Department of Decision and Information Sciences

BZAN 6353 Research Design for Problems in Business Analytics
Course Information
Spring 2023

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          and/or by appointment

Required Text: Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora, 2nd Edition, 2015.

Course Description

This course covers the strategy to translate a real business problem into research practices. Students will learn the principles of conducting empirical research with emphasis on learning how to ask relevant business research questions. They will learn to apply best research practices for formulating relevant hypotheses, collecting data, interpreting results, and proposing concrete recommendations for decision making. They will be trained on how to leverage the data as the evidence that supports or disqualifies their beliefs and to avoid the pitfalls of common data collection methods.

Course Contents

The course consists of five modules which deal with different aspects of research design for solving business problems using techniques in data analytics. Each module covers a set of core concepts which are used to develop frameworks to solve problems of conducting research in business analytics to solve specific problems the businesses and corporations encounter. Each module also serves as the conceptual edifice for one or more application exercises where students use the frameworks developed in the modules to address specific problems in research design. The structure and contents of each module is discussed below.

Module 1: Research Methods: Conceptual Foundations

This module introduces students to the fundamentals of conducting research in business analytics. Students are introduced to ideas of rigor in research, to recognize the trade-offs between rigor and relevance, and methods of optimizing rigor without sacrificing relevance. They are introduced to the idea of explanatory research models and what these models attempt to achieve. In particular, they develop frameworks to understand the nature and extent of relationships and associations between factors of interest and phenomena whose outcomes they seek to explain. They learn how these outcomes as well as factors of interest can be converted into constructs which can then be measured and translated into variables.

Students will build on these conceptual frameworks and learn to formulate specific hypotheses related to business problems that can be solved by invoking specific techniques in business analytics. They will learn about the criteria for formulating rigorous problem statements and the pitfalls of loosely defined and/or imprecisely formulated hypotheses.

In the Application session they will apply these frameworks to develop constructs, operationalize constructs with variables, and devise measurement systems for variables. They will apply these techniques to solve commonly occurring research problems in business analytics in specific business contexts.

Module 2: Causal Inference

This module introduces students to the idea of cause and effect and how inference can be supported by research design. Students will learn about the idea of randomness and how randomization and representativeness are related. They will learn about rules of categorization and the role of variance in data. They will learn about sampling and what rigorous sampling is meant to achieve. They will be introduced both probabilistic and non-probabilistic sampling techniques.

In the Application Session, students will apply sampling techniques to solve specific business analytics problems. They will learn to apply analysis of variance and related techniques to solve problems of inference in contexts characterized by heterogeneity of data sources.

Module 3: Measurement

In this module two key concepts in empirical research – especially as they pertain to business analytics – are introduced. These are Reliability and Validity. Students learn about the role of reliability and validity in interpreting data as well as in the design of research that addresses specific problems. They will learn about threats to reliability as well as measures of reliability. They will also learn about different kinds of validity including construct validity, content validity, criterion validity and how each influences both the design of research and the interpretation of results. Students will use the conceptual frameworks developed in the module to design research surveys; they will assess the extent to which their survey instruments could face the twin threats of lack of reliability and poor validity.

In the Application session students will work on applying the conceptual frameworks to solving specific business problems.

Module 4: Research Design

In this module students will be exposed to principles of research design. They will learn conceptual frameworks of experimental research design as well as those of quasi-experimental research design. They will learn how the design informs the extent to which information signals are enhanced (signal enhancing research designs) and noise is reduced (noise reducing research designs).

In the Application session they will learn to apply the appropriate research design given the structure of the business analytics problem and the nature of the data sources. They will work on a variety of design problems set in commonly occurring business contexts.

Module 5: Advanced Concepts in Causal Inference

This module covers the building and analysis of a model of effects. Such models of effects require an understanding of how causal inference manifests itself and how it can be identified. The module also covers multivariate models and how these can be employed to measure the nature and extent of

effect sizes and the threats to causal inference in working with these models. This module will build on the ideas developed in previous modules as well as expose students to advanced techniques in identifying and measuring the marginal impact of one or more factors on an outcome of interest.

Teaching Methods:

1. **In Person Sessions:** Important material from the text and outside sources will be covered in class. Students should attend these sessions and participate in the proceedings. Discussion is encouraged and from time to time we may review, analyze, or discuss outside material relevant to the topics being covered.

2. **Online Synchronous Sessions:** Materials covered during these sessions will supplement and complement the material covered in the face-to-face sessions in class. We may also use some sessions to help you present solutions to structured business problems using analytical and/or other techniques and methods. In some cases a face to face class may be substituted by an online session to optimize content delivery and (if necessary) meet contingencies and exigencies. Students are encouraged to review, analyze, and make informed comments on the ideas and frameworks discussed in class.

3. **Online Asynchronous Sessions:** Important concepts, conceptual frameworks and discussions of tools and techniques will be made available to students via these sessions. Students are required to make themselves fully familiar with the contents covered in these sessions. We will switch between different delivery modes as needed and in response to contingencies and situations that might arise.

4. **Group Project:** students will work in groups and apply several of the conceptual frameworks learned in class to come up with a research design that addresses elements of data collection, inference, causality, and decision-making to solve business problems.

5. **Quizzes:** Quizzes will be open book/note and will test material that is covered in the course. The material covered in a quiz will be cumulative to the extent that students may be required to apply and/or use concepts learned in earlier in the course.

6. **Class Participation:** Students are encouraged to attend the synchronous sessions) and take part in the discussions. Students' original perspectives grounded in appropriate analytical frameworks on business problems (expressed in class), insightful responses to specific questions posed by the instructor, participation in class discussions that help raise and/or answer insightful questions all count toward the class participation grade. There are multiple different ways in which students may earn points for class participation. The instructor will be willing to evaluate ideas from students and offer feedback on appropriate means of earning class participation points.

The instructor will call on students to answer questions in class. Students are required to come adequately prepared to class and be familiar with the reading materials assigned for each class.

We may use the concept of a 'flipped classroom' in one or more class sessions, where some materials that may be part-technical in nature can be made available via the blackboard and where we will use the synchronous sessions – face to face and/or online – for discussions and crafting applications to business problems.

NOTES ONLINE: You will have access to all material via the **Blackboard Learn** application.

- The lecture slides will be available in the <u>Course Contents</u> section of the class web site. The slides posted <u>within 24 hours prior to each class session</u>. But, on a few rare occasions, I might make minor changes to them **just in time for our class**. Of course, I will make you aware of these changes.

7. **Announcements** regarding the class such as schedule changes, projects, quizzes, and so on will be made in class during the synchronous sessions as well as on the web at the <u>Announcements</u> page on Blackboard. Please be sure to check if there are announcements.

8. **Instructor's Office Hours:** The course is designed to leave us with strategic flexibility to deal with contingencies that may arise – pandemic related, weather, or some other unforeseen event. The instructor will therefore offer multiple formats for students to reach him during his office hours (and/or by appointment). Students may see the instructor in person, use zoom or other video conferencing mechanisms, or call the instructor by phone. Students are not restricted to contacting the instructor only during office hours; they are welcome to make appointments outside of the instructor's office hours.

9. **Contacting the Professor:** You can reach me by telephone or email. If you try to reach me, and you are unable to do so, then leave a message for me. I will try to get back to you within 48 hours.

10. **Teaching Assistant (TA):** As we cover this course, it is my intention to have the support of a TA. The teaching assistant for this course will be announced soon.

11. **Grading:**

   1. Quiz 1: 10% of final grade
   2. Quiz 2: 15% of final grade
   3. Quiz 3: 20% of final grade.
   4. Group Project: 40% of final grade
   5. Class Participation: 15% of final grade

   Final course letter grade follows the numeric-letter grade system used here at University of Houston.

Course Policies:

Missed Classes: The student is responsible for obtaining material, which may have been distributed through a variety of different methods. This can be done through contacting a classmate or by contacting the instructor during his office hours. Missed or late tests, quizzes cannot be made up under any circumstances, unless an officially acceptable reason is provided and is deemed to be consistent with Bauer College's policies. **Any uncoordinated, unexcused missed quizzes or other evaluation exercises will result in a score of 0 for that evaluation exercise.**

Group Project: The delivery schedule of completed work, and the mode of delivery will be specified ahead of time. You are required to be a part of a group <u>with about 5 or 6 other students</u>. All students

that have enrolled in the course will be assigned to groups using a random number generating process. You will work with your group members on the project deliverables. The instructor may assign additional members to a group, remove members from a group, or <u>change the composition of groups</u> in response to contingencies that arise and for advancing the learning goals of students in the context of situations that may necessitate such interventions.

Toward the end of the semester, you will have an opportunity to conduct <u>a peer evaluation</u> of what each member of your group contributed to the work done. I will use the scores on these evaluations in an appropriate weighted fashion to determine each group member's final adjusted score for the group project.

<u>Academic Dishonesty</u>: Plagiarism and cheating are serious offenses and may be punished by failure on quiz, or project; failure in course; and or expulsion from the University. For more information, refer to the "Academic Dishonesty" policy in the University's Catalog. The University of Houston Academic Honesty Policy is strictly enforced by the C. T. Bauer College of Business. No violations of this policy will be tolerated in this course. A discussion of the policy is included in the University of Houston Student Handbook, http://www.uh.edu/dos/hdbk/acad/achonpol.html. Students are expected to be familiar with this policy.

<u>Need for Assistance</u>: If you have any condition, such as a physical or learning disability, which will make it difficult for you to carry out the work as outlined in this document, or which will require academic accommodations, please notify me as soon as possible. I will recommend that you contact the Center for Students with Disabilities. The contact person is Justin Dart in the CSD building #568, room 110. The numbers for the CSD office are Ph: 713-743-5400; TDD: 713-749-1527; Fax: 713-743-5396 or email: uhcsd@uh.edu.

<u>Posting of Grades</u>: Your scores will be posted on blackboard and where deemed necessary, they will be reported via other methods.

Tentative Lecture Outline

<u>This outline is</u> **<u>tentative</u>**. It may change in the event of unforeseen class disruptions. As such, it could be modified as time goes by. I have built **<u>strategic flexibility</u>** into the course design to deal with contingencies that may arise – pandemic related, weather, or some other unforeseen event.

The default assumption for any session is that it will be delivered synchronously *in* the classroom. As we make progress, I will update this document and specify any additional session level details.

No	Date	Topic	Reading / Reference Material
1	January 19	***Module 1: Research Methods: Conceptual Foundations*** What is rigor in analytics? What are the limits of phenomenology? Explanatory Research and Models Constructs, Measurements, and Variables Relationships and Associations	Instructor's Notes / Teaching Excerpts. **Optional:** Chapter 1: Theory-Based Data Analysis for the Social Sciences 2nd Edition, by Carol S. Aneshensel

No	Date	Topic	Reading / Reference Material
2	26-Jan	***Application Exercises*** Working with constructs Operationalizing variables Measurement and Measurement Models and Errors Working with Associations, Relationships and Explanatory models	Instructor's Notes / Teaching Excerpts
3	02-Feb	***Formulating Problems & Hypotheses*** Criteria of problems and problem statements Hypotheses The Multivariate Approach: Problems and Definitions	Instructor's Notes [Based on Chapter 2: Foundations of Behavioral Research, 4th Edition, Kerlinger]
		Module 2: Causal Inference Sampling and Randomness Randomness, Randomization, Representativeness Non-Probabilistic Sampling	Instructor's Notes [Based on Chapter 8: Foundations of Behavioral Research, 4th Edition, Kerlinger] Chapter 4, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora
4	09-Feb	***Hypothesis Testing & Analysis of Variance*** Hypothesis Testing Frameworks Analysis of Variance ***Quiz – 1*** *Administered (Tentative)*	Instructor's Notes [Based on Chapter 13: Foundations of Behavioral Research, 4th Edition, Kerlinger]
5	16-Feb	***Application Exercises*** Applying Analysis of Variance and Related Methods to business problem contexts Working with Hypotheses, and Random Samples	Instructor's Teaching Excerpts / Notes
6	23-Feb	***Foundations of Survey Research*** Foundations of Survey Research Survey Design: Selecting the Survey Method Surveys & Sampling, Estimation Methods ***Group Project Phase 1 – Administered*** *(Tentative)*	Chapter 7, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora.
7	02-Mar	***Module 3: Measurement*** **Reliability** Theory of Reliability	Chapter 5, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora. Instructor's Notes

No	Date	Topic	Reading / Reference Material
		Standard Error of Mean; Standard Error of Measurement	[Based on Chapter 27, Foundations of Behavioral Research, 4th Edition, Kerlinger.]
8	09-Mar	**Validity** Content Validity & Validation Criterion Validity & Validation Construct Validity & Validation	Chapter 5, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora. Instructor's Notes [Based on Chapter 28, Foundations of Behavioral Research, 4th Edition, Kerlinger.]
		WEEK OF MARCH 13: SPRING BREAK	
9	23-Mar	*Module 4: Research Design* *Research Design & Application Exercises* *Elements of Research Design* *Applying Research Design Principles: Mitigating threats to research design in decision-making problems* ***Group Project Phase – I Due (Tentative)*** ***Group Project Phase 2 – Administered*** *(Tentative)*	Instructor's Teaching Notes / Excerpts Chapter 8, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora.
10	30-Mar	**Experimental Design** Foundations of Experimental Design Classifying Experimental Designs Signal Enhancing & Noise Reducing Designs	Chapter 8, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora Chapter 9, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora
11	06-Apr	**Quasi Experimental Design** Categories of Quasi Experimental Designs The Non-Equivalent Groups Design The Regression Discontinuity Design Review of Regression and Related Concepts *Quiz – 2 Administered (Tentative)*	Chapter 10, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora
12	13-Apr	**Module 5: Advanced Concepts in Causal Inference** Research Design Issues in the use of methods based on Multiple Regression Threats to Research Rigor – Investigating Regression Models & Rigor of inference *Application Exercises* ***Group Project Phase 2 – Due***	Instructor's Notes [Chapter 32 & 33, Foundations of Behavioral Research, 4th Edition, Kerlinger]
13	20-Apr	**Review & Recap**	Instructor's Teaching Excerpts
	May 1	*Quiz – 3 Administered (Tentative)*	

Spring 2023: University of Houston Policies

Policy Guidelines for All Courses

COVID-19 Information
Students are encouraged to visit the University's COVID-19 website for important information including diagnosis and symptom protocols, testing, vaccine information, and post-exposure guidance. Please check the website throughout the semester for updates. Consult the (select: Undergraduate Excused Absence Policy or Graduate Excused Absence Policy) for information regarding excused absences due to medical reasons.

Reasonable Academic Adjustments/Auxiliary Aids
The University of Houston complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, pertaining to the provision of reasonable academic adjustments/auxiliary aids for disabled students. In accordance with Section 504 and ADA guidelines, UH strives to provide reasonable academic adjustments/auxiliary aids to students who request and require them. If you believe that you have a disability requiring an academic adjustments/auxiliary aid, please contact the Justin Dart Jr. Student Accessibility Center (formerly the Justin Dart, Jr. Center for Students with DisABILITIES).

Excused Absence Policy
Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy and Graduate Excused Absence Policy for reasons including: medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Under these policies, students with excused absences will be provided with an opportunity to make up any quiz, exam or other work that contributes to the course grade or a satisfactory alternative. Please read the full policy for details regarding reasons for excused absences, the approval process, and extended absences. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Recording of Class
Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Justin Dart, Jr. Student Accessibility Center. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may be recorded by the instructor. Students may use instructor's recordings for their own studying and notetaking. Instructor's recordings are not authorized to be shared with *anyone* without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.

Resources for Online Learning
The University of Houston is committed to student success, and provides information to optimize the online learning experience through our Power-On website. Please visit this website for a comprehensive set of resources, tools, and tips including: obtaining access to the internet, AccessUH, Blackboard, and Canvas; using your smartphone as a webcam; and downloading Microsoft Office 365 at no cost. For questions or assistance contact UHOnline@uh.edu.

UH Email
Please check and use your Cougarnet email for communications related to this course. To access this email, login to your Microsoft 365 account with your Cougarnet credentials.

Academic Honesty Policy
High ethical standards are critical to the integrity of any institution, and bear directly on the ultimate value of conferred degrees. All UH community members are expected to contribute to an atmosphere of the highest possible ethical standards. Maintaining such an atmosphere requires that any instances of academic dishonesty be recognized and addressed. The UH Academic Honesty Policy is designed to handle those instances with fairness to all parties involved: the students, the instructors, and the University itself. All students and faculty of the University of Houston are responsible for being familiar with this policy.

Helpful Information

Coogs Care: https://uh.edu/dsa/coogscare/

Student Health Center: https://www.uh.edu/healthcenter/