GRADUATE COUNCIL: NEW COURSE PROPOSAL

Originating Unit: HCHS

Type of action: ☑ New course ☐ Full online course**

Semester and year course will take effect: Spring 2025

New course title: Multilevel modeling

Appropriate computer abbreviation (30 spaces or less): Multilevel Modeling

Course instructional methodology: Lecture

course component types: ugradcouncil.tcu.edu/forms/Course Component Types.pdf

New course number: **80253**

Prerequisites for new course: *include an attachment if additional space is needed*

HCHS 80233 Advanced Statistics

Click here to attach a file

attached files can be seen and managed in Acrobat Pro by clicking on View > Show/Hide > Navigations Panes > Attachments

Description of new course (catalog copy): *include an attachment if additional space is needed*

HCHS 80253 *Multilevel Modeling.* This course explores advanced statistical modeling techniques, with a focus on Multilevel Regression Models, Growth Curve Modeling, and Structural Equation Modeling, tailored specifically for health sciences research. Through a combination of lectures, hands-on exercises, and real-world examples, students will develop the skills necessary to conduct complex statistical analyses. The course places a strong emphasis on practical applications, critical evaluation of results, and the effective communication of findings in both written and oral formats. *Prerequisite: HCHS 80233 or permission of instructor.*

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Fully Online Courses**

All online courses, and /or distance learning offerings must meet State Compliance regulations as defined by specific state legislation. TCU Distance Learning is any for-credit instruction provided to a TCU student outside the State of Texas. This includes internships, clinical, video conferencing, online, or any other delivery format that crosses state lines. Contact the Koehler Center for Teaching Excellence for guidelines. Include a letter of support from the Koehler Center with this proposal.

Supporting evidence or justification: (For a new course, attach proposed syllabus, including course objectives, course outline, and representative bibliography.)

Describe the intended outcomes of the course and how they will be assessed: *include an attachment if additional space is needed*

Learning outcomes and means of assessment are listed in the attached syllabus.

Click here to attach a file

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Additional resources required:

Faculty: No additional resources required

Space: No additional resources required

Equipment: No additional resources required

Library: No additional resources required

Financial Aid: No additional resources required

Other:

Change in teaching load: None; this would be part of Dr. Zhang's regular teaching load

Does this change affect any other units of the University? ☐ Yes ☑ No

If yes, submit supporting statement signed by chair of affected unit.

If cross-listed, provide evidence of approval by all curriculum committees appropriate to both the originating and the cross-listed units.

Chair of Originating Unit:

Name: Emily Lund

Unit: HCHS

Signature: Lund, Emily

Digitally signed by Lund, Emily
Date: 2024.01.08 12:15:17 -06'00'

Syllabus: HCHS 80253 Multilevel Modeling in Health Sciences

Instructor Name: Yan Zhang
Semester and Year:
Number of Credits: 3 credits
Class Location: BASS 2001
Class Meeting Day(s) & Time(s): TBD
Zoom Access Information:

Office Location: BASS 2002
Office Hours: by appointment only
Telephone: 817-257-7303
Email: yan.zhang@tcu.edu
Response Time: By end of next day Mon-Thu; by 11:30am on Monday if Fri-Sun

Final Exam Date & Other Important Dates

Topic	Instruction Accessible @	Due by 11:30 pm on	Present in class
Data Analysis Portfolio Midterm Review	**First Class**	**TBD**	**TBD**
Group Research Project	**First Class**	**TBD**	**TBD**

Rescheduling of Exams Policy: If you encounter extenuating circumstances and need to reschedule an exam, you may submit a request. To initiate this process: 1) Provide legitimate proof of the extenuating circumstances. 2) Propose a reasonable new submission time, not exceeding 48 hours after the original exam due time. Ensure your request reaches the instructor at least 24 hours prior to the exam due time. The instructor will promptly review your request and notify you of the decision on whether a late submission is granted.

Course Description

This course explores advanced statistical modeling techniques, with a focus on Multilevel Regression Models, Growth Curve Modeling, and Structural Equation Modeling, tailored specifically for health sciences research. Through a combination of lectures, hands-on exercises, and real-world examples, students will develop the skills necessary to conduct complex statistical analyses. The course places a strong emphasis on practical applications, critical evaluation of results, and the effective communication of findings in both written and oral formats.

Learning Outcomes

Upon completion of this doctoral-level course, students will:

1. Apply advanced statistical models, including Multilevel Regression Models, Growth Curve Modeling, and SEM, to address complex research questions in health sciences.
2. Critically evaluate and interpret results from sophisticated statistical analyses.
3. Demonstrate proficiency in using statistical software for modeling health-related data.
4. Design and execute a research project using advanced statistical techniques.
5. Communicate statistical findings effectively in both written and oral formats.

Prerequisites

Prerequisites: HCHS 80233 Advanced Statistics in health sciences or equivalent.

Major Connections: This course will advance your statistics knowledge and analytical skills developed in the advanced statistics course and help you, as Ph.D. students, develop expertise and empirical techniques required for your dissertation research projects as well as peer-reviewed presentation and publication.

Required Texts / Materials

Heck, R. H., & Thomas, S. L. (2020). *An Introduction to Multilevel Modeling Techniques* (4th ed.). Taylor & Francis.

This text offers a comprehensive treatment of multilevel models for univariate and multivariate outcomes. It explores their similarities and differences and demonstrates why one model may be more appropriate than another, given the research objectives.

Additional / Supplementary Resources

Other Additional / Supplementary Resources will be also provided throughout the course.

Teaching Philosophy

In this course, my teaching philosophy centers on cultivating critical thinking, equipping students with advanced statistical analysis skills, and fostering confidence in conducting quantitative research within the health sciences.

Inspiring Critical Thinking: I encourage students to think critically by fostering discussions that challenge assumptions and explore the rationale behind statistical methods. This approach develops the skills needed to evaluate models, assess their appropriateness for different research contexts, and make informed decisions.

Empowering with Statistical Analysis Skills: I aim to empower students practically, providing hands-on workshops and real-world case studies for the application of statistical methods using software tools. This hands-on experience not only deepens understanding but also instills proficiency in tackling quantitative challenges independently.

Building Confidence in Quantitative Research: The course is designed to progressively build confidence, starting with foundational concepts and guiding students through advanced statistical techniques. Regular feedback on assignments and projects ensures students gain confidence in designing, analyzing, and interpreting quantitative research in health sciences.

Encouraging a Growth Mindset: I foster a growth mindset, viewing challenges as opportunities for learning. Embracing this mindset, students are encouraged to see setbacks as a natural part of the learning process and to view mistakes as valuable learning experiences.

Supportive Learning Environment: The classroom is a collaborative and inclusive space where diverse perspectives are valued. Open dialogue and active engagement are encouraged, creating a supportive community of scholars.

Through this philosophy, my goal is to instill not only proficiency in statistical modeling but also a lasting appreciation for the transformative impact of quantitative research in advancing knowledge within the health sciences. Together, we embark on a journey of intellectual exploration and skill development that extends beyond the boundaries of this course.

Instructional Methods

In alignment with the learning outcomes and my teaching philosophy, the instruction methods in this course include:

1. **Interactive Discussions:** Engage in interactive class discussions that challenge assumptions and encourage critical thinking about the rationale behind statistical methods. This approach cultivates a deeper understanding of the principles underlying statistical models.
2. **Hands-On Workshops:** Facilitate hands-on workshops where students actively apply statistical methods using relevant software tools. This practical experience is instrumental in translating theoretical knowledge into practical skills, empowering students with the proficiency needed for real-world applications.
3. **Real-World Case Studies:** Explore real-world case studies that demonstrate the application of statistical models in health sciences research. Analyzing practical examples enhances students' ability to connect theoretical concepts to authentic research scenarios, promoting a holistic understanding of statistical modeling.
4. **Regular Feedback on Assignments:** Provide consistent and constructive feedback on assignments and projects. This feedback serves as a scaffolding mechanism, guiding students towards a deeper comprehension of statistical concepts and fostering confidence in their quantitative research abilities.
5. **Progressive Skill Development:** Design the course content in a progressive manner, starting with foundational concepts and gradually introducing advanced statistical techniques. This approach ensures that students build confidence step by step, developing a strong skill set for conducting quantitative research in the health sciences.
6. **Open-Ended Problem-Solving:** Encourage open-ended problem-solving exercises that challenge students to think critically and apply statistical methods creatively to solve research problems. This approach fosters a mindset of adaptability and innovation in approaching quantitative challenges.
7. **Peer Collaboration:** Promote peer collaboration through group activities and discussions. Collaborative learning provides an opportunity for students to share diverse perspectives,

enhancing their understanding of statistical modeling and creating a supportive community of scholars.

8. **Reversed Classroom Teaching:** Implement reversed classroom teaching, where traditional lecture and homework elements are reversed. Students engage with instructional materials independently before class, allowing in-class time for interactive discussions, problem-solving, and application exercises. This approach enhances active learning and reinforces comprehension.

Through these instruction methods, this course aims to create an enriching learning experience that goes beyond the acquisition of knowledge, focusing on the development of critical thinking skills, practical proficiency in statistical analysis, and the confidence to excel in quantitative research within the dynamic field of health sciences.

Course Policies and Requirements

Assignments

1. **Practical Application Exercises:** Complete practical application exercises designed to reinforce the hands-on application of statistical methods. These exercises, conducted in a workshop format, will provide an opportunity for students to gain proficiency in using relevant software tools for data analysis in health-related contexts.
2. **Critical Analysis of a Multilevel Modeling Study:** Undertake a critical analysis of a published multilevel modeling study within your field of study in health sciences. This assignment challenges students to evaluate and critique the statistical methods employed in a real-world study, bridging theoretical knowledge with practical application. Through this analysis, students will deepen their understanding of multilevel modeling in the context of authentic research challenges in their specific disciplines.
3. **Iterative Data Analysis Portfolio:** Develop an iterative data analysis portfolio showcasing the application of statistical methods to address specific research questions in health sciences. This portfolio, with feedback-driven iterations, provides a continuous learning process and builds confidence in navigating complex quantitative research tasks.
4. **Collaborative Research Project with Real Data:** Engage in a collaborative research project with peers using real data from the students' respective disciplines. This assignment encourages teamwork, allowing students to apply advanced statistical methods to authentic research questions, emphasizing the practical relevance of statistical modeling in their specific fields of study.

Grading

Final Grade Elements / Grade Breakdown:

Outcome(s)	Assignments, Exams/Quizzes, Presentations, etc.	Percentage
1,2,5	Application Exercises	20
1,2,5	Case Study Analysis	10

Outcome(s)	Assignments, Exams/Quizzes, Presentations, etc.	Percentage
1,2,3,4,5	Data Analysis Portfolio	35
1,2,3,4,5	Research Project	35

Grading Scales

Grade	Score	Grade	Score
A	94–100	C	70–76.99
A-	90–93.99	F	<70
B+	87–89.99		
B	84–86.99		
B-	80–83.99		
C+	77–79.99		

Late Work

All required assignments, unless otherwise stated, must be submitted on TCUonline by the designated time and date for each task. The online submission portal will close after the specified deadline. **Late submissions will not be accepted and will result in a score of "0" for the respective work unless negotiated PRIOR TO the due date.**

In cases where extenuating circumstances prevent a student from completing their work on time, immediate communication with the instructor is crucial. The student may request late submission for specific work due to extenuating circumstances. The emphasis on "extenuating circumstances" recognizes unforeseen and exceptional situations beyond the student's control. Such requests must propose a reasonable new submission date and be submitted to the instructor within 24 hours of the occurrence of extenuating circumstances. The request will be promptly reviewed, and the student will receive a response within 24 hours of submission, indicating whether a late submission is granted.

Concerns will be addressed following the Chain of Communication for Graduate Courses.

Grading Concerns

Chain of Communication for Graduate Courses

If you have any questions or concerns about your experiences in this course, the first step is to communicate these questions or concerns directly with the person(s) involved. Your instructor is your primary contact for any questions or concerns that arise with this course. The chain of communication for this course is

- Your instructor (Dr. Yan Zhang); if the situation is unresolved, consult with
- The Program Director (Dr. Emily Lund); if the situation is unresolved, consult with

- The Associate Dean for Research (Dr. Emily Lund)

Participation / Attendance

I strongly encourage you to **attend all synchronous class sessions** as it is unlikely that students will do well in the course project without attending the class lecture and exercise. You must contact the instructor **prior to** the scheduled synchronous class if you have to miss a required synchronous session for an emergency condition, illness, or catastrophic event. You will have to have a doctor's note or other legitimate documents for the missed time and day.
Without legitimate reason and proper documentation or prior approval, you will be deducted 1 point for each absence from your final grade accordingly. Three or more absences will be considered as a sign of a condition endangering a student's academic status, and the status will be reported to Dr. Lund, the Ph.D. Program Director.

Class Norms & Netiquette

All members of the class are expected to follow rules of common courtesy in all email messages, discussions, and chats. If I deem any of them to be inappropriate or offensive, I will forward the message to the Chair of the department and appropriate action will be taken, not excluding expulsion from the course. The same rules apply online as they do in person. Be respectful of other students. Foul discourse will not be tolerated. Please take a moment and read some basic information about netiquette (http://www.albion.com/netiquette/).

Participating in the virtual realm, including social media sites and shared-access sites sometimes used for educational collaborations, should be done with honor and integrity. Please review the relevant sections of the Student Handbook (https://deanofstudents.tcu.edu/student- handbook/) for TCU's network and computing policies and communication guidelines.

I would like to have a safe and respectful environment where we can share and discuss our opinions freely, so I request you please do not share any sensitive, private, and confidential information discussed in class outside of our classroom. **Neither photo-taking nor video recording is allowed without the consensus of the whole class.**

Course Specifics

Throughout this course, students may work on a real-world dataset, of which all information must be de-identified (no names of individuals). References to certain private situations should be written in a manner not to identify any individuals. Confidentiality must be maintained at all times for the protection of patients and healthcare organizations when applicable.

Technology Policies

Email

Only the official TCU student email address will be used for all course notifications. It is your responsibility to check your TCU email on a regular basis.

Course Materials

TCU students are prohibited from sharing any portion of course materials (including videos,

PowerPoint slides, assignments, or notes) with others, including on social media, without written permission by the course instructor. Accessing, copying, transporting (to another person or location), modifying, or destroying programs, records, or data belonging to TCU or another user without authorization, whether such data is in transit or storage, is prohibited. The full policy can be found at: https://security.tcu.edu/polproc/usage-policy/.

Violating this policy is considered a violation of Section 3.2.8 of the Student Code of Conduct found in the Student Handbook (https://deanofstudents.tcu.edu/student-handbook/), and may also constitute Academic Misconduct or Disruptive Classroom Behavior. TCU encourages student debate and discourse; accordingly, TCU generally interprets and applies its policies, including the policies referenced above, consistent with the values of free expression and First Amendment principles.

TCU Syllabus Policies & Resources

Please use this **link** or scan the QR code with a mobile device camera to access policies and resources including support for TCU students, student access and accommodation, anti-discrimination and Title IX information, and other important information.

Course Schedule

This calendar represents my current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunities. Such changes will be clearly communicated.

Date	Topic	Preparation / Homework	Class Activity
Week 1	Introduction to Advanced Statistical Modeling	Read Chapter 1 Prepare for Data Analysis Portfolio	Overview of the course, Introduction to Multilevel Modeling
Week 2	Getting Started with Multilevel Analysis	Read Chapter 2	Hands-on workshop on basic multilevel modeling concepts
Week 3	Multilevel Regression Models	Read Chapter 3	Practical exercises on multilevel regression models
Week 4	Extending Two-Level Regression Models	Read Chapter 4	Application of extended regression models in health research
Week 5	Methods for Examining Individual and Organizational Change	Read Chapter 5	Case studies and discussion on methods for examining change

Date	Topic	Preparation / Homework	Class Activity
Week 6	Multilevel Models with Categorical Variables	Read Chapter 6	Application of multilevel modeling to categorical variables
Week 7	Advanced Regression Methods	Readings and exercises	Application of advanced regression methods in health research
Week 8	HLM Review	Review HLM concepts	In-depth review and practical exercises on HLM
Week 9	Midterm Data Analysis Portfolio Review	Review Data Analysis Portfolio	Midterm project work and review of covered topics
Week 10	Multilevel Structural Equation Models	Read Chapter 7	Hands-on workshop on SEM in health sciences research
Week 11	SEM Review	Review SEM concepts	Application and exercises on SEM in health research
Week 12	Multilevel Latent Growth and Mixture Models	Read Chapter 8	Practical examples and exercises on latent growth and mixture models
Week 13	Growth Curve Modeling Review	Review growth curve modeling	Hands-on review and application of growth curve modeling
Week 14	Data Consideration in Examining Multilevel Models	Read Chapter 9	Discussion on considerations and challenges in multilevel modeling
Week 15	Final Project Work and Independent Research	Prepare for final project	Independent work on final projects and research proposals
Week 16	Project Presentations and Course Review	Finalize project presentations	Student presentations, course review, and Q&A