Instructor: Richard W. Harris, Ph.D.; 131 TLRB
Email: richard_harris@byu.edu
Office Hours: 11-12 MWF or by appointment
Class time: 8-9:15 MW, 125 TLRB

And inasmuch as they sought wisdom they might be instructed.
Doctrine & Covenants 1:26

Click here for the course syllabus as a Microsoft Word file

Course Description
This course is designed to make clear the philosophical and logical foundations of scientific reasoning based on the principles of empiricism, operationism, causality, and probability theory. Students will learn about the principles underlying quantitative and qualitative research designs and the types of statistical methods appropriate for the analysis of different kinds of data. Projects are incorporated that facilitate skillful reading and comprehension of scientific literature and the ability to formulate a well-founded research proposal.

Course Philosophy
In this course, we will survey the fundamental methods of clinical research and statistical measurement as well as the scientific principles upon which such methods are based. Central to the organization of the course is the instructor’s belief that the term “science,” especially in the clinical realm, is best conceived as a verb that signifies a set of specified operations used for problem solving, decision making, and communicating knowledge in a manner that can be objectively evaluated by others. As a noun, the concept of “science” can be intimidating, if not shrouded in mystery. As a verb, it is understood to be merely a set of systematic mental observations and relevant tools for their expression that culminate in an evolving body of facts.

Course Texts

Other Learning Materials
The course may involve additional readings, Internet-based tutorials, and exercises.

Course Web site: COMD 600 syllabus Winter 2007.doc
Reference Books. The library contains many texts and reference works on statistics and research design which discuss concepts to be covered in this course. You may feel a need for additional information, or you might want alternate descriptions to those given in the assigned texts or in lecture. The HBLL first floor's BF section has psych research methods texts and the 2nd floor's QA section covers statistics and computer science.

Other Resources
You will be required to submit your sample prospectus for this class in printed and electronic for. This is designed to help you prepare your thesis for Electronic Submission to the Graduate School at the completion of your graduate studies. Please refer to the Electronic Thesis and Dissertation web pages on the following web site:
http://etd.byu.edu/

Also, please thoroughly review the BYU Minimum Standards for Theses and Dissertations web site:
http://www.byu.edu/gradstudies/resources/publications/MinimumStandards.pdf

The Statistical Consulting Center provides free consulting to students, provided they are accompanied by their major professor (more details will be provided in class). The English Department faculty may read your thesis to help identify grammar and punctuation errors for a small fee (approximately $10) (more details will be provided in class). The Writing Center, 1010 JKHB x8-4306
http://www.lib.byu.edu/hbll/  
http://www.comdisdome.com/dome/index.jsp  
http://www.comdisdome.com/dome/tutorial.jsp?_dm=comdis&_sk=

Course Goals
Students in audiology and speech language pathology need to know how to measure and describe behavior, avoiding pitfalls invalidating measurement. Second, they need to know how to objectively read the literature to access new knowledge throughout their professional careers. Both of these needs are critical to successful research (and successful clinical practice).

In this class we address these needs by studying research methods. Students will learn principles of research design and how to apply the scientific method to clinical assessment and intervention. We will take a “practical” approach to do this, focusing heavily on the thesis that each of you must complete for your master’s degree.

Prerequisites to this Course
The prerequisites to this course are Math 110 and Stat 222. Although we will review some of the material covered in these courses, a basic understanding of statistics will be assumed.

Concepts to be Studied in this Course
The nature of graduate study; characteristics of a strong graduate program
Planning feasible research studies
Reviewing the literature
Components of research articles and theses: overview
  Introduction section
Review of literature section (appendix to thesis)
Method section
Results section
Discussion section
Selecting a research question
Scientific method, types of research
Terms, concepts, and research methods
Research design, group and single subject
The editorial review & publication process
Ethics in research
APA style
Statistics: basic notions
  statistical methods commonly used in ASLP research
  looking for differences
  looking for relationships
  non-parametric statistics in ASLP research & clinical work
  other statistical methods in ASLP research
  characteristics of good data analysis

Examinations
There will be two examinations. Examinations must be taken on the scheduled date. Exceptions will be made only in "exceptional cases" and should be negotiated well in advance when possible. Examinations will be "closed book". Exams will cover both lecture and text material, about 50/50. The exams will be essay and short answer in nature. The first exam will be administered in class on the date noted in the calendar. The second exam will be administered on the scheduled day during finals week. Each examination will be worth 100 points.

Quizzes
There will be 2 or 3 unannounced quizzes on reading assignments. Each quiz will be worth 25 points.

APA Assignments
There will be 8 APA exams from the APA Style-Student’s Workbook and Training Guide. These are take home exams and you need to submit one exam each Monday. Each take home APA exam is worth 15 points.

Review of the Literature/Prospectus
The final two requirements will be to 1) write a prospectus and 2) submit it to me electronically and in printed form (more details provided in class). This prospectus should be very similar to a research publication (minus results and discussion). More details to be given in class. The prospectus will have several dates where you will have to submit portions of the prospectus. These dates will be announced in class on September 11.

A prospectus is a research thesis proposal. There is no guarantee that you will actually be able to use the prospectus that you write. That decision will be up to your chair person. The prospectus will be graded on:
Writing style (20): Is your proposal well written? Is it easy to read? Is it written in a formal writing style? Are words spelled correctly, sentences well-formed, etc.
Impact (10): Do you make a compelling case that your study should be done? You should make sure you explain yourself well enough so that an "intelligent but uneducated" reader can see why you would want to do your study.
Literature Review (20): Although the amount of literature cited will vary from idea to idea, you should remember that a strong literature review is impressive. A limited, or dated review may cost you points. Does your review have an organizational plan? You are not limited to the methods discussed in class. If you do not use a method suggested in class, however, it is up to you to make it work.
Research Design (20): Do you present a well thought out plan for conducting your study. This will include methods for selecting subjects, procedures, and all other aspects of "how" you will carry out your study. If it is not clear how you will do what you propose you will be in serious trouble. If you don't have a feeling for how much detail is enough, you should err on the side of "too much."
APA style (20): You must follow APA guidelines in your proposal. You will lose one point per APA style violation. Repeated violations of the same APA rule will not count against your grade.
Literature search (5): You will need to turn in a copy of the reference list you created in your library literature search. Your computer print out will be fine, however, if you want to put your reference list on a separate sheet of paper that will also be acceptable. It is very difficult to say how many sources should be found on any given topic (we will discuss this in detail in class). However, keep in mind that if you have a very short list (say under 10) you may lose points. The prospectus you submit is to be 100% your work.

Late Work
Unless you have a written excuse (note from your doctor documenting serious illness, etc.) I will penalize a late written assignment by subtracting 5 percentage points from its score for each day late. Unexcused late examinations are not allowed and will be given a score of 0.

Class Participation
I expect attendance and class participation. Much of what we'll do in class involves discussion of the readings, ideas, etc., and you will need to be present and prepared to contribute to the class. If you have more than one absence during the semester you will lose 5 points per missed class period. If you are significantly late you may also lose points. If you have unusual circumstances that make it difficult to attend class you should let me know (e.g., serious illness, etc.).

If you are having difficulty in the course, you should meet with me immediately to go over your class and reading notes and to get direction for supplemental readings.

Grading Procedure
Midterm and Final examinations 2 (100 pts. each) 200
Prospectus 100
<table>
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<tr>
<th>Assignment</th>
<th>Points</th>
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<tr>
<td>Electronic prospectus</td>
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<tr>
<td>Statistics assignments</td>
<td>50</td>
</tr>
<tr>
<td>Unannounced quizzes on reading</td>
<td>75</td>
</tr>
<tr>
<td>APA take home</td>
<td>80</td>
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<tr>
<td>Three short papers – 2 pages each-TBA</td>
<td>100</td>
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There are a total of 630 points available. I will calculate your final percentage using 630 as the highest possible score. The grading scale I will use at the end of the semester is listed below. No extra credit is possible.

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<tr>
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<td>A-</td>
<td>90-93.9</td>
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<td>B+</td>
<td>87-89.9</td>
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<td>B</td>
<td>84-86.9</td>
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<tr>
<td>B-</td>
<td>80-83.9</td>
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<td>D</td>
<td>64-66.9</td>
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<td>D-</td>
<td>60-63.9</td>
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Incomplete grades will only be given when serious circumstances (health, family tragedy, etc.) arise after the final drop deadline and persist through the final exam date. You should come and talk to me immediately if you need to take an incomplete. Work schedule, child-care problems, or commuting difficulties are not acceptable reasons for missing exams/classes or receiving an Incomplete.
Course Timetable

The following pages contain:

A. **The COURSE SCHEDULE OVERVIEW for the semester (1 page)**
   This overview indicates the topics and textbook chapters to be addressed during each week of the semester. *Note: This schedule is subject to change following the first day of class*

B. **A WEEKLY OUTLINE of topics to be addressed (14 pages)**
   This outline indicates the number of class sessions per week, the date of each session, and the topics and subtopics (and chapter) to be addressed during each week.
   Please keep in mind that the course outline is only a guide. Topics for sessions are subject to adjustment at the discretion of the instructor.
<table>
<thead>
<tr>
<th>Week</th>
<th>Session Nos.</th>
<th>Date/s</th>
<th>Topic</th>
<th>Chapter</th>
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<tr>
<td>1</td>
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<td>Course Introduction; History and Philosophy of Science</td>
<td>1</td>
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<tr>
<td>2</td>
<td></td>
<td>Jan 17</td>
<td>Getting Started: Basic Concepts of Research</td>
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<tr>
<td>3</td>
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<td>Jan 22/24</td>
<td>Selecting a Research Problem 2 page summary-&quot;Evidence-Based Practice&quot;</td>
<td>3</td>
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<tr>
<td>4</td>
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<td>Jan 29/31</td>
<td>Reviewing the Literature and Stating Research Problems</td>
<td>4</td>
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<tr>
<td>5</td>
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<td>Feb 5/7</td>
<td>Sampling Theory and Methods</td>
<td>5</td>
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<tr>
<td>6</td>
<td></td>
<td>Feb 12/14</td>
<td>Controlling, Measuring, and Recording Variables</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Feb 20/21</td>
<td>MIDTERM EXAMINATION (Feb 20-Tuesday) Causal Inferences and Threats to Their Validity</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Feb 26/28</td>
<td>Experimental Designs</td>
<td>8</td>
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<tr>
<td>9</td>
<td></td>
<td>Mar 5/7</td>
<td>Nonexperimental Research Methods</td>
<td>9</td>
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<tr>
<td>10</td>
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<td>Qualitative Research Methods</td>
<td>10</td>
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<td>11</td>
<td></td>
<td>Mar 19/21</td>
<td>Analyzing Data: Descriptive Statistics</td>
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</tr>
<tr>
<td>12</td>
<td></td>
<td>Mar 26/28</td>
<td>Analyzing Data: Inferential Statistics</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Apr 2/4</td>
<td>Reading, Writing, and Presenting Research</td>
<td>13</td>
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# WEEKLY TIMETABLE

<table>
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<tr>
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<td></td>
<td>Jan 8/10</td>
<td><strong>Course Introduction; History and Philosophy of Science</strong></td>
<td>1</td>
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</tbody>
</table>

## WEEK 1

### Topic/Chapter Outline

- Ongoing reading assignment – Read the APA manual – then reread the APA manual. There may be quiz or test questions involving APA style. Any of these types of questions will be open book. Students are expected to be thoroughly familiar with APA style.

- **History of Scientific Thought**

- **Nature of Scientific Thought**
  - Scientific versus Nonscientific Knowledge
  - Logic of Science
  - Science and Empiricism
  - Language of Science
  - Operationism

- **Reasons for Scientific Inquiry**
  - Testing and Assessing Theories
  - Eclectic Approach to Research

- **Clinical Relevance of Science**
  - Evidence-Based Clinical Practice
  - Clinician-Researcher Collaboration
  - The Clinical Scientist
<table>
<thead>
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<td></td>
<td>Jan 17</td>
<td>Getting Started: Basic Concepts of Research</td>
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</table>

### WEEK 2

- Variables as the Focus of Research
- Definition and Types of Variables
  - Measurement Variables
  - Research Variables
  - Extraneous Variables
- Introduction to the Types of Research
  - Quantitative Research
  - Qualitative Research
  - True Experimental Research
  - Quasi-Experimental Research
  - Nonexperimental Research
  - Clinical Research
  - Applied versus Basic Research
  - Pilot Studies
- The Scientific Method as a Research Process
  - Structure and Content of a Research Article
- Ethics of Research
<table>
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<tr>
<td>3</td>
<td></td>
<td>Jan 22/24</td>
<td>Selecting a Research Problem</td>
<td>3</td>
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</table>

**Topic/Chapter Outline**

Two page typed summary of “Evidence-Based Practice” due today at beginning of class on Monday, September 18

- Significant Questions Lead to Significant Answers
- Origination of a Question
  - Using the Library
- Rationale for a Question
- Feasibility of Answering a Question
- Ethical Issues and Research Problems
WEEKLY TIMETABLE

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<tr>
<td>4</td>
<td></td>
<td>Jan 29/31</td>
<td>Reviewing the Literature and Stating Research Problems</td>
<td>4</td>
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</table>

**Topic/Chapter Outline**

- Reviewing Research Literature
  - Writing the Literature Review

- Stating the Research Problem
  - Research Question; Research Hypotheses

- Null Hypothesis
  - Statistical Logic of Null Hypotheses
  - Conceptual Basis of Null Hypotheses
  - Case for Personal Probabilities in Hypothesis Testing
  - Case Against Hypothesis Testing
  - Perspectives of Behaviorism
### WEEKLY TIMETABLE

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<td>5</td>
<td></td>
<td>Feb 5/7</td>
<td><strong>Sampling Theory and Methods</strong></td>
<td>5</td>
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</tbody>
</table>

### Topic/Chapter Outline

- No class on Tuesday, October 3 – Dr. Harris out of town – we will discuss possible options for this date during the first day of class.

- Choosing a Sample of Subjects
  - Some Preliminary Concepts and Definitions
  - Importance of Sampling to Research
  - Random Assignment versus Random Selection
  - Types of Populations

- Random Sampling Methods
  - Simple Random Sampling
  - SystematicSampling
  - Stratified Sampling
  - Cluster Sampling

- Nonrandom Sampling Methods
  - Consecutive Sampling
  - Convenience Sampling
  - Purposive Sampling
  - Snowball Sampling
  - Matched Samples; Blocking

- Selection Bias and Sampling Error
  - Minimizing Selection Bias and Sampling Errors
  - When Bigger is Better
  - When Smaller is Better
  - Statistical Considerations in Selecting a Sample
  - Sampling and the Generalization of Findings
WEEKLY TIMETABLE

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<td>Controlling, Measuring, and Recording Variables</td>
<td>6</td>
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</table>

**WEEK 6**

**Topic/Chapter Outline**

- **Controlling Variables**
  - Systematic Variance
  - Error Variance; Sources of Variance
  - Maximizing Experimental Systematic Variance
  - Minimizing Random and Systematic Errors

- **Specifying Measurements**
  - Measurement Utility
  - Reliability of Measurement
  - Types of Reliability
  - Validity of Measurement
  - Definition of Validity
  - Types of Validity
  - Applying Reliability and Validity to Psychometric Assessment
  - Measurement Scales

- **Recording Measurements**
  - Response Frequency
  - Response Latency
  - Response Duration
  - Response Amplitude-Intensity
**WEEKLY TIMETABLE**

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<th>Chapter</th>
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<td>Feb 20/21</td>
<td>Causal Inferences and Threats to Their Validity</td>
<td>7</td>
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</table>

**Topic/Chapter Outline**

- In class Midterm Examination administered in class October 23.
- Determining Causality
- Validity of Research Designs
  - Internal Validity
  - Threats to Internal Validity
  - Within-Subject Sources of Internal Invalidity
  - Between-Subject Sources of Internal Invalidity
  - External Validity
  - Threats to External Validity
  - Threats to Statistical Conclusion Validity
  - Threats to Construct Validity
WEEKLY TIMETABLE

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<th>Chapter</th>
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<td>8</td>
<td></td>
<td>Feb 26/28</td>
<td>Experimental Designs</td>
<td>8</td>
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</table>

Topic/Chapter Outline

- Ways to Classify Research Designs
- Choosing a Research Design: Experimental Methods
- True Experimental Designs:
  - Pretest-posttest control group design
  - Posttest only control group design
  - Solomon four-group design
  - Multi-group and factorial designs
  - Randomized controlled trials
  - Repeated measures designs
  - Mixed experimental design
- Quasi-Experimental Designs
  - Non-equivalent comparison groups design
  - Single time-series design
  - Multiple time-series design
- Single-Subject Designs
  - A-B design
  - A-B-A design
  - A-B-A-B design
  - Alternating Treatments design
  - Reversal design
  - Multiple-baseline design
  - Changing criterion design
  - Evaluating Treatment Efficacy in Single-subject Research
- Pre-Experimental Designs
  - One-shot case study
  - One-group pretest-posttest design
  - Static-group comparison design
<table>
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<th>Chapter</th>
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<tr>
<td>9</td>
<td></td>
<td>Mar 5/7</td>
<td>Nonexperimental Research Methods</td>
<td>9</td>
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**WEEK 9**

- Case Studies and Case Series
- Cohort and Case-Control Studies
- Causal-Comparative (Ex-Post-Facto) Studies
- Survey Research
  - Steps in Developing a Survey
  - Interviews
- Evaluating Diagnostic Tests
  - Accuracy of a Diagnostic Test
  - Measures of Test Accuracy
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<th>Chapter</th>
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<td>Qualitative Research Methods</td>
<td>10</td>
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</tbody>
</table>

**Topic/Chapter Outline**

- Qualitative versus Quantitative Research Methods
- When Is the Qualitative Approach the “Best Approach”?
- Observational Methods in Qualitative Research
  - Participant Observation
  - Ethical Concerns in Observational Research
- Ethnography
- Qualitative Research Interviews
- Grounded Theory
- Phenomenology
- Case Study Method
- Discourse Analysis
- Content Analysis
- Analyzing Qualitative Data
- Evaluating Qualitative Research
  - Evaluating Reliability and Validity
  - Advancing Trustworthiness Through Triangulation
- Relevance of Qualitative Research to Human Communication
## WEEKLY TIMETABLE

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<th>Chapter</th>
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<td>11</td>
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<td>Mar 19/21</td>
<td>Analyzing Data: Descriptive Statistics</td>
<td>11</td>
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</tbody>
</table>

### Topic/Chapter Outline

- Descriptive versus Inferential Statistics
- Types of Data
  - Nominal Ordinal Data
  - Interval and Ratio Data
- Organizing and Portraying Data
  - Graphic Displays of Frequency Distributions
  - Shapes of Frequency Distribution Scores
- Central Tendency of Data
  - Measures of the Center
- Variability of Data
  - Measures of Variability
- Describing Relationships and Predicting Outcomes
  - Correlation
  - Regression
## WEEKLY TIMETABLE

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<td>Analyzing Data: Inferential Statistics</td>
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</tbody>
</table>

### Topic/Chapter Outline

- **Probability: The Basis for Statistical Inference**
  - Probabilities and Level of Confidence
  - The Bayesian View of Probability

- **Sampling Variability**
  - Confidence Intervals

- **One-Sample Case: Testing Hypotheses for a Single Group**
  - Errors and Power in Statistical Inference

- **One-Sample Proportion Test**

- **Two-Sample Case: Testing Hypotheses for Two Groups**
  - Unpaired \( t \) Test for Independent Samples
  - Paired \( t \) Test for Dependent Samples

- **Nonparametric Alternatives to Parametric Statistics**
  - Chi-Square Test
  - Nonparametric Rank-Order Methods

- **Multigroup Designs: Testing Hypotheses for Three or More Groups**
  - Analysis of Variance (ANOVA)

- **Multiple Comparison Methods**

- **Other ANOVA Designs and Methods**
  - Randomized-Blocks Analysis of Variance
  - Analysis of Covariance
  - Nonparametric Tests for Multigroup Designs
  - The \( p \)-value Approach in Testing Hypothesis
  - Meta-Analysis

- **Complex Statistical Methods**
  - Multivariate Analysis of Variance; Discriminant Analysis
  - Factor Analysis

- **Computer Applications in Statistics**
## WEEKLY TIMETABLE

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<td>13</td>
<td></td>
<td>Apr 2/4</td>
<td>Reading, Writing, and Presenting Research</td>
<td>13</td>
</tr>
</tbody>
</table>

### Topic/Chapter Outline

- The Value of Critical Thinking
- Catabolic Thinking in Reading Research
- Anabolic Thinking in Writing Research
  - Research Proposal Outline
  - Funding Research
- Theses and Dissertations
- Writing Well
- Professional Presentations
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<th>WEEK</th>
<th>Session Nos.</th>
<th>Date/s</th>
<th>Topic</th>
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<td>14</td>
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<td>Apr 9/11/16</td>
<td>Review-Prospectus due</td>
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1. The student will be able to write a research proposal

1a. Topic approval.
1b. Outline approval.
1c. Reference approval.
1d. Writing Center review.
1e. Draft 1 peer review.
1f. Draft 2 review.
1g. Final paper grade.

Written comments on items 1a through 1f and a final grade on 1g.

III-F
III-G
IV-B

*More detail is available regarding these standards at: http://www.byu.edu/aslp/

David O. McKay School of Education (DOMSE) Conceptual Framework (required by the DOMSE):

CF-1 Embrace and apply the moral dimensions of teaching.
Practicing nurturing pedagogy
Providing access to knowledge
Enculturating for democracy
Ensuring responsible stewardship of the schools

CF-2 Demonstrate academic excellence.

CF-3 Model Collaboration.

CF-4 Act with Social Competence.

Council on Academic Accreditation Standard (CAA):

Standard III-B The applicant must demonstrate knowledge of the nature of basic human communication and swallowing process, including their biological, neurological, acoustic, psychological, developmental, linguistic and cultural bases.

Standard III-C The applicant must demonstrate knowledge of the nature of speech, language, hearing, and communication disorders and differences and swallowing disorders, including the etiologies, characteristics, anatomical/physiological, acoustic, psychological, developmental, and linguistic and cultural correlates.

Standard III-D The applicant must possess knowledge of the principles and methods of prevention, assessment, and intervention for people with communication and swallowing disorders, including consideration of anatomical/physiological, psychological, developmental, and linguistic and cultural correlates of the disorders.

Standard III-E The applicant must demonstrate knowledge of standards of ethical conduct.

Standard III-F The applicant must demonstrate knowledge of processes used in research and the integration of research principles into evidence-based clinical practice.

Standard III-G The applicant must demonstrate knowledge of contemporary professional issues.

Standard IV-A The applicant must complete a curriculum of academic and clinical education that follows an appropriate sequence of learning sufficient to achieve the skills outcomes in Standard IV-G.

Standard IV-B The applicant must possess skill in oral and written or other forms of communication sufficient for entry into professional practice.

**WEEK 14**

Prospectus is due today in final form – submit both printed and electronic versions.

Review for Final Examination