August 30, 2010

Dear Student:

Welcome to the graduate course *Statistical Reasoning in Education* at Cedarville University! We will meet in the Apple Technology Resource Center from September 25- December 11.

I have enclosed a copy of the course syllabus, which includes topics that will be addressed. It also lists the textbooks that will be used. You can purchase these textbooks in person at the University bookstore, or you can order them over the telephone at 937-766-3209.

If you have any questions regarding this course, please do not hesitate to contact me by e-mail at hwangc@cedarville.edu

Sincerely,

Chi-en Hwang, Ph.D.
Professor of Psychology
EDU 6250 Statistical Reasoning in Education
Fall 2010

Instructor: Chi-en Hwang, 766-7974 (O), 372-9043 (H), Williams 223
E-mail <hwangc@cedarville.edu>

Course Description: A survey of descriptive and inferential statistics for use in investigation and
decision making in education. Topics covered include the nature of quantitative design in educational
research, descriptive statistics for univariate distributions, joint distributions, drawing inferences from
statistical data, and statistical tests for between-subjects and within-subject designs.

Pre-class Assignment: Each student will prepare a data set prior to the class. The data will be collected
from school or community regarding student outcomes. The process of data collection may take as long
as two to three months. The student will work closely with others from the school or community in the
data collection process. The data set will be used for the research project assignment of the course. For
details regarding the data set and research project, please read the instructions to the research project
assignment in the last part of the syllabus.

Topics to be covered: The student will demonstrate an understanding of:

1. The role of research and statistics in educational decision making.
2. The importance of reliability and validity and threats to threats to these in educational decision
making.
3. The development and use of frequency distributions.
4. The measures of central tendency, their relationship to the assumption of normality and the use of
the normal curve.
5. The computation, meaning, and proper use of correlation coefficients.
6. The computation, and predictive use of linear regression analysis.
7. Probability theory and the use of statistics in making inferences about a population from a sample
mean or inferences about differences between means.
8. The concepts of error and power in statistics and research and how these influence the level of
certainty of statistically based inferences.
9. The concepts of degrees of freedom, confidence intervals, and statistical significance.
10. The computation and use of t-tests for making statistically informed inferences for independent
and dependent samples.
11. The computation and use of one-way ANOVA.
12. The computation and use of factorial ANOVA.
13. The computation and use of chi-square tests.

Alignment with standards: The course addresses competencies for Strategic Leadership for the
principalship (all areas) and Curriculum, Instruction, and Professional Development (CIPD) in all
licensure areas. The course addresses the following standards: Guideline 1.0, Standard 1.3; Guideline 2.0,
standards 2.2, 2.4; Guideline 3.0, Standard 3.3.

Course Texts:
Houghton Mifflin. (H)


References


Course Requirements: (details on 3-5 will be provided on separate handouts)
1. Daily quiz based on the assigned readings. (30%)
2. Daily computer lab exercise using SPSS and other CEDARNET softwares. (15%)
3. Daily homework and problem sets focusing on computation and application of statistics in analyzing educational data. (25%)
4. Journal Article Review: Review of statistical procedures used in articles published in educational journals (10%)
5. Research Project: Design a data collection method, apply the proper statistical procedure in data analysis and write a report on the results. (20%)

Course Schedule:

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic(s)</th>
<th>Readings</th>
</tr>
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<tbody>
<tr>
<td>9/25</td>
<td>Design of Educational Research Understanding Data: Measurement Scales, Frequency Distribution &amp; Percentiles Descriptive Statistics I: Measures of Central Tendency Descriptive Statistics II: Measures Variability Z-scores and Standard Scores Normal Curve, Sampling Theory and Central Limit Theorem Norm</td>
<td>(H) 2 &amp; 6 (Ly) 6 (pp. 49-53) (H) 7 (Ly) 6 (pp. 53-57) (H) 8 (Ly) 6 (pp. 57-59) (H) 9 (pp. 218-228) (Ly) 8 (H) 9 (pp. 229-246) (H) 5 (pp. 114-117) (Ly) 7 (pp. 77-85)</td>
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<tr>
<td>10/30</td>
<td>Statistical Inference and Probability Test of Single Sample Mean Test of the Differences between Two Independent Samples</td>
<td>(H) 12, 13 (pp. 336-344) (H) 13 (pp. 345-367) (H) 14 (pp. 368-382) (H) 15</td>
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<tr>
<td>11/20</td>
<td>One-Way ANOVA and Between-</td>
<td>(H) 17</td>
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Subject Experiment

Two-way ANOVA and Factorial Design (H) 18

12/4 Correlational Research and Correlation Coefficients (H) 10
Practical Applications: Reliability & Validity in Test Scores (Ly) 6 (pp. 59-63) (Ly) 2
Linear Regression and Prediction (H) 11

12/11 Chi-Square Test (H) 21
Repeated Measures Design and Dependent-Samples t-Test (H) 16

HOMEWORK PROBLEMS (All assignments are due the NEXT DAY)

9/25  (H) Chap 6: 20, 24, 25
      Added to 25: Make a grouped frequency distribution with \( i = 3 \). Make a histogram based on the grouped data and compare with the graphs you did in #25.

      (H) Chap 7: 15, 21, 25
      (H) Chap 8: 16, 17
      (H) Chap 9: 12, 15, 16, 24

10/30 (H) Chap 12: 26, 27

      (H) Chap 14: 14, 15
      (H) Chap 15: 16, 19

11/20 (H) Chap 17: 21, 22
      Conduct a two-way ANOVA using your own data set and interpret the results

12/4  (H) Chap 10: 22, 24, 26

      (H) Chap 11: 23, 24

12/11 Conduct a Chi-square analysis by SPSS to test the relation between two categorical variables. Explain the results from the output.

      (H) Chap 16: 24
General Information

Find two research articles in published educational journals (can be electronic) that used statistical procedures and reported the results of statistical analyses. One of articles should use procedures involving the comparison of two or more groups (i.e., independent-samples t-test or ANOVA), and one of the articles should use correlational methods such as correlation or regression or chi-square. Write a review on each of the two articles concerning the statistical procedure(s) used in the study.

The following information should be included in the review:

Source:

Title
Author(s)
Journal
Date of Publication

Purpose of the Study: identify the research question(s).

Method of Data Collection: whether is through observation, survey, experiment or combination of more than one method.

Sample: method of sampling and general description of the sample.

Statistical Procedures:

Descriptive statistics reported: identify the variables and statistics.

Inferential statistics reported: answer the following questions for every procedure

1. What statistical test was performed?
2. What is the statistical hypothesis tested?
3. Was the result statistically significant?
4. What is the related research question or hypothesis in the study?

Conclusions Drawn from Statistical Analyses:

1. Which of the research hypotheses were supported by the statistical results?
2. Which of the research hypotheses were not supported by the data?
3. Did the author(s) make all the claims based on statistical evidences?
4. Did the author(s) discard any inconsistent statistical findings in order to support the original research hypotheses?
5. Did the author(s) use appropriate statistical procedures for data analysis?
6. Are there any alternative statistical procedures for this study?
EDU 6250: Statistical Reasoning in Education

INSTRUCTIONS TO RESEARCH PROJECT

Due: December 16, 2010

The purpose of the research project is to integrate knowledge of statistics and service to the community. The student will collaborate with others in the community to choose a topic from current issues, develop a study to find answers or solutions to the problem, identify research questions and make hypotheses, gather data to test the hypotheses, and analyze data and make conclusions. The final report of the project will be made available to the community where the data are collected.

This project involves five parts: 1) collect a data set which has both quantitative and qualitative variables, 2) formulate research questions and hypotheses from the data, 3) conduct statistical analyses on the data to provide answers to the research questions, 4) produce a written report including graphs and tables concerning the major findings, and 5) present the results to the community and make recommendations for implementation based on the findings.

Data Set

The data can be collected through observation, survey interview, or experiment. The data set should include at least one qualitative/categorical variable (such as gender, race, occupation, etc.) and one quantitative variable (such as test score, age, salary, etc.). The sample should have a minimum size of 30 individuals. The data should be collected prior to the beginning of the class and can be shared by several members in class. The format of the data set can be either in EXCEL or other spreadsheet that can be directly input to the computer for analysis.

Research Questions and Hypotheses

Each person should identify one or two research questions. Predictions of outcome (i.e., hypotheses) should be made to each one of the research questions. Identify proper statistical procedures for data analysis.

Data Analysis Using PASW Statistics (SPSS)

Enter the data into PASW Statistics and created a “.sav” file. Perform statistical analyses on the data and save all the output on a “.spv” file. Review the results of computer analyses and make note on the value of the test statistic and level of significance in each run.

Written Report

The written report should follow that APA format and include the following sections

- Title Page: Includes a title of 10 to 12 words, author’s name and institutional affiliation, and a running head (50 characters of less).
- Abstract: An abstract is a brief (120 words or less) summary of the content of the paper.
• **Introduction**: Opens with a statement of problem followed by specific research questions and hypotheses, design of the study, and theoretical framework.

• **Method**: Describes the target population and sample, and means/procedure of data collection.

• **Results**: In this section you will report the statistical findings that either supported or disconfirmed each of the research hypotheses. Summarize the findings in tables (a good reference is the APA publication Presenting Your Findings: A Practical Guide for Creating Tables, 1999) and graphs. Graphs produced by the SPSS or other computer graphic software should be edited to have proper headings and labels. Narratives should include a description of the sample size, statistical procedures, and the computer program that was used to perform the statistical analyses. Level of statistical significance, statistical power and effect size should also be reported. By convention, statistical findings that have reached the level of statistical significance should be reported in the context of the research hypotheses. The report of results should be objective **without** personal opinions or interpretations.

• **Discussion**: You are in a position to evaluate and interpret the results and their implications with regard to your original hypotheses. What conclusions can be drawn from this study? Be specific. Were any problems encountered during the study? What are the limitations of the study and how can the results be generalized? What could be done different if the study were to be repeated?

**Presentation**

Prepare the PowerPoint slides for a 15-minute oral presentation to the community where the data were collected. Provide opportunities to exchange ideas with others in the community and obtain feedbacks. The file of the slides should be submitted to the instructor as one of the class assignments. An alternative format can be a poster presentation.