Research Design for Modeling and Simulation

Instructor Contact
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Overview:
This course emphasizes the theoretical and practical aspects of research methodologies as they relate to human-centered Modeling and Simulation. The course is designed to support the development of critical science consumption and production. Students demonstrate scholarly writing and critical analysis skills needed to develop a research proposal.

Prerequisites: Graduate standing

Recommended: Statistics, IDS 6147 should be taken prior to or in conjunction with this class.

Learner Objectives:
As producers of researchers, students should be able to carry out a systematic inquiry into their own research by:
- Familiarity with the use of literature research tools (e.g., bibliographic management, advanced search engine techniques, university resources for graduate-level work)
- Finding and framing a research question relevant to M&S
- Designing a research proposal suitable for M&S
- Developing testable hypotheses
- Selecting qualitative, quantitative or mixed research methods to explore the research question
- Designing a research methodology which would adequately address the hypotheses
- Identifying appropriate statistical methods for interpretation of results
- Recognizing factors that create limitations in a study
- Leveraging M&S approaches in research design
- Selecting data collection tools which align to their hypotheses
- Completing CITI certification to verify eligibility to collect human subject data
- Generating IRB-formatted human protection protocol

As consumers of research, students should be able to read a research report and:
- Identify and evaluate the clarity of the problem statement.
- Determine the theoretical or logical rationale of the research problem.
- Identify the specific research question under investigation.
- Determine whether the question is stated in terms amenable to investigation.
- Appraise the thoroughness and relevance of the literature review.
- Determine if the literature review establishes the need for conducting the research.
- Establish the credibility of the research.
- Assess the theoretical perspectives and/or a priori assumptions of the researchers.
- Identify the population(s) being studied.
- Evaluate the appropriateness of the research methodology for the study.
- Assess the clarity and consistency of the results.
- Identify the limitations of the study.
- Offer alternative interpretations of the results.
- Discuss the implications of the study in view of the strengths and weaknesses of the research.
- Distinguish between quantitative and qualitative research designs and methods.
Required text

Additional required readings are available online or through the UCF Libraries.

Recommended text

Course Outline
This course has been divided into three phases:

1) Knowledge acquisition (what are the basic things I need to know to start research?),
2) Critical thinking (how does what I know about research methods fit into current and future research?), and
3) Application (can I apply what I know about research into a plan?)

With this in mind, you will work throughout the semester on developing a Human Protection Protocol for a human-centered modeling and simulation study. To get you to the stage where you can put together a justifiable, appropriate, and rigorous study, the course will progress through the above phases. You will be given the liberty to choose a topic, so long as it demonstrates an understanding of the open research questions in human-centered M&S (and there are lots of them).

Research Basics (6 Weeks):

a. Module 1: Introduction
   i. Pretest—This will fulfill the student engagement requirement for the university and must be completed before the remainder of the course material is unlocked
   ii. Overview of course. What is human-centered M&S? How to construct research questions
   iii. HW1: Topic formation. Discussion post: Post topic of inquiry. Find a non-UCF master’s thesis or dissertation related to your topic. Post the reference and link to the paper. In addition to using this work to become more familiar with your own topic, you will be conducting a critique of this dissertation/thesis during the semester. Respond to at least one other post, with feedback that shares information that can help that project advance (e.g. potential collaborators, labs that are working on that topic, excellent journals/websites/conferences).

b. Module 2: Formulating and testing hypotheses and pilot testing
   i. Steps in constructing testable hypotheses
   ii. Exploring ways to explore (e.g. prototyping, Wizard of Oz, UX feedback)
   iii. HW2: Forming Research Hypotheses—Discussion post of 2 research questions, each with 3 testable hypotheses. Response with 2 recommendations, requests for clarification, and/or additional potential hypotheses

c. Module 3: Data sources
   i. Potential threats to validity, generalizability, and replicability
   ii. Identifying population implications a priori and their influence on statistical choices
   iii. HW3: Where will your data come from? Assignment submission: What types of data will you use? Where will you get this data/what tools or access will be required? How should that data be analyzed?

d. Module 4: Data collection & Design
   i. Quantitative (e.g. surveys, computational techniques, physiological)
   ii. Qualitative (e.g. ethnography, focus groups, phenomenological interviews)
iii. Mixed (focus on purpose and sequencing)
iv. Transdisciplinarity
v. Sampling and Statistics (e.g. Latin hypercubes, Taguchi methods)
vi. HW 4: Assignment submission—Discussion post. Post a diagram of your research design. Include DVs and IVs, interventions/manipulations. Use your diagram to show how information collected will help answer your research question by testing your hypotheses.
e. Module 5: Simulation methods to inform theory
   ii. HW5: Role of M&S in your topic area—Assignment submission 500 word MAX. Describe how modeling and simulation support research in your topic area. Provide examples from academic literature and reference the reading.
f. Module 6: Human subject research in simulation and cyber environments
   i. IRB
   ii. HPP
   iii. HW 6: Completion of CITI training. Download IRB forms pertinent to your research.

Critiquing Research Methodology (6 Weeks)
g. Module 7: Introduction to methodological critique: Read the following:
      https://www.dovepress.com/conducting-an-article-critique-for-a-quantitative-research-study-persp-peer-reviewed-article-NRR
   iii. HW 7: What elements of your own research project will you need to look at more closely, now that you see some of the items that are recommended for critique? Discussion Post. Respond to one other
h. Module 8: Article Reviews
   ii. AR1: Critical analysis rubric: Group Discussion Post: Must post your own review, before you will be permitted to read the other reviews. Reply with arguments/points of consideration to other posts. Your group will need to develop a single analysis and post it to the class discussion.
i. Module 9: Article Reviews
   ii. AR2: Critical analysis rubric: Group Discussion Post: Must post your own review, before you will be permitted to read the other reviews. Reply with arguments/points of consideration to other posts. Your group will need to develop a single analysis and post it to the class discussion.
j. Module 10: Article Reviews
ii. **AR3**: Critical analysis rubric: Group Discussion Post: Must post your own review, before you will be permitted to read the other reviews. Reply with arguments/points of consideration to other posts. Your group will need to develop a single analysis and post it to the class discussion.

k. **Module 11**: Article Reviews
   ii. **AR4**: Critical analysis rubric: Group Discussion Post: Must post your own review, before you will be permitted to read the other reviews. Reply with arguments/points of consideration to other posts. Your group will need to develop a single analysis and post it to the class discussion.

l. **Module 12**: Group methodology critiques
   i. This module will have you reading and writing reviews for your group member’s research proposals.
   ii. **HW 8**: Post your IRB draft proposal to your Group in Webcourses by uploading into your group’s “FILES”. Read the other drafts and provide feedback using the critical analysis rubric. Your Assignment submission will be to upload both of your feedback sheets in “Assignments”, and to upload your own draft in the class “Assignments” section.

Applications (3 Weeks)

m. **Module 13**: Research Proposal presentation
   i. You will be developing a human subject research protocol using the templates from the UCF IRB.
   ii. You give a 10 minute overview of your protocol using ppt or another presentation software. The rubric will be posted online.
   iii. Presentations will last for 2 weeks. Participation is required.
   iv. **Research proposal**: Slides or a link to the presentation will be posted by the due date. Students will sign up for presentation times.

n. **FINAL EXAM**: 2 parts
   i. Upload final version of IRB protocol and Informed Consent
   ii. Cumulative exam

**Grading**

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<tr>
<th>Assignment</th>
<th>Points</th>
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<tr>
<td>Homework 8 submissions</td>
<td>400pts</td>
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<tr>
<td>Article Reviews 4 submissions</td>
<td>200pts</td>
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<tr>
<td>Research proposal presentation</td>
<td>100pts</td>
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<tr>
<td>IRB protocol</td>
<td>200pts</td>
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<tr>
<td>Final exam</td>
<td>100pts</td>
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**Late assignments**

I do NOT accept late submissions. This class is progressive, with each week building on the prior week’s work to get you to your final presentation and proposal, so falling behind in the coursework can have detrimental effects. I strongly recommend that you work ahead as often as possible so that you have a cushion of time if you run into a rough spot. That said, you can be the best time manager and sometimes the unexpected occurs. Please, contact me immediately if any circumstance arises that may adversely affect your progress. We will work on a plan together. No extra credit is ever given.

**Religious Observances**

Students are expected to notify their instructor in advance if they intend to miss class to observe a holy day of their religious faith. For a current schedule of major religious holidays, see the Faculty Center’s main web page under “Calendars,” and for additional information, contact the Office of Diversity Initiatives at 407-823-6479.
Grades/Method of Evaluation

I use a 90-80-70-60 scale, based on percentage of total points. I do my best to give prompt feedback to your work so that you are able to know how you are doing as the course goes on. Take advantage of the rubrics for assignments, as they will guide you to achieving maximum credit for your work. Please note, simply meeting the assignment requirements does not guarantee an A. I define A as outstanding, and the bare minimum is never outstanding.

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<tr>
<th>Letter Grade</th>
<th>Points</th>
<th>Description</th>
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<tbody>
<tr>
<td>A</td>
<td>90-100</td>
<td>Outstanding work! Much more than would normally be expected for a student at this level. Very strong performance. I learned something valuable from you.</td>
</tr>
<tr>
<td>B</td>
<td>80-89</td>
<td>Good work! Clearly above average. More than would normally be expected for a student at this level. Above average work and performance. Very few minor flaws.</td>
</tr>
<tr>
<td>C</td>
<td>70-79</td>
<td>OK. Directions were followed. You did what would normally be expected for the assignment for a student at this level. A few minor flaws.</td>
</tr>
<tr>
<td>D</td>
<td>60-69</td>
<td>You can do much better. You have performed at a level that is below what one would expect for a student at this level. A number of minor flaws and/or one major flaw</td>
</tr>
<tr>
<td>F</td>
<td>59 or below</td>
<td>What happened? Well below average. More than one major flaw and/or an inordinate number of minor flaws.</td>
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Grade postings: All grades will be posted on Webcourses.

Make up exams
As the quizzes/ exams are online, the students may take them any time up until their final due date. If you will not be able to take the test on the day it is due, you must plan to take it prior to that time. In the case of an emergency, contact the instructor immediately to arrange for alternative plans.

Attendance Policy
According to the university, this class is "mixed mode". Here is the official description:

**M – Mixed Mode/Reduced Seat Time** courses include both required classroom attendance and online instruction. Classes have substantial activity conducted over the web, which substitutes for some classroom meetings.

While I do not directly penalize for missed classes, attendance it is extremely important to success in this class and should be considered mandatory.

Academic Engagement
All instructors/faculty are required to document students’ academic activity at the beginning of each course. In order to document that you began this course, please complete the following academic activity by the end of the first week of classes or as soon as possible after adding the course. Failure to do so may result in a delay in the disbursement of your financial aid.

To document your academic engagement, you will complete a quiz by the end of the first week of class. This quiz must be completed in order to unlock the remainder of the curriculum

Final Exam
The final exam submission will be due at the time assigned by UCF. This time will be posted on Webcourses within the first week. The final exam is open book and will be available for 1 week so you may take it at any point between the time it opens and it is due.
Changes/Announcements
Though I try to plan for everything, life will surprise us and we may have to make adjustments. In the event that anything in this syllabus changes (e.g. classroom moves, changes in due dates, contact information), I will use a broad announcement so that all students are informed immediately. It is critically important that you set your webcourse announcements so that you receive all notifications and be sure to check the class site at least twice a week.

Academic Honesty
Plagiarism and cheating of any kind on an examination, quiz, or assignment will result at least in an "F" for that assignment (and may, depending on the severity of the case, lead to an "F" for the entire course) and may be subject to appropriate referral to the Office of Student Conduct for further action. See the UCF Golden Rule for further information. I will assume for this course that you will adhere to the academic creed of this University and will maintain the highest standards of academic integrity. In other words, don’t cheat by giving answers to others or taking them from anyone else. I will also adhere to the highest standards of academic integrity, so please do not ask me to change (or expect me to change) your grade illegitimately or to bend or break rules for one person that will not apply to everyone.

Accessibility Statement
The University of Central Florida is committed to providing reasonable accommodations for all persons with disabilities. This syllabus is available in alternate formats upon request. Students with disabilities who need accommodations in this course must contact the professor at the beginning of the semester to discuss needed accommodations. No accommodations will be provided until the student has met with the professor to request accommodations. Students who need accommodations must be registered with Student Accessibility Services, Ferrell Commons, 7F, Room 185, phone (407) 823-2371, TTY/TDD only phone (407) 823-2116, before requesting accommodations from the professor.

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Third-Party Software and FERPA
During this course you might have the opportunity to use public online services and/or software applications sometimes called third-party software such as a blog or wiki. While some of these could be required assignments, you need not make any personally identifying information on a public site. Do not post or provide any private information about yourself or your classmates. Where appropriate you may use a pseudonym or nickname. Some written assignments posted publicly may require personal reflection/comments, but the assignments will not require you to disclose any personally identity-sensitive information. If you have any concerns about this, please contact me.