ED_PSYCH 569
Seminar in Quantitative Techniques in Education (3 Cr.)
Topics in Multivariate Data Analysis
Spring 2018
CLEV 63, Thursday, 4:10 PM – 7:00 PM

Instructor: Shenghai Dai
Office: Cleveland Hall 354
Phone: (509) 335-0958
E-mail: s.dai@wsu.edu
Office Hours: Thursday: 2:00 – 3:00 PM or by appointment

Prerequisites
ED_RES 565 Quantitative Methods.

Course Description
ED_PSYCH 569 aims to provide a conceptual and practical basis to statistical literacy in the education disciplines. The course this semester focuses on the General Linear Model (GLM) and its extensions, and the various forms it takes in the multivariate context. The forms of the model will be discussed in relationship to the particular research questions for which they are appropriate. A range of multivariate statistical analysis procedures are considered to examine relationships between multiple variables (e.g., multiple dependent and/or independent variables) and comparisons will be made to their univariate equivalent. Principal component and factor analysis will be covered as a way to reduce the number of measured variables to a smaller number of scores and to study the structure in data or underlying factors. Confirmatory factor analysis and structural equation modeling (SEM) will be introduced. Profile analysis as the multivariate approach to repeated measures and survival analysis to time-series data will also be covered.

The limitations (i.e., assumptions) and unresolved issues of each forms of the GLM will be examined. Students will learn to formulate research questions, to select appropriate analysis procedures, to conduct statistical analyses, and to report, interpret and write up narratives of the results in relation to the research questions and context. The student is exposed to statistical software packages common in the social and behavioral sciences.

Course Learning Objectives
Based on classroom instruction and activities, reading assignments, discussions, and related activities, each student should demonstrate basic knowledge and application in the following areas:

1. Matrix algebra
2. Multiple regression
3. Multivariate analysis of variance (MANVOA)
4. Discriminant function analysis
5. Principle component and exploratory factor analysis (PCA & EFA)
6. Confirmatory factor analysis (CFA) & introduction to structural equation modeling (SEM)
7. Profile analysis: the multivariate approach to repeated measures
8. Survival/Failure analysis
9. Statistical software packages

Students should exit the course with an increased ability to (a) conduct the discussed statistical analyses, (b) relate such analyses to experimental designs, (c) use statistical software packages, and (d) critically review the analyses in research articles.
Required Texts (and reading as assigned)

Recommended Book

Other Sources
Some students have also found the following books or articles useful:


E-mail Policy
I reply to email within 24 to 48 hours. I usually check email Monday-Friday, 9:00am to 5:00pm. If you do not hear from me after 48 hours, please feel free to email me again. If your email necessitates lengthy clarification of class readings or discussions, I will ask that you come see me about your concerns/questions during office hours.

Attendance/Participation
I expect all students to (a) attend class on time, (b) participate actively in class discussions, (c) read all assigned readings, and (d) turn in assignments on time. We will try to have lab time each class session to practice what we have discussed. If you are unable to attend class, please notify me in advance. You are responsible for information missed during your absence. No late assignments are accepted for credit.

Assessment of Learning and Grading
The course grade a student earns is determined by the following combination of assessments of the objectives listed above. I also note that you should expect to spend a few hours on homework assignments and work throughout the semester on your project. A last day effort on assignments is not a robust strategy for mastering the content.

Exams [30%]
There will be two take-home exams (i.e., Mid-Term & Final). Both exams are comprised of various item formats (e.g., multiple-choice, short essay, calculation). Make-up exams (alternate form) are available only in extreme circumstances.

Homework Assignments [70%]
There will be a total of five homework assignments throughout the course. The assignments will consist of statistical problems to solve, but also may include other learning/practice experiences. The data for the assignments and further assignment information will be provided. Data and sample code files will be posted in a class folder or available from textbook website. No make-up assignments will be offered. Late assignments are not accepted for credit. Assignments are due at the start of the class with no exceptions.
Table 1  
*Grade Scale for the Course Displaying Percent Associated with Letter Grade*

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100 - 93%</td>
</tr>
<tr>
<td>A-</td>
<td>92 - 90%</td>
</tr>
<tr>
<td>B+</td>
<td>89 - 87%</td>
</tr>
<tr>
<td>B</td>
<td>86 - 83%</td>
</tr>
<tr>
<td>B-</td>
<td>82 - 80%</td>
</tr>
<tr>
<td>C+</td>
<td>79 - 77%</td>
</tr>
<tr>
<td>C</td>
<td>76 - 73%</td>
</tr>
<tr>
<td>C-</td>
<td>72 - 70%</td>
</tr>
<tr>
<td>D+</td>
<td>69 - 67%</td>
</tr>
<tr>
<td>D</td>
<td>66 - 60%</td>
</tr>
<tr>
<td>F</td>
<td>59% or below</td>
</tr>
</tbody>
</table>

*Note: I reserve the right to change the scale if in favor of the student and I round to the nearest whole number.*

Assigning Incompletes:

University policy (Acad. Reg. #90) states that Incompletes may only be awarded if: "the student is unable to complete their work on time due to circumstances beyond their control.

Resources

SPSS and SAS are available in Cleveland Hall Room 63.

Mobile Phones/Beepers/PDAs/Computers

Any student carrying a mobile phone/beeper or other PDA should turn it off or set it to vibrate during class. In the event that a student must remain “on-call” during class, they should plan to sit where they can easily leave the room without disturbing others. Also, please refrain from sending text messages or participating in other social media outlets (e.g., Facebook) while in class. If you cannot refrain from such activities you will be asked to leave the classroom.

Students with Documented Disabilities

Pullman Campus

Students with Disabilities: Reasonable accommodations are available for students with documented disabilities or chronic medical conditions. If you have a disability and need accommodations to fully participate in this class, please visit the Access Center website to follow published procedures to request accommodations: [http://www.accesscenter.wsu.edu](http://www.accesscenter.wsu.edu). Students may also either call or visit the Access Center in person to schedule an appointment with an Access Advisor. Location: Washington Building 217; Phone: 509-335-3417. All disability related accommodations MUST be approved through the Access Center. Students with approved accommodations are strongly encouraged to visit with instructors early in the semester during office hours to discuss logistics.

WSU Online Course

Reasonable accommodations are available in online classes for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend you begin the process as soon as possible.

For more information contact a Disability Specialist on your home campus:

* Pullman or WSU Online: 509-335-3417, [http://accesscenter.wsu.edu](http://accesscenter.wsu.edu), [access.center@wsu.edu](mailto:access.center@wsu.edu)
* Spokane: 509-358-7534, [https://spokane.wsu.edu/studentaffairs/disability-resources](https://spokane.wsu.edu/studentaffairs/disability-resources)

**Academic Freedom**

WSU supports the faculty’s academic freedom, right to freedom of expression, and responsibility to fulfill course objectives that are approved by the Faculty Senate. This is fundamental to who we are as an institution. Along with these rights comes the responsibility to protect the freedom of expression of all members of our community, including students. The same is stated clearly in our own policies and procedures, including the Faculty Responsibilities section of the WSU Faculty Manual:

“As teachers, professors encourage the free pursuit of learning in their students. They hold before them the best scholarly standards of their disciplines. They demonstrate respect for the student as an individual and adhere to their proper role as intellectual guides and counselors…They protect students’ academic freedom.”

**Service/Emotional Support Animal Guidelines**

Please review the campus policy on [service/emotional support animals](http://www.wsu.edu/). Pets are not allowed on campus and service animals must be registered with the WSU Access Center. Please contact the Access Center at 509-335-3417 with any questions.

**Academic Integrity Policy**

Washington State University, a community dedicated to the advancement of knowledge, expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The purpose of these standards and processes is to educate students and protect the welfare of the community.

University instructors have the authority to intervene in all situations where students are suspected of academic dishonesty. In such instances, responsible instructors retain the authority to assign grades to students considering, from an academic standpoint, the nature of the student action. The consequences for such actions should be spelled out beforehand in the syllabus. More information regarding responding to academic integrity violations can be found at: [http://conduct.wsu.edu](http://conduct.wsu.edu). Feel free to contact the Office of Student Standards and Accountability (509-335-4532) if you would like more specific information about the process. The Writing Program (509-335-7959) can assist with proactive assignment design that minimizes intentional or unintentional academic dishonesty.

Attention to this policy is particularly important in a course like EDPSY/EDRES 565, in which collaboration with other students is encouraged. If, for example, you work closely with other students during the planning, execution, or interpretation of your data analyses – a process that I support – you should make sure that the other students’ contributions are recognized explicitly in your written account. **Academic dishonesty is not tolerated and will result in action** (i.e., **failing the assignment and/or course depending on the nature of the offense**) in accord with the policy. Please contact me if you have questions with this issue.

**Campus and Classroom Safety**

Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the “Alert, Assess, Act,” protocol for all types of emergencies and the “Run, Hide, Fight” response for an active shooter incident. Remain **ALERT** (through direct observation or emergency notification),
ASSESS your specific situation, and _ACT_ in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the _FBI’s Run, Hide, Fight video_ and visit the _WSU safety portal._

**Emergency Notification System**

Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors. It is highly recommended that you review the Campus Safety Plan (http://safetyplan.wsu.edu/) and visit the Office of Emergency Management website (http://oem.wsu.edu/) for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.
## Tentative Class Schedule*

<table>
<thead>
<tr>
<th>DATES</th>
<th>TOPIC</th>
<th>READINGS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-11</td>
<td>Introduction and overview</td>
<td>Chapters 1 - 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Taxonomy of multivariate techniques</em></td>
<td></td>
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<tr>
<td></td>
<td><em>Review of univariate techniques</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Assumptions underlying multivariate techniques</em></td>
<td></td>
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</tr>
<tr>
<td>1-18</td>
<td>Matrix Algebra &amp; Lab</td>
<td>Appendix A</td>
<td></td>
</tr>
<tr>
<td>1-25</td>
<td>Matrix Algebra (Cont.) &amp; Lab &lt;br&gt;<strong>(HW #1 assigned)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-1</td>
<td>Multiple Linear Regression &lt;br&gt;<strong>(HW #2 assigned)</strong></td>
<td>Chapter 5</td>
<td>HW #1 due (10%).</td>
</tr>
<tr>
<td>2-8</td>
<td>Multivariate analysis of variance (MANOVA)</td>
<td>Chapter 7</td>
<td>HW #2 due (15%).</td>
</tr>
<tr>
<td>2-15</td>
<td>MANOVA (cont.) &lt;br&gt;<strong>(HW #3 assigned)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-22</td>
<td>Discriminant function analysis</td>
<td>Chapter 9</td>
<td>HW #3 due (15%).</td>
</tr>
<tr>
<td>3-1</td>
<td>Principal component and exploratory factor analysis (PCA &amp; EFA) &lt;br&gt;&lt;br&gt;<strong>(Exam #1 assigned)</strong></td>
<td>Chapter 13</td>
<td></td>
</tr>
<tr>
<td>3-8</td>
<td>PCA &amp; EFA (cont.)</td>
<td></td>
<td>Exam #1 due (15%).</td>
</tr>
<tr>
<td>3-15</td>
<td><strong>Spring Break No Class</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-22</td>
<td>PCA &amp; EFA (cont.) &lt;br&gt;<strong>(HW #4 assigned)</strong></td>
<td>Chapter 13</td>
<td></td>
</tr>
<tr>
<td>3-29</td>
<td>Confirmatory factor analysis (CFA)</td>
<td></td>
<td>HW #4 due (15%).</td>
</tr>
<tr>
<td>4-5</td>
<td>CFA (cont.) and Introduction to structural equation modeling (SEM). &lt;br&gt;<strong>(HW #5 assigned)</strong></td>
<td>Chapter 14</td>
<td></td>
</tr>
<tr>
<td>4-12</td>
<td><strong>AERA WEEK (TBD)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-19</td>
<td>Profile analysis</td>
<td>Chapter 8</td>
<td>HW #5 due (15%).</td>
</tr>
<tr>
<td>4-26</td>
<td>Survival analysis &lt;br&gt;<strong>(Exam #2 assigned)</strong></td>
<td>Chapter 11</td>
<td></td>
</tr>
<tr>
<td>5-3</td>
<td><strong>Exam Week No Class</strong></td>
<td></td>
<td>Exam #2 due (15%).</td>
</tr>
</tbody>
</table>

**Notes:**
- The instructor reserves the right to adjust the schedule as needed.
- Additional readings may be assigned.