From White, E. M. (1995) Assigning, Responding, Evaluating.

Case Study: Using Garfield Framework



What: Students' ability to apply the concepts of confidence intervals and variability to real data and ability to interpret and discuss results accurately.

Purpose: To determine if students are able to use the concept of confidence intervals to compare and contrast volatile financial data.

Method: A student lab/case, where a prior sample report is made available on the web

Who: Students work in teams of two and instructor evaluates the written report

Feedback: Instructor returns the report the following week with an overall grade and specific comments re: quality of writing (organization, grammar, spelling, etc.) and content (type of graphics used/omitted; treatment of data; conclusions, etc.)

Case Study

Case w/ Sample Student Work

- Risk and Return in World Markets
- Motor Vehicle Fatalities