Child Development 243: Advanced Statistics
Multivariate Statistics

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Office Hours:	Monday 8-10 Also, by appointment	Tuesday 9-11 Also, by appointment

Class Meeting Time: Thursdays 4:00-5:15 (see Calendar below for specific dates)
Room : Eliot-Pearson Room #163 (Conference Room)

Lab Time: Thursdays 5:30-6:30
Room: Mark Learning Resource Center

Course Overview:

This course is designed to introduce students to multivariate statistics. In this course, students will learn the fundamental components required for use of multivariate techniques; in addition, students will be conceptually introduced to a wide variety of advanced multivariate techniques. The course is designed to provide students with basic knowledge on both *when* and *how* to use specific techniques. A firm understanding of Basic Statistics (i.e., chi-square and correlation) is a prerequisite for this course. This course will prepare students to engage in specialized training in more advanced multivariate techniques (e.g., Structural Equation Modeling and Hierarchical Linear Modeling).

Topics that will be thoroughly covered by the instructors are identified in the course outline beginning on page 3 of this syllabus. Each topic will be discussed with regard to (1) the purpose of the strategy, (2) the "how to" of the strategy (using SPSS), and (3) the application of the strategy in developmental research (how do you "read" the output and translate it into a "write-up" of the method). The first half of each class will be in lecture format, with the purpose of the strategy presented by one of the course instructors. The second half of each course will be in "lab" format at which time we will go, as a class, to the lab and "use" the procedure to analyze data based on specific research questions. Every other week, students will be required to complete homework assignments that will require them to interpret output and discuss the best use for each analytic method as a tool to examine research questions informed by developmental science.

Course Philosophy:

The philosophy of the instructors in regard to this course stresses the salience of knowledge of statistics as a foundation for reading and conducting research. Equivalent

importance is placed on developing a conceptual understanding of each technique and the ability to apply each technique appropriately.

Required Texts and Readings:

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate data analysis, 5th Edition. Upper* Saddle River, NJ: Prentice Hall.

Green, S., Salkind, N., & Akey, T. (2000). *Using SPSS for windows: Analyzing and understanding data, 2nd Edition.* Upper Saddle River, NJ: Prentice Hall.

Readings available in the Reserve Section of the Tisch Library

Books on Reserve at the Tisch Library:

Howell, D. C. (1999). *Fundamental Statistics: For the behavioral sciences (4th ed.).* Boston, MA: Duxbury Press.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics (4th ed.).* Boston, MA: Allyn & Bacon.

Course Calendar

Note: [R] = indicates that this source is on Reserve at Tisch Library
[O] = indicates that this source can be obtained through the Tufts on-line library

January 17	*Why so much emphasis on statistics?* *What are multivariate statistics?* Review of Correlation	Lab: Homework 1 (Due 2/7)	J

I. The research question*methods/statistics*results *triad*

II. Introduction to Multivariate Statistics

III. Review of Correlation

Required:

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). Chapter 1: What is multivariate analysis? pgs. 1-31.

[R]Grimm, G. & Yarnold, P. (2000). Chapter 1: Introduction to multivariate statistics. In. L. Grimm & P. Yarnold (Eds.), Reading and Understanding Multivariate Statistics (pp. 1-18). Washington, DC: APA.

[R]Hopkins, K., & Weeks, D. (1990). Tests for normality and measures of skewness and kurtosis: Their place in research reporting. Educational & Psychological Measurement, 50(4), 717-729.

Recommended:

[R]Brown, G., Harris, T., & Lemyre, L. (1991). Now you see it, now you don't: Some considerations on multiple regression. In D. Magnusson, L. Bergman, et al. (Eds.). Problems and Methods in Longitudinal research: Stability and change. European Network on Longitudinal Studies on Individual Development, 5. (pp. 67-94). New York, NY: Cambridge University Press.

[R]Tabachnick, B., & Fidell, L. (2001). Chapter 1: Introduction to Multivariate Statistics, pgs. 1-16.

[R]Tabachnick, B., & Fidell, L. (2001). Chapter 2: A guide to statistical techniques: Using the book, pgs. 17-30.

[R]Howell, D. C. (1999). Chapter 9: Correlation, pgs. 141-169.

January 24	Regression; Multiple Regression	Lab: Homework 1 (Due 2/7)	J

I. Introduction to Regression

II. Multiple Regression

Required:

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). Chapter 4: Multiple Regression Analysis. pgs. 141-213.

[R]Licht, M. (2000). Chapter 2: Multiple regression and correlation. In. L. Grimm & P. Yarnold (Eds.), Reading and Understanding Multivariate Statistics (pp. 19-64). Washington, DC: APA.

[R]James, L., & Brett, J. (1984). Mediators, moderators, and tests for mediation. Journal of Applied Psychology, 69, 307-321.

[O]Tram, J., & Cole, D. (2000). Self-perceived competence and the relation between life events and depressive symptoms in adolescence: mediator or moderator? Journal of Abnormal Psychology, 109, 753-760.

Recommended:

[R]Howell, D. (1999). Chapter 10: Regression, pgs. 172-192.

[R]Howell, D. (1999). Chapter 11: Multiple Regression, pgs. 197-219.

[R]Tabachnick, B., & Fidell, L. (2001). Chapter 5: Multiple Regression, pgs. 111-170.

January 31	Multiple Regression; Brief Introduction to Path Analysis	Lab: Homework 1 (Due 2/7)	J

I. Previous week's readings (cont'd)

II. Brief Introduction to Path Analysis

Required:

Klem, L. (2000). Path analysis. In. L. Grimm & P. Yarnold (Eds.), Reading and Understanding Multivariate Statistics (pp. 65-98). Washington, DC: APA.

February 7	Review of Chi-Square; ANOVA; Two-way ANOVA	Lab: Homework 2 (Due 2/21)	J

I. Chi-Square Review

II. Power

III. One-Way Analysis of Variance

IV. Two-way Analysis of Variance; Factorial ANOVA

Required:

[R]Howell, D. C. (1999). Chapter 19: Chi-square, pgs. 371-389.

[R]Howell, D. C. (1999). Chapter 15: Power, pgs. 279-296.

[R]Cohen, J. (1992). A power primer. Psychological Bulletin, 112, 155-159.

[R]Howell, D. C. (1999). Chapter 16: One-way Analysis of Variance, pgs. 299-331.

[R]Howell, D. C. (1999). Chapter 17: Factorial Analysis of Variance, pgs. 335-353.

[R]Thomas, S., & Davison, M. (1983). Moral reasoning development and graduate education. Journal of Applied Developmental Psychology, 4, 227-238.

Recommended:
[R]Tabachnick, B. & Fidell, L. (2001). Chapter 3: Chi-square analysis, pg. 55.

[R]Tabachnick, B. & Fidell, L. (2001). Chapter 3: Power, pg. 34.

[R]Tabachnick, B. & Fidell, L. (2001). Chapter 3: Hypothesis Testing & Analysis of Variance, pgs. 31-40.

[R]Tabachnick, B. & Fidell, L. (2001). Chapter 3: Factorial Between-Subjects ANOVA, pgs. 40-45.

February 14	Repeated Measure ANOVA	Lab: Homework 2 (Due 2/21)	J

I. Repeated Measures ANOVA – Experimental/Treatment Design

II. Within-Subjects Repeated Measures; Mixed Models ANOVA

Required:
[R]Howell, D. C. (1999). Chapter 18: Repeated-Measures Analysis of Variance, pgs. 357-368.

[R]Kessler, G., Ibrahim, F., & Harris, K. (1986). Character development in adolescence. Adolescence, 21, 1-9.

[O]Bumpus, M., Crouter, S., & McHale, S. (2001). Parental autonomy granting during adolescence: Exploring gender differences in context. Developmental Psychology, 37, 163-173.

February 21	Introduction of Covariance; The special case of ANCOVA	Lab: Homework 3 (Due 2/28)	J

I. Covariates – When is it appropriate to use a covariate?

II. Analysis of Covariance

Required:
[R]Tabachnick, B., & Fidell, L., (2001). Chapter 8: Analysis of Covariance, pgs. 275-321.

[R]Holman, T., & Li, B. (1997). Premarital factors influencing perceived readiness for marriage. Journal of Family Issues, 18, 124-144.

February 28	MANOVA	Lab: Homework 4 (Due 3/14)	D

I. Multivariate Analysis of Variance

Required:
[R]Bray, J. H., & Maxwell, S. E. (1985). Multivariate analysis of variance (pg. 1-56). Beverly Hills, CA: Sage.

[R]Fuligini, A. J., & Eccles, J. S. (1993). Perceived parent-child relationships and early adolescents' orientation toward peers. Developmental Psychology, 29, 622-632.

Recommended:
[R]Tabachnik B. G., & Fidell, L. S. (2001). Using Multivariate Statistics (4th Ed.) Chapter 9, pgs. 322-390.

[R]Weinfurt, K. (2000). Multivariate Analysis of Variance. In. L. Grimm & P. Yarnold (Eds.), Reading and Understanding Multivariate Statistics (pg. 245-276). Washington, DC: APA.

March 7	MANCOVA	Lab: Homework 4 (Due 3/14)	D

I. Multivariate Analysis of Covariance

Required:
[R]Tabachnik B. G., & Fidell, L. S. (2001). Using Multivariate Statistics (4th Ed.) Chapter 9, pgs. 322-331, 346-352.

[R]East, P. L., & Rook, K. S. (1992). Compensatory patterns of support among children's peer relationships: A test using school friends, nonschool friends, and siblings. Developmental Psychology, 28, 163-172.

Recommended:
[R]Tabachnik B. G., & Fidell, L. S. (2001). Using Multivariate Statistics (4th Ed.) Chapter 9, pgs. 322-390.

March 14	Introduction to Factor Extraction Techniques: Principal Components Analysis(PCA) vs. Factor Analysis(FA)	Lab: Homework 5 (Due 3/28)	D

I. Multidimensional Scaling

Required:

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). Chapter 10: Multidimensional Scaling. pgs. 519-575.

Recommended:

[R]Stalans, L. (2000). Multidimensional Scaling. In. L. Grimm & P. Yarnold (Eds.), Reading and Understanding Multivariate Statistics (pp. 137-168). Washington, DC: APA.

II. Factor Analysis

Required:

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). Chapter 3: Factor Analysis. pgs. 87-138.

[R]Vassend, O., & Skrondal, A. (1997). Validation of the NEO Personality Inventory and the five-factor model. Can findings from exploratory and confirmatory factor analysis be reconciled? European Journal of Personality, 11, 147-166.

Recommended:

[R]Bryant, F. & Yarnold, P. (2000). Principal-Components Analysis and Exploratory and Confirmatory Factor Analysis. In. L. Grimm & P. Yarnold (Eds.), Reading and Understanding Multivariate Statistics (pp. 99-136). Washington, DC: APA.

Spring Recess	----No Class---		

March 28	Exploratory vs. Confirmatory Factor Analysis	Lab: Homework 6 (Due 4/10)	D

I. Factor Analysis

Required:

See previous week's readings (cont'd).

[R]Alwin, D. F. (1992). Factor Analysis. In E. F. Borgatta & M. L. Borgatta (Eds.), Encyclopedia of Sociology (pp. 621-638). New York: MacMillan.

[R]Safran, S. A., Turk, C. L., & Heimberg, R. G. (1998). Factor structure of the Social Interaction Anxiety Scale and the Social Phobia Scale. Behaviour Research and Therapy, 36, 443-453.

April	**4**	Factor Analysis (continued) & a Short Presentation of Structural Equations Modeling	Lab: Homework 6 (Due 4/10)	D

I. Factor Analysis

Required:
See readings from previous two week's (cont'd).

II. A Brief Introduction to Structural Equation Modeling

Required:
Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). Chapter 11: Structural Equation Modeling. pgs. 577-644.

[R]Nix, R. L., Pinderhughes, E. E., Dodge, K. A., Bates, J. E., Pettit, G. S., & McFadyen-Ketchum, S. A. (1999). The relation between mothers' hostile attribution tendencies and children's externalizing behavior problems: The mediating role of mothers' harsh discipline practices. Child Development, 70, 896-909.

Recommended:
[R]Hoyle, R. H. (1995). The structural equation modeling approach: Basic concepts and fundamental issues. In R. H. Hoyle (Ed.), Structural equation modeling: Concepts, issues, and applications (pp. 1-15). Thousand Oaks, CA: Sage.

April	11	--- No Class--- (Meeting of the Society for Research on Adolescence) Group Meetings Monday through Wednesday with Instructors to Discuss Presentation --Prepare Presentations--

Monday's Schedule this Thursday – **April 18**	Class Presentations Schedule to be Announced

April 25	Class Presentations Schedule to be Announced

May 2	(Reading Day)

Final Exam	To Be Scheduled During Final Exam Week – TBA

Course Requirements:

The course requirements include the following:

Class Attendance and Participation. Attendance for all class sessions is expected. Lectures will generally build on topics from the previous class(es), and consequently it would be in your best interest to attend all sessions. Do not hesitate to ask any question during class. The instructors will have the discretion to consider poor attendance when considering a student's final grade.

Biweekly Assignments (30 points each x 6 assignments = 180 points total). During the lab session we will be using SPSS to analyze data using the various statistical techniques that have been discussed in class. You will be expected to run the required statistics, interpret the analysis, and provide a write-up of the results. This write-up will consist of the student's short answers to specific questions related to the analysis, as well as a brief "results-type" write-up of the analysis. Students can work individually or as a group to run the analysis, however the write-up must be completed independently. These assignments will be due at the start of class on the day listed in the course outline.

Midterm and Final Exam (80 points each x 2 exams = 160 points). The purpose of the mid-term and final exams are to test students' knowledge in regard to the application of multivariate techniques. Each exam will require simple computations and essay responses. The final exam will not be cumulative. Exams will be "take-home"; students will be encouraged to use texts, course materials, and additional materials to answer exam questions to the best of their abilities. Students are required to complete each exam independently and without the help of any other person. Any student who does not complete the exams independently will be referred to the Dean of Arts and Sciences for infraction of the Tufts University honor code.

Final Project and Presentation (60 points). As the instructors will discuss, statistical and methodological procedures should be approached as any substantive topic would be approached. The purpose of this final project is twofold: (1) students will learn

how to research and develop knowledge about a specific methodological/statistical topic, (2) students will develop presentation skills, and (3) each student will be introduced to a wide variety of multivariate topics and will be able to develop a set of readings that will "prime" you to use advanced multivariate techniques well beyond the parameters of this course.

To complete this project: students will prepare and deliver a presentation on a multivariate procedure or topic (see example topics listed below) that will be approximately 30 minutes in length. Students should present in pairs. In order to prepare for this presentation, students should do the following:

(1) Choose a presentation partner
(2) Rank order presentation topics (see below) that are of interest to the students or propose additional topics to instructors.
(3) During the second class meeting we will choose topics and schedule presentations for class meetings on April 18th and 25th
(4) Students should develop presentations during the semester
(5) Students should schedule a meeting with one instructor before April 8th, or during the week of April 8th (M, Tu, or W) to go over materials that will be used for presentations
(6) Presentations should include the following:
    - An oral overview of the topic highlighting the major issues associated with the technique.
    - An outline of the presentation for each student and instructors
    - 2 articles: <u>One</u> article that describes the technique/topic and the major points associated with the topic (i.e., a chapter from a textbook, etc.) and a <u>second</u> article in which the technique is used or is assessed.
    - A list of references used to create the presentation

<u>Suggested Topics for presentations:</u>
Canonical Correlation
Cluster Analysis
Discriminant Function Analysis
Growth Curve Analysis
Hierarchical Linear Analysis
Log Linear Analysis
Logistic Regression
Meta-Analysis
Survival Analysis

Grading Guidelines:

Biweekly Assignments	180	Points (30 Points Each)
Final Project	60	
Mid-Term	80	
<u>Final</u>	<u>80</u>	
Total Points	**400**	

The following are strict grading guidelines for student grades out of a total possible 400 points:

Grade	Grade Range	Point Cut-off for this Grade
A	95-100%	380
A-	90-94.9%	360
B+	87-89.9%	348
B	84-86.9%	336
B-	80-83.9%	320
C+	77-79.9%	308
C	74-76.9%	296
C-	70-73.9%	280
D+	67-69.9%	268
D	64-66.9%	256
D-	60-63.9%	240
Fail	59.9% and below	Below 240