

## **Research Design in Engineering Education**

EGN 6020 Section 28696

**Class Periods:** T 5-6, R 6

**Location:** NSC 520

**Academic Term:** Fall 2024

### ***Instructor:***

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Office Hours: R 5

### ***Course Description***

Fundamentals of research design in engineering education research. How to select a research approach that aligns with a research question, principles of research design, management of data, and ethics of human subject research.

### ***Course Pre-Requisites / Co-Requisites***

None

### ***Course Objectives***

Focuses on the fundamentals of research design in engineering education. Particular attention will be paid to the relationship between how a study is designed and the valid assessment of study results and conclusions. There will be an emphasis on understanding the linkages between theory, empirical statements or research questions, study objectives, study design, and valid inferences or conclusions. The principles of various research designs including true experiments, quasi-experiments, and qualitative studies will be discussed with particular emphasis on how each is better or worse at dealing with various issues of both internal and external validity.

The specific objectives for this course are:

- Understanding the major concepts involved in designing and conducting research
- Understanding how to construct different types of research designs and the strengths and limitations of each approach
- Developing strong capabilities in the following areas: (1) Writing a proposal, (2) Conducting a literature review, and (3) Managing data
- Reviewing how engineering education research is conducted and how it informs our understanding of learning and teaching practices
- Applying the designs and concepts learned in class to a real-world research design
- Understanding the differences between causality and correlation and be able to construct a narrative about relationships

### ***Materials and Supply Fees***

None

### ***Required Textbooks and Software***

- Title: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches
- Author: John W. Creswell, J. David Creswell

- Publication date and edition: Nov. 8, 2022, 6<sup>th</sup> Edition
- ISBN Number: 978-1071817940

### ***Additional Readings***

- Find new references that are relevant

### ***Course Schedule***

Module	Week	Topic	Assignment
1	1	What is Research? Exploring the philosophical foundations of engineering education research	Online posting 1: Introductory discussion
	2	Theory and category of design and perspectives on epistemology in engineering education	Online posting 2: Positionality
2	3	Structured literature review and identifying engineering education research questions	Online posting 3: Research questions
3	4	Types of engineering education data, measuring and defining variables, sampling, research approaches in engineering education	HW1: Literature Review, Online posting 4: Purpose statement
	5	Experimental design, quasi-experimental design	Peer review on HW1
4	6	Survey design and validation	Online posting 5: Hypothesis statement
5	7	Mixed methods study design and introduction to case studies	Online posting 6: Non-traditional research methods, HW2 Draft: Comparisons on Research Designs
6	8	IRB, human subjects' research, and ethics in research	Required IRB training completion
7	9	Designing research proposals in engineering education	Peer review on HW2 draft
	10		HW2: Comparisons on Research Designs
8	11	Research design proposal discussion	Online posting 7
9	12	Data management	
	13	Data considerations: validity, interpretability, directionality, causality, and comparison groups. Discussion on regression analysis (causation and correlation)	Online posting 8
	14		Research design proposals
10	15	Final presentation	Peer reviews on research design proposals

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

This course is interactive so attendance is expected. Excused absences must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Online Postings (8)	100 each	20%
Homework Assignments (2) (Literature Review and Comparisons of Research Design)	100 each	20%
Peer Reviews (3)	100 each	6%
Required trainings (IRB)	100 each	4%
Final Project (Part 1): Research Design Proposal	100	30%
Final Project (Part 2): Presentation	100	20%
		100%

#### **Online posting on course reading/listening/viewing assignments (20%)**

We will use the course readings from the required textbooks and additional readings/listening/viewing content as the central basis for our discussion. The purpose of this assignment is for you to reflect on the content and summarize it in a concise manner prior to discussion in class. In addition, this is an opportunity for you to shape some of the course discussions on these topics. Questions you may answer (you do not have to address them all in every post):

- What were the clearest takeaways from the content?
- What were the most confusing parts of the content?
- What did you learn that could have practical usefulness?
- What new concepts or theories did you encounter?
- What was the most unexpected thing you learned from the week's content?
- How did the in-class discussion and/or presentation (where applicable) enhance your understanding of the week's topic? Did the class impact your initial understanding of the topic in any way?
- How, if at all, have this week's course readings or discussions influenced your research interests?

#### **Homework Assignments (20%)**

Length: 4-page max, double-spaced

Everyone is expected to work on the following two different homework assignments:

- 1) Literature Review: Submit a preliminary literature review related to your research interest based on at least 5 papers or journal articles of your choice. Students can decide on the type of review they want to conduct, like the systematic literature review, qualitative review, etc.
- 2) Comparisons on Research Designs: Select three research designs of your choice and do a comparative analysis based on when their use is most appropriate. Extend this analysis to include design choices that are appropriate for carrying out various types of studies around your research interest.

#### **Peer Review (6%)**

Students will review one other student's HW and final research design proposal and provide them with written feedback. The feedback will be structured by shouldtemplate provided by the instructor. This assignment helps students develop skills in self-regulation in learning to judge the quality of their own writing by comparing it to peers, and develop their capacity as critical, constructive, and compassionate peer reviewers of others' work. Both these skills are critical to doing successful graduate-level research.

#### **Online Training (4%)**

Everyone is expected to complete the required IRB and CITI training and submit their completion certificates on e-learning.

## **Final Project: Research Design Proposal + Presentation (50%)**

Everyone is expected to work on a research design proposal around an engineering education-based research question of their choice. You are expected to:

- Select appropriate research methods,
- Design a study with a step-by-step description of how the data will be collected,
- Formulate a data management plan, and
- Write an ethics statement that deals with addressing the ethical issues in conducting the study.

As a part of the research design proposal, students are expected to also situate the research questions in the relevant literature. Students will submit the proposal document and give a presentation in which they are expected to justify the study design in the context of the research questions and answer questions pertaining to the validity and interpretability of the study. Students can apply for IRB approval of the study design, but it is not required.

## ***Grading Policy***

The following is given as an example only.

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

## ***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

## ***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

## Health and Wellness

### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](mailto:title-ix@ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

## Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** <https://care.dso.ufl.edu>.

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.