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## Integrating Writing in the Statistics Curriculum

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Union Graduate College  
eCOTS, May 19-23, 2014



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## Setting

- Union Graduate College is comprised of four schools offering master's degrees and post-baccalaureate certificates in:
  - Management and Healthcare Management
  - Engineering and Computer Science
  - Education
  - Bioethics
- Effective communication (oral and written) is a required competency
- There is no college-wide writing resource center
- Graduate level statistics courses are offered in all schools
  - Required for MBA, elective for all other programs
  - Taught both on-line and in the classroom

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## Expectations

- Students in professional master's degree programs aspire to leadership positions in their fields
- Communication is a core competency for professional success and upward mobility
- Our programs develop writing competency across the curricula
- In statistics courses we focus on writing professional quality reports and presentations that communicate the results of statistical analysis
  - In lay language (no statistical jargon)
  - In the context of the business problem

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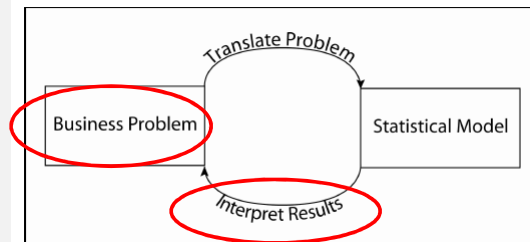
## Observed Writing Issues

- There is a wide range of writing skill based on:
  - Undergraduate major
  - Amount of professional work experience
- Many students are unfamiliar with technical writing
- Many students are unfamiliar with common professional writing formats
  - Technical reports
  - Abstracts
  - Journal articles
  - Project proposals

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## Pedagogical Approach

- Problem-solving approach to statistics
  - Statistical analysis supports decision-making
  - Effectively communicating statistical results to decision-makers in the language of the business is expected.



- 1/3, 1/3, 1/3 guideline
  - Spend 1/3 of your time on developing a clear, concise problem statement, 1/3 of your time on analysis, and 1/3 of your time communicating results

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## Classroom Activities Include Writing

- Small group activity – What is a good hospital stay?
  - Given a vague question small groups write out a clear and precise problem statement.
  - Classroom discussion of the different problem statements created from the same question illustrates the need for careful problem specification
- Individual activity followed by class discussion – review business memo
- Class discussion – review abstracts from published articles
- On-line discussion – piloting a survey

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## Student Learning Assessments

### Management

- One page memo summarizing a descriptive analysis
- Four presentation slides summarizing a test of hypothesis
- Two page technical report on using simple linear regression to develop a capital asset pricing model
- Three page technical paper summarizing a multiple regression case study

### Bioethics

- Ten question survey on a health-related topic
- Final project - ten page empirical research proposal
  - Periodic written one page progress reports

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## Resources

- Guidelines
  - Structure and content of a technical report
  - Constructing good survey questions
- Case Study Guidance contains writing and presentation tips
- Collection of published examples of reports, presentations, posters, abstracts, proposals posted on the learning management system
- Internet resources
  - Purdue Owl project
  - Author instructions from journals

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## Evaluating Student Written Work

- All assignments have a rubric for writing/presentation quality including
  - Structure and organization
  - Correct grammar and spelling
  - Adherence to page limits
  - Clear and concise writing
- Writing/presentation quality account for 10-20% of assignment grade
- Graded assignments comprise
  - 90% of course grade in bioethics
  - 70% of course grade in management
- Be explicit as to what are errors and what are suggestions for improving clarity and style.

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## Best Practices

- Be prepared to provide examples of outlines, memos, and technical reports
  - Don't forget to require an outline as part of an assignment
- Be explicit when precise technical language is required in writing statistical results
- Assess writing no more than 10% of assignment grade
- Instructors must model good writing in everything they do
  - Board work, tests, assignment, emails to students
- Encourage proofreading and having someone else review their assignments
- Early in the course give small writing assignments that have small contribution to final course grade
  - Allows students to become accustomed to technical writing and expectations for professional quality without undue worry about the impact on final course grade

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## Conclusions

- Writing reinforces statistical concepts
  - The act of writing causes students to think about the interpretation of their results
  - Use of abstracts and page limits helps students recognize and focus on the key statistical information
  
- Many students understand the importance of good writing for career success
  - Create a safe atmosphere to practice developing professional writing skills
  - Provide motivation and examples of good writing
  - Hold students accountable for their writing