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MAR 22 2016

## Course Information

Date Submitted: 3/8/2016

Current Prefix and Number: EDP - Edc. & Counseling Psychology , EDP 711 ADVANCED QUANTITATIVE METHODS

Other Course:

Proposed Prefix and Number: EDP 711

What type of change is being proposed?

Major Change

Should this course be a UK Core Course? No

## 1. General Information

a. Submitted by the College of: EDUCATION

b. Department/Division: Educational, School and Counseling Psych

c. Is there a change in 'ownership' of the course? No

If YES, what college/department will offer the course instead: Select...

e. Contact Person

Name: Michael Toland

Email: toland.md@uky.edu

Phone: 257-3395

Responsible Faculty ID (if different from Contact)

Name: Kelly Bradley

Email: kdbrad2@uky.edu

Phone: 257-4923

f. Requested Effective Date

Semester Following Approval: Yes OR Effective Semester:

## 2. Designation and Description of Proposed Course

a. Current Distance Learning (DL) Status: N/A

b. Full Title: ADVANCED QUANTITATIVE METHODS

Proposed Title: ADVANCED QUANTITATIVE METHODS

c. Current Transcript Title: ADVANCED QUANTITATIVE METHODS

Proposed Transcript Title: ADVANCED QUANTITATIVE METHODS

d. **Current Cross-listing:** Same as EPE 711

Proposed – ADD Cross-listing :

Proposed – REMOVE Cross-listing:

e. **Current Meeting Patterns**

LECTURE: 2

LABORATORY: 2

**Proposed Meeting Patterns**

LECTURE: 2

LABORATORY: 2

f. **Current Grading System:** Graduate School Grade Scale

Proposed Grading System: *Graduate School Grade Scale*

g. **Current number of credit hours:** 3

Proposed number of credit hours: 3

h. **Currently, is this course repeatable for additional credit?** Yes

Proposed to be repeatable for additional credit? Yes

If Yes: **Maximum number of credit hours:** 12

If Yes: **Will this course allow multiple registrations during the same semester?** Yes

**2i. Current Course Description for Bulletin:** This course is designed to familiarize student with advanced quantitative techniques. Topics include structural equation modelling, item response theory, rasch modelling, hierarchical linear modelling, and data mining. Other specific analysis techniques may also be explored.

**Proposed Course Description for Bulletin:** This course will provide students with an overview of the theory and applications of advanced quantitative methods. A quantitative research method focuses on advanced quantitative methodologies used in methodologically-oriented studies in educational education, evaluation, and statistics. The goal of this course is to prepare students to analyze data using advanced quantitative methods. It covers topics in the areas of multilevel modeling, data mining, missing data, categorical data analysis, meta-analysis, and longitudinal data analysis. Other specific analysis techniques may also be explored. Given the advanced nature of the course, we will not shy away from using the mathematical tools needed to develop the conceptual understanding. But the emphasis of the course will be on the conceptual understanding and application of the tools rather than on the math or the mechanics behind the tools.

**2j. Current Prerequisites, if any:** Prereq: Intermediate Statistics

Proposed Prerequisites, if any: Prereq: Intermediate Statistics

**2k. Current Supplementary Teaching Component:**

Proposed Supplementary Teaching Component:

**3. Currently, is this course taught off campus?** No

Proposed to be taught off campus? No

If YES, enter the off campus address:

4. Are significant changes in content/student learning outcomes of the course being proposed? Yes

If YES, explain and offer brief rationale: The course description has changed to reflect the focus on just advanced quantitative (statistical) content so that any content related to advanced psychometrics has been moved out of 711 and into the new 712 course.

5a. Are there other depts. and/or pgms that could be affected by the proposed change? No

If YES, identify the depts. and/or pgms:

5b. Will modifying this course result in a new requirement of ANY program? No

If YES, list the program(s) here:

6. Check box if changed to 400G or 500: No

## Distance Learning Form

Instructor Name:

Instructor Email:

Internet/Web-based: No

Interactive Video: No

Hybrid: No

1. How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations?

2. How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.

3. How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.

4. Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?

If yes, which percentage, and which program(s)?

5. How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?

6. How do course requirements ensure that students make appropriate use of learning resources?

7. Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

8. How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (<http://www.uky.edu/UKIT/>)?

9. Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? NO

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.

10. Does the syllabus contain all the required components? NO

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.

**Instructor Name:**

SIGNATURE|RJREES2|Robert J Reese|EDP 711 CHANGE Dept Review|20151027

SIGNATURE|JPBIEB01|Jeffery Bieber|EDP 711 CHANGE Cross-List Chair Review|20151103

SIGNATURE|MYRT|Martha L Geoghegan|EDP 711 CHANGE College Review|20160303

SIGNATURE|ZNNIKO0|Roshan N Nikou|EDP 711 CHANGE Graduate Council Review|20160322

### Course Change Form

<https://myuk.uky.edu/sap/bc/soap/rfc?services=>

Open in full window to print or save

Generate F

Attachments:

Upload File

	ID	Attachment
Delete	5660	711_Syllabus_old_done.docx
Delete	5986	EDP 711_Syllabus revised done121115.pdf

NOTE: Start form entry by choosing the Current Prefix and Number  
(\*denotes required fields)

Current Prefix and Number:		EDP - Edc. & Counseling Psychology EDP 711 ADVANCED QUANTITATIVE METHODS	Proposed Prefix & Number: (example: PHY 401G) <input checked="" type="checkbox"/> Check if same as current	EDP 711
* What type of change is being proposed?		<input checked="" type="checkbox"/> Major Change <input type="checkbox"/> Major - Add Distance Learning <input type="checkbox"/> Minor - change in number within the same hundred series. ex: 799 is the same "hundred series" <input type="checkbox"/> Minor - editorial change in course title or description which does not change in content or emphasis <input type="checkbox"/> Minor - a change in prerequisite(s) which does not imply a change in course content or emphasis, or which is made necessary by the deletion or significant alteration of the prerequisite(s) <input type="checkbox"/> Minor - a cross listing of a course as described above		
Should this course be a UK Core Course? <input type="radio"/> Yes <input checked="" type="radio"/> No				
If YES, check the areas that apply:				
<input type="checkbox"/> Inquiry - Arts & Creativity <input type="checkbox"/> Composition & Communications - II <input type="checkbox"/> Inquiry - Humanities <input type="checkbox"/> Quantitative Foundations <input type="checkbox"/> Inquiry - Nat/Math/Phys Sci <input type="checkbox"/> Statistical Inferential Reasoning <input type="checkbox"/> Inquiry - Social Sciences <input type="checkbox"/> U.S. Citizenship, Community, Diversity <input type="checkbox"/> Composition & Communications - I <input type="checkbox"/> Global Dynamics				
<b>1. General Information</b>				
a. Submitted by the College of:		EDUCATION		Submission Date: 3/8/2016
b. Department/Division:		Educational, School and Counseling Psych		
c.* Is there a change in "ownership" of the course?				
<input type="radio"/> Yes <input checked="" type="radio"/> No    If YES, what college/department will offer the course instead? <input type="text" value="Select..."/>				
e.* Contact Person Name:		Michael Toland	Email: <a href="mailto:toland.md@uky.edu">toland.md@uky.edu</a>	Phone: 257-3395
* Responsible Faculty ID (if different from Contact):		Kelly Bradley	Email: <a href="mailto:kbrad2@uky.edu">kbrad2@uky.edu</a>	Phone: 257-4923
f.* Requested Effective Date:		<input checked="" type="checkbox"/> Semester Following Approval	OR	Specific Term: <sup>2</sup>
<b>2. Designation and Description of Proposed Course.</b>				
a. Current Distance Learning(DL) Status:		<input checked="" type="radio"/> N/A <input type="radio"/> Already approved for DL* <input type="radio"/> Please Add <input type="radio"/> Please Drop		
*If already approved for DL, the Distance Learning Form must also be submitted unless the department affirms (by checking this box ) that the proposed change will affect DL delivery.				
b. Full Title:		ADVANCED QUANTITATIVE METHODS	Proposed Title: *	ADVANCED QUANTITATIVE METH
c. Current Transcript Title (if full title is more than 40 characters):		ADVANCED QUANTITATIVE METHODS		
c. Proposed Transcript Title (if full title is more than 40 characters):		ADVANCED QUANTITATIVE METHODS		
d. Current Cross-listing:		OR		

	<input type="checkbox"/> N/A	Currently <sup>3</sup> Cross-listed with (Prefix & Number):	Same as EF
Proposed – ADD <sup>3</sup> Cross-listing (Prefix & Number):			
Proposed – REMOVE <sup>3,4</sup> Cross-listing (Prefix & Number):			
<b>e. Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours<sup>5</sup> for each meeting pattern</b>			
<b>Current:</b>	Lecture 2	Laboratory <sup>4</sup> 2	Recitation
	Clinical	Colloquium	Practicum
	Seminar	Studio	Other: _____ Please explain:
<b>Proposed: *</b>	Lecture 2	Laboratory <sup>5</sup> 2	Recitation
	Clinical	Colloquium	Practicum
	Seminar	Studio	Other: _____ Please explain:
<b>f. Current Grading System:</b>		Graduate School Grade Scale	
Proposed Grading System:*		<input type="radio"/> Letter (A, B, C, etc.) <input type="radio"/> Pass/Fail <input type="radio"/> Medicine Numeric Grade (Non-medical students will receive a letter grade) <input checked="" type="radio"/> Graduate School Grade Scale	
<b>g. Current number of credit hours:</b>	3	Proposed number of credit hours:*	3
<b>h.* Currently, is this course repeatable for additional credit?</b>			<input checked="" type="radio"/> Yes <input type="radio"/> N
<b>* Proposed to be repeatable for additional credit?</b>			<input checked="" type="radio"/> Yes <input type="radio"/> N
<b>If YES:</b>	Maximum number of credit hours:	12	
<b>If YES:</b>	Will this course allow multiple registrations during the same semester?		<input checked="" type="radio"/> Yes <input type="radio"/> N
<b>i. Current Course Description for Bulletin:</b>			
This course is designed to familiarize student with advanced quantitative techniques. Topics include structural equation modelling, item response theory, rasch modelling, hierarchical linear modelling, and data mining. Other specific analysis techniques may also be explored.			
<b>* Proposed Course Description for Bulletin:</b>			
This course will provide students with an overview of the theory and applications of advanced quantitative methods. A quantitative research method focuses on advanced quantitative methodologies used in methodologically-oriented studies in educational education, evaluation, and statistics. The goal of this course is to prepare students to analyze data using advanced quantitative methods. It covers topics in the areas of multilevel modeling, data mining, missing data, categorical data analysis, meta-analysis, and longitudinal data analysis. Other specific analysis techniques may also be explored. Given the advanced nature of the course, we will not shy away from using the mathematical tools needed to develop the conceptual understanding. But the emphasis of the course will be on the conceptual understanding and application of the tools rather than on the math or the mechanics behind the tools.			
<b>j. Current Prerequisites, if any:</b>			
Prereq: Intermediate Statistics			
<b>* Proposed Prerequisites, if any:</b>			
Prereq: Intermediate Statistics			
<b>k. Current Supplementary Teaching Component, if any:</b>			<input type="radio"/> Community-Based Experience

	<input type="radio"/> Service Learning <input type="radio"/> Both	
<i>Proposed Supplementary Teaching Component:</i>	<input type="radio"/> Community-Based Experience <input type="radio"/> Service Learning <input type="radio"/> Both <input type="radio"/> No Change	
3. Currently, is this course taught off campus?	<input type="radio"/> Yes <input checked="" type="radio"/> N	
* Proposed to be taught off campus?	<input type="radio"/> Yes <input checked="" type="radio"/> N	
If YES, enter the off campus address:		
4.* Are significant changes in content/student learning outcomes of the course being proposed?	<input checked="" type="radio"/> Yes <input type="radio"/> N	
If YES, explain and offer brief rationale:		
The course description has changed to reflect the focus on just advanced quantitative (statistical) content so that any content related to advanced psychometrics has been moved out of 711 and into the new 712 course.		
6. Course Relationship to Program(s).		
a.* Are there other depts and/or pgms that could be affected by the proposed change?	<input type="radio"/> Yes <input checked="" type="radio"/> N	
If YES, identify the depts. and/or pgms:		
b.* Will modifying this course result in a new requirement <sup>2</sup> for ANY program?	<input type="radio"/> Yes <input checked="" type="radio"/> N	
If YES <sup>2</sup> , list the program(s) here:		
6. Information to be Placed on Syllabus.		
a.	<input type="checkbox"/> Check box if changed to 400G or 500.	If changed to 400G- or 500-level course you must send in a syllabus and you must include the differentiation between under and graduate students by: (i) requiring additional assignments by the graduate students; and/or (ii) establishing different gra in the course for graduate students. (See SR 3.1.4.)

<sup>1</sup>See comment description regarding minor course change. *Minor changes are sent directly from dean's office to Senate Council Chair.* If Chair deems the change as "not minor," the form will be appropriate academic Council for normal processing and contact person is informed.

<sup>2</sup>Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

<sup>3</sup>Signature of the chair of the cross-listing department is required on the Signature Routing Log.

<sup>4</sup>Removing a cross-listing does not drop the other course – it merely unlinks the two courses.

<sup>5</sup>Generally, undergrad courses are developed such that one semester hr of credit represents 1 hr of classroom meeting per wk for a semester, exclusive of any lab meeting. Lab meeting generally least two hrs per wk for a semester for 1 credit hour. (See SR 5.2.1.)

<sup>6</sup>You must also submit the Distance Learning Form in order for the course to be considered for DL delivery.

<sup>7</sup>In order to change a program, a program change form must also be submitted.

New course to replace advanced quantitative methods seminars taught in regular sequence in  
EPE and EDP

### **EPE/EDP 711 Advanced Quantitative Methods**

**Instructor will vary by topic.**

**Credit Hours:** 3 credit hours per class, repeatable up to 12 hours

**Class Meetings:** Class will meet 2.5 hours per week, in either 140 or 245 TEB (computer smart classrooms)

#### **Course Goals and Prerequisites:**

The goal of this course is to provide students with knowledge of how to perform advanced quantitative methods useful in answering questions using observational or experimental data. It will allow them to more critically review research published that claims to answer such questions. The prerequisite is the first two semesters of quantitative methods, with a minimum of intermediate statistics or the equivalent as approved by the instructor.

**Course Description:** This course will provide students with an overview of the theory and applications of advanced quantitative methods. A quantitative research method focuses on advanced quantitative methodologies used in methodologically-oriented studies in educational measurement, evaluation, and statistics. The goal of this course is to prepare students to analyze data using advanced quantitative methods. It covers topics in the areas of Rasch Modeling, Item Response Theory, Structural Equation Modeling, Multilevel Modeling, and Data Mining (as well as additional techniques). Given the advanced nature of the course, we will not shy away from using the mathematical tools needed to develop the conceptual understanding. But the emphasis of the course will be on the conceptual understanding and application of the tools rather than on the math or the mechanics behind the tools.

**Student Learning Objectives:** The ultimate objective is that by the end of this course you will be able to:

- Conceptually understand the statistical methods covered in the course and how they can be applied to analyze a variety of issues
- Interpret the results of quantitative analyses and think critically about the potential issues that arise when trying to draw conclusions from such results
- Conduct analyses using appropriate measurement and/or statistical package(s)
- Prepare a proposal or manuscript for publication using at least one of the measurement or statistical models used in the course

**Grading:** Grading will be based on approximately 3 homework (totaling 60%), one final project or final exam (30%) and class participation (10%) that will involve both data analysis and a thoughtful description of both the analysis and the findings. One homework will involve a class presentation. Depending on the size of the class, some assignments may be done in groups.

Grading scale for graduate students will be earned as follows:

A:  $90\% \leq \text{Final Course \%} \leq 100\%$ .

B:  $80\% \leq \text{Final Course \%} < 90\%$

C:  $70\% \leq \text{Final Course \%} < 80\%$

E:  $\text{Final Course \%} < 70\%$



New course to replace advanced quantitative methods seminars taught in regular sequence in  
EPE and EDP

**Academic Integrity:**

Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: <http://www.uky.edu/Ombud>. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Part II of *Student Rights and Responsibilities* (available online <http://www.uky.edu/StudentAffairs/Code/part2.html>) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

**Please note:** Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

New course to replace advanced quantitative methods seminars taught in regular sequence in  
EPE and EDP

**Accommodations due to disability:**

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address: [jkarnes@email.uky.edu](mailto:jkarnes@email.uky.edu)) for coordination of campus disability services available to students with disabilities.

**Attendance, Participation, Classroom Behavior, Decorum, and Civility:** You are expected to come to all classes on-time, complete reading assignments, and participate in all activities and discussions. The instructor understands that some absences are unpreventable. However, students missing in excess over one-fifth of class meetings will result in a denial of course credit and be awarded a grade of W for the course. The following are non-penalized acceptable reasons for missing class beyond the one exception: serious illness, illness or death of family member, University-related trips, major religious holidays, and other circumstances the instructor finds to be reasonable cause for nonattendance. If warranted, the instructor will ask for verification of a missed class and if acceptable be allowed to complete any missed work as arranged by the instructor. Be sure to **turn off** your cell phone and/or pagers prior to each class. Avoid being tardy, as arriving late to class disturbs the other class members and instructor. Be respectful and civil while others are participating in dialogue in the course. Ultimately, treat others how you want to be treated.

**Submission of Work:** All assessments are due on the due date specified in the course schedule. **LATE ASSESSMENTS WILL BE ACCEPTED AT THE SOLE DISCRETION OF THE INSTRUCTOR.** Exceptions will be made ONLY in extreme circumstances, such as (but not limited to) an incapacitating illness or injury, or a death in the family. Since the course materials are posted on Blackboard, events such as (but not limited to) vacation/travel plans, social obligations, or family gatherings do not constitute exceptions. Turn in all work using the last 4 digits of your UK student identification number. **DO NOT WRITE YOUR NAME ON ANY ASSESSMENT IN THIS COURSE** except the final paper. All homework and reworked homework are to be submitted in hard copy – typed; hand-written work will not be accepted. E-mailed homework will NOT be accepted. However, the final paper is to be included on a CD along with a hard copy of your final paper. All work should follow APA guidelines (6th ed.).

New course to replace advanced quantitative methods seminars taught in regular sequence in  
EPE and EDP

**Outline of course topics and readings:** The following outline describes the topics that will be covered in sections of 711. The variety of topics is why this course is repeatable for up to 12 hours. Associated readings for each course are provided; however, specific text book requirements and reading list will be supplied by the individual instructor per class.

### Rasch Modeling

Rasch analysis constructs linear measures from scored observations, such as responses to multiple-choice questions, Likert scales and quality-of-life assessments. This course covers the practical aspects of data setup, analysis, output interpretation, fit analysis, differential item functioning, dimensionality and reporting.

- Wright, B. D., & Masters, G. M. (1982). *Rating scale analysis*. Chicago, IL: Mesa Press.
- Wright, B. D., & Stone, M. H. (1979). *Best test design*. Chicago, IL: Mesa Press.
- Bond & Fox (2007). *Applying the Rasch Model: Fundamental Measurement in the Human Sciences*. 2<sup>nd</sup> ed.
- Winsteps Manual, available for download at [www.winsteps.com](http://www.winsteps.com)
- Rasch Measurement Transactions & SIG Activity; <http://www.rasch.org/rmt/>

### Item Response Theory

The course of item response theory (IRT) will introduce specific terminologies, models, and computer programs of IRT and apply them to educational and psychological test data. In the first phase, we will focus on development and difference between classical test theory (CTT) and IRT, as well as their application fields. In the second phase, we will focus on several practical fields of applications of IRT models, such as model-data fit, test equating, differential item functioning, test construction, and computerized adaptive testing.

- De Ayala, R. J. (2009). *The Theory and Practice of Item Response Theory*. New York, NY: Guilford.\*
- Hambleton, R.K., Swaminathan, H., & Rogers, H.J. (1991). *Fundamentals of item response theory*. Newbury Park: Sage.
- Introduction to Item Response Theory (1991), Hambleton, Swaminathan, & Rogers, Sage Series: Measurement Methods in the Social Sciences (R. Jaeger, Ed.)
- Item response theory: principles & applications (1985). Hambleton & Swaminathan. Boston: Kluwer Publishing
- Applications of item response theory to practical testing problems, Lord, F. Hillsdale, NJ: Lawrence Erlbaum Associates
- Item response theory: parameter estimation techniques, Baker, F. B. (1992). New York: Marcel Dekker, Inc.

New course to replace advanced quantitative methods seminars taught in regular sequence in  
EPE and EDP

### Structural Equation Modeling

Theory, application, interpretation of Structural Equation Modeling (SEM) techniques. Includes covariance structures, path diagrams, path analysis, model identification, estimation, and testing. Additional topics include: covariance structures, path diagrams, path analysis, model identification, estimation, and testing.

- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd Ed). New York: Guilford Press.
- Byrne, B. B. (2010). *Structural equation modeling using AMOS. Basic concepts, applications, and programming* (2nd Ed). New York: Routledge.
- Brown, Timothy A., *Confirmatory Factor Analysis for Applied Research*. London: The Guilford Press, 2006.
- Muthén, Linda K. & Bengt O. Muthén, *Mplus User's Guide* (5<sup>th</sup> ed.). Los Angeles: Muthén & Muthén, 2007

### Multilevel Modeling

Introduction to multilevel modeling and hierarchical data structures, random and fixed effects, intercepts and slopes as outcomes models, estimation, centering, emphasis on two level models, use and interpretation of statistical software. Advanced topics in multilevel modeling and hierarchical data structures including three level models with random and fixed effects, longitudinal models, multilevel models for binary and categorical outcomes.

- Raudenbush, S.W. & Bryk, A.S (2002) . *Hierarchical Linear Models: Applications and Data Analysis Methods*, 2<sup>nd</sup> Ed. Thousand Oaks CA: Sage.
- Kreft, I.G.G & DeLeeuw, J. (1998) *Introducing Multilevel Modeling*. Thousand Oaks CA: Sage.
- Bosker, R.J. & Snijders (1999) *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Thousand Oaks CA: Sage.

### Data Mining

Data Mining attempts to identify interesting structural patterns in large data sets that can be used to make future predictions. This course will introduce fundamental strategies and methodologies for data mining along with the concepts underlying them, and will provide hands-on experience with a variety of different techniques Exploration of data mining methodologies. Topics may include decision tables, decision trees, classification rules, association rules, clustering, statistical modeling, and linear models.

- Margaret Dunham (2003) *Data Mining Introductory and Advanced Topics*, Prentice Hall.
- Jiawei Han and Micheline Kamber (2005) *Data Mining Concepts and Techniques*, Morgan Kaufmann, 2nd Ed.
- Pang-Ning Tan, Michael Steinbach, and Vipin Kumar (2005) *Introduction to Data Mining*, Addison Wesley.

\*\* Additional Topics will be introduced depending on student needs and faculty interests

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Week	Date	Topic	Readings from De Ayala (2009)*	Due
1	Aug. 25	Introduction to Measurement	Preface & Ch. 1	
2	Aug. 30	The One-Parameter Model	Ch. 2	
2	Sept. 1	The One-Parameter Model	Ch. 2	
3	Sept. 6	The One-Parameter Model	Ch. 2	
3	Sept. 8	Joint Maximum Likelihood Parameter Estimation	Ch. 3	
4	Sept. 13	Joint Maximum Likelihood Parameter Estimation	Ch. 3	
4	Sept. 15	Joint Maximum Likelihood Parameter Estimation	Ch. 3	
5	Sept. 20	Marginal Maximum Likelihood Parameter Estimation	Ch. 4	<b>HW#1</b>
5	Sept. 22	Marginal Maximum Likelihood Parameter Estimation	Ch. 4	
6	Sept. 27	Marginal Maximum Likelihood Parameter Estimation	Ch. 4	
6	Sept. 29	Marginal Maximum Likelihood Parameter Estimation	Ch. 4	
7	Oct. 4	The Two-Parameter Model	Ch. 5	<b>HW#2</b>
7	Oct. 6	The Two-Parameter Model	Ch. 5	
8	Oct. 11	The Two-Parameter Model	Ch. 5	
8	Oct. 13	The Three-Parameter Model	Ch. 6	
9	Oct. 18	The Three-Parameter Model	Ch. 6	
9	Oct. 20	The Three-Parameter Model	Ch. 6	
10	Oct. 25	Rasch Models for Ordered Polytomous Data	Ch. 7	<b>HW#3</b>
10	Oct. 27	Rasch Models for Ordered Polytomous Data	Ch. 7	
11	Nov. 1	Rasch Models for Ordered Polytomous Data	Ch. 7	
11	Nov. 3	Rasch Models for Ordered Polytomous Data	Ch. 7	
12	Nov. 8	Rasch Models for Ordered Polytomous Data	Ch. 7	
12	Nov. 10	Non-Rasch (IRT) Models for Ordered Polytomous Data	Ch. 8	
13	Nov. 15	Non-Rasch (IRT) Models for Ordered Polytomous Data	Ch. 8	
13	Nov. 17	Non-Rasch (IRT) Models for Ordered Polytomous Data	Ch. 8	
14	Nov. 22	Non-Rasch (IRT) Models for Ordered Polytomous Data	Ch. 8	<b>HW#4</b>
14	Nov. 24	<b>HOLIDAY (NO CLASS)</b>		
15	Nov. 29	Linking and Equating	Ch. 11	
15	Dec. 1	Linking and Equating	Ch. 11	<b>Draft of Paper</b>
16	Dec. 6	Differential Item Functioning	Ch. 12	
16	Dec. 8	Differential Item Functioning	Ch. 12	
17	Dec. 12	Turn in Final Paper		<b>Final Paper</b>

## EPE/EDP 711 Advanced Quantitative Methods

**Instructor will vary by topic.**

**Credit Hours:** 3 credit hours per class, repeatable up to 12 hours

**Class Meetings:** Class will meet 2.5 hours per week, in either 140 or 245 TEB (computer smart classrooms)

### **Course Goals and Prerequisites:**

The goal of this course is to provide students with knowledge of how to perform advanced quantitative methods useful in answering questions using observational or experimental data. It will allow them to more critically review research published that claims to answer such questions. The prerequisite is the first two semesters of quantitative methods, with a minimum of intermediate statistics or the equivalent as approved by the instructor.

**Course Description:** This course will provide students with an overview of the theory and applications of advanced quantitative methods. A quantitative research method focuses on advanced quantitative methodologies used in methodologically-oriented studies in educational education, evaluation, and statistics. The goal of this course is to prepare students to analyze data using advanced quantitative methods. It covers topics in the areas of multilevel modeling, data mining, missing data, categorical data analysis, meta-analysis, and longitudinal data analysis. Other specific analysis techniques may also be explored. Given the advanced nature of the course, we will not shy away from using the mathematical tools needed to develop the conceptual understanding. But the emphasis of the course will be on the conceptual understanding and application of the tools rather than on the math or the mechanics behind the tools.

**Student Learning Objectives:** The ultimate objective is that by the end of this course you will be able to:

<b>Learning Target/Outcome</b>	<b>Assessment (Formative/Summative)</b>
<ul style="list-style-type: none"><li>• <b>Conceptually understand the statistical methods covered in the course and how they can be applied to analyze a variety of issues</b></li></ul>	Class Participation, Homework, and Final Project or Final Exam (Formative)
<ul style="list-style-type: none"><li>• <b>Interpret the results of quantitative analyses and think critically about the potential issues that arise when trying to draw conclusions from such results</b></li></ul>	Class Participation, Homework, and Final Project or Final Exam (Formative)
<ul style="list-style-type: none"><li>• <b>Conduct analyses using appropriate statistical package(s)</b></li></ul>	Class Participation, Homework, and Final Project or Final Exam (Formative)
<ul style="list-style-type: none"><li>• <b>Prepare a proposal or manuscript for publication using at least one of the statistical models used in the course</b></li></ul>	Class Participation, Homework, and Final Project or Final Exam (Summative)

**Grading:** Grading will be based on approximately 3 homework (totaling 60%), one final project or final exam (30%) and class participation (10%) that will involve both data analysis and a thoughtful description of both the analysis and the findings. One homework will involve a class presentation. Depending on the size of the class, some assignments may be done in groups.

Grading scale for graduate students will be earned as follows:

A:  $90\% \leq \text{Final Course \%} \leq 100\%$

B:  $80\% \leq \text{Final Course \%} < 90\%$

C:  $70\% \leq \text{Final Course \%} < 80\%$

E: Final Course % < 70%

## **COURSE POLICIES AND PROCEDURES**

### Learning/Classroom Accommodations due to Disability.

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. It is located on the corner of Rose Street and Huguelet Drive in the Multidisciplinary Science Building, Suite 407. You can reach them via phone at (859) 257-2754 and via email at [drc@uky.edu](mailto:drc@uky.edu). Their web address is

<http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/>

### Statement of Diversity.

The course will be conducted with openness and respect to all individuals' points of view and experience. The activities and discussions will not tolerate discrimination or prejudice toward any person or group's religion, ethnicity, disability, gender, or sexual orientation.

### Academic Integrity.

Per University policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the University may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: <http://www.uky.edu/Ombud>. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Senate Rules 6.3.1 (see <http://www.uky.edu/Faculty/Senate/> for the current set of Senate Rules) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording, or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code, or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work, which a student submits as his/her own, whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone.

When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content, and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas, which are so generally and freely circulated as to be a part of the public domain.

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

#### Submission of Work.

All course work are due on the dates specified in the course schedule listed on Canvas. *LATE ASSESSMENTS WILL BE ACCEPTED AT THE SOLE DISCRETION OF THE INSTRUCTOR.* Exceptions will be made ONLY in extreme circumstances, such as (but not limited to) an incapacitating illness or injury, or a death in the family. Since the course materials are posted on Canvas, events such as (but not limited to) vacation/travel plans, social obligations, or family gatherings do not constitute exceptions. If students must miss a scheduled task, they must notify me about the reason for the absence before it occurs. In the event of emergency absences (e.g., personal illness, major accident, death of family member), students should notify the instructor as soon as possible, preferably through e-mail communication. Additional assessments may be required for missed tasks.

#### Excused Absences.

Students need to notify the professor of absences prior to class when possible. *Senate Rules 5.2.4.2* defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Two weeks prior to the absence is reasonable, but should not be given any later. Information regarding major religious holidays may be obtained through the Ombud (859-257-3737, [http://www.uky.edu/Ombud/ForStudents\\_ExcusedAbsences.php](http://www.uky.edu/Ombud/ForStudents_ExcusedAbsences.php)).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused) per University policy.



Per *Senate Rule 5.2.4.2*, students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required); and for making up the missed work. The professor must give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred.

#### Verification of Absences:

Students may be asked to verify their absences in order for them to be considered excused. *Senate Rule 5.2.4.2* states that faculty have the right to request “appropriate verification” when students claim an excused absence because of illness, or death in the family. Appropriate notification of absences due to University-related trips is required prior to the absence when feasible and in no case more than one week after the absence.

Incomplete Grade. Incomplete grades for this course are issued reluctantly and sparingly. The university permits students one calendar year—unless a shorter time frame is determined mutually by the student and instructor—to remove an “I” grade. If the contracted work is not completed satisfactorily, the “I” grade converts automatically to an “E” (a failing mark). UK rules require students requesting an “I” grade to complete a contract specifying how and when the “I” will be removed within the calendar year. The contract must be submitted to the course instructor before an “I” grade can be issued. Incomplete work and missing assessments will be assigned “E” grades if the student does not submit a completed Incomplete Grade Contract by the time the course ends.

Behavior, Decorum and Civility. Please be respectful to others in the class and engage in civil discourse when we discuss topics that have a diversity of perspectives. Please minimize distractions by closing out other windows on your computer and not using other devices while you are engaged in the course.

**Outline of course topics and readings:** The following outline describes the topics that will be covered in sections of 711. The variety of topics is why this course is repeatable for up to 12 hours. Associated readings for each course are provided; however, specific text book requirements and reading list will be supplied by the individual instructor per class.

#### Multilevel Modeling

Introduction to multilevel modeling and hierarchical data structures, random and fixed effects, intercepts and slopes as outcomes models, estimation, centering, emphasis on two level models, use and interpretation of statistical software. Advanced topics in multilevel modeling and hierarchical data structures including three level models with random and fixed effects, longitudinal models, multilevel models for binary and categorical outcomes.

- Raudenbush, S.W. & Bryk, A.S (2002) . Hierarchical Linear Models: Applications and Data Analysis Methods, 2<sup>nd</sup> Ed. Thousand Oaks CA: Sage.
- Kreft, I.G.G & DeLeeuw, J. (1998) Introducing Multilevel Modeling. Thousand Oaks CA: Sage.

- Bosker, R.J. & Snijders (1999) *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Thousand Oaks CA: Sage.

### Data Mining

Data Mining attempts to identify interesting structural patterns in large data sets that can be used to make future predictions. This course will introduce fundamental strategies and methodologies for data mining along with the concepts underlying them, and will provide hands-on experience with a variety of different techniques. Exploration of data mining methodologies. Topics may include decision tables, decision trees, classification rules, association rules, clustering, statistical modeling, and linear models.

- Margaret Dunham (2003) *Data Mining Introductory and Advanced Topics*, Prentice Hall.
- Jiawei Han and Micheline Kamber (2005) *Data Mining Concepts and Techniques*, Morgan Kaufmann, 2nd Ed.
- Pang-Ning Tan, Michael Steinbach, and Vipin Kumar (2005) *Introduction to Data Mining*, Addison Wesley.

### Missing Data.

This course will introduce modern methods for handling missing data for cross-sectional and longitudinal designs. A focus will be placed on model based missing data techniques, maximum likelihood and multiple imputation. Modern methods are far superior to traditional methods such as pairwise, listwise, mean imputation, and other single imputation methods.

- Enders, C. (2010). *Applied Missing Data Analysis*. Guilford Press.

### Categorical data analysis

This course will cover a variety of methods that can be used to handling cross-sectional and longitudinal categorical data. Topics in logistic regression for binary, multi-nominal, and ordinal outcomes will be addressed as well as log-linear models for handling similar types of data. Categorical data analysis goes beyond using traditional linear models to properly modeling categorical data based on the type of data. Other methods that will be discussed are Kappa, Gamma, and Tau.

- Agresti, A. (2002). *Categorical Data Analysis* (2<sup>nd</sup> ed).
- Bilder, C. & Loughin, T. (2014). *Analysis of Categorical Data with R*. CRC Press.

### Meta-Analysis

This course will introduce students to the history of meta-analysis, but will emphasize how to generalize results from several quantitative studies without collecting any new data. In this course students will learn how to develop a research question that can be answered via meta analysis, how to collect data (articles) for the analysis, test assumptions for fixed and random effects approaches for doing meta-analysis, correct for statistical and psychometric artifacts, and write-up results for publication.

- Borenstein, M. Hedges, L. & Rothstein, H. (2008). *Introduction to Meta-Analysis*. Wiley.
- Rothstein, Sutton, & Borenstein. *Publication Bias in Meta-Analysis*. Chichester: Wiley

### Longitudinal Data Analysis

In this course students will learn how to analyze longitudinal designs. Topics covered, but not limited to, introduction to the multilevel model for change, treating time flexibly, modeling linear and nonlinear change, modeling change with different covariance structures, and cox regression

- Singer, J. D., & Willett, J. B. (2003). Applied longitudinal data analysis: Modeling change and event occurrence. Oxford.

\*\* Additional Topics will be introduced depending on student needs and faculty interests

**EXAMPLE TENTATIVE COURSE SCHEDULE FOR  
LONGITUDINAL DATA ANALYSIS**

<b>Week</b>	<b>Date</b>	<b>Topic</b>	<b>Readings from Singer and Willet</b>	<b>Due</b>
1	Aug. 25	Syllabus		
2	Sept. 1	Making friends with my software	Ch. 1	
3	Sept. 8	Exploring longitudinal data for change	Ch. 2	
4	Sept. 15	Intro to Multilevel model for change	Ch. 3	<b>HW#1</b>
5	Sept. 22	Doing Data analysis for change	Ch. 4	
6	Sept. 29	Time metric	Ch. 5	
7	Oct. 6	Modeling discontinuous and nonlinear change	<b>Ch. 6</b>	
8	Oct. 13	Examining the multilevel model's error covariance structure	<b>Ch. 7</b>	<b>HW#2</b>
9	Oct. 20	Modeling Using covariance structure analysis	<b>Ch. 8</b>	
10	Oct. 27	Latent growth modeling	Ch. 8	
11	Nov. 3	Event occurrences	Ch. 9	<b>HW#3</b>
12	Nov. 10	Event occurrences	Ch. 9	
13	Nov. 17	Cox regression	Ch. 14	<b>Draft of Paper</b>
<b>14</b>	<b>Nov. 24</b>	<b>HOLIDAY (NO CLASS)</b>		
15	Dec. 1	Cox regression and more	Ch. 15	<b>HW#4</b>
16	Dec. 8	Review		
17	Dec. 12	Final Paper is due		<b>Final Paper</b>