**McNair Research Methods – Math-intensive disciplines**

Instructor: Michael Garrett • Email: [zmdg11@etsu.edu](mailto:zmdg11@etsu.edu)

232-2 Sherrod Library

The greatest difference between undergraduate and graduate work is that in graduate school, you are to learn how to discover, pose, and solve problems outside the direction of an authority. This seminar will pursue those skills. I will also work with you to develop an efficient professional workflow to organize the components of research—academic articles and notes, data, graphics, and your own writing.

Course Description

**Course format:** I will assign daily readings largely from research articles and texts about doing research. You should be ready to discuss these in session. Specific daily work will be assigned as needed. These should be finished before class and you should be ready to talk about them. In class, we will present our ideas to one another, brainstorm, pursue your individual interests, and pose and solve problems together. I will spend some time presenting notes and leading discussions. We will work in session on practical problems searching academic databases, digesting research, and writing. You will be asked to present components of your proposal as you develop them, and we will offer constructive criticism.

**Major products:** (a) A research proposal, written up according to the McNair proposal template. This is a clear articulation of your interest and the specific problem you are proposing to address, a focused review of the literature around your specific interest, and a detailed description of the methods you will use to pursue your study; (b) A slide presentation. This is a succinct presentation of your research proposal, designed to give an academic audience a clear enough understanding of your proposal to allow them to judge its merits. You will present this to your peers and invited guests on the last day of the program.

**Assessment:** You will be assessed according the McNair Grading Rubric. The standards for this seminar are about how you engage in the process of building research skills; how prepared you are for the daily work of the seminar; how you contribute and respond to group discussions; how well you develop a research idea; and how your major products for this seminar meet their purposes.

Course objectives

**Competence with analyzing research design****. The student will develop their understanding and competence in:**

1. The ethical treatment of human subjects in research

2. The consequences of undertaking research generally

3. Correlation vs. causation and the type of evidence for each

4. Technical terms describing common research designs: experiment, controlled randomized trial, observational study, correlational study, and case study

5. Problems defining a population of interest, representing populations from samples, conceptualizing phenomena, operationalizing concepts, controlling for confounding influences, and establishing measurement procedures

6. "Statistical significance" vs. "practical significance"

7. Finding the purpose, population, research question, hypotheses, method, procedure, results, significance, and limitations in studies

8. Research design strategies to manage confounding conditions: direct manipulation of a variable, averaging over randomly varying influences, and accounting for well-described variables during analysis

9. Challenges to research claims based on questions about the purpose of the study, the population of interest and sampling, measurement, control, and strength of evidence

**Competence in creating and presenting a research proposal: The student will develop their understanding and competence in:**

1. Formulating an area of interest sufficient for an exploratory search for literature using an academic search engine

2. Using a preliminary literature review to narrow an area of interest

3. Using controlled-vocabulary searches, natural language searches, and various delimiters to narrow a search down to a target concept

4. Generating good research questions from a question of interest

5. Proposing experimental procedures to answer a well-formed research question

6. Searching literature to establish concepts, operations, measurement procedures, confounding influences, and threats to the claims of a study

7. Exporting citations from an academic search engine to be imported into a word processor or presentation software

8. Creating a formal proposal for research that addresses: purpose of a study, the definition and representation of a population or target phenomenon, the conceptualization of ideas, the operationalization of concepts, the quality of measurements, the control of confounding influences, the clarity of procedures, the analysis of data, whether results address the research question, the statistical and practical significance of results, and the limitations on the claims and generalizations of the results

|  |  |  |
| --- | --- | --- |
|  | **Seminar Schedule** |  |
| **Week** | **Topics** | **Progress toward your proposal** |
| 1 | Describing the nature of science. Defining a coherent area of interest: the phenomenon of interest, populations, open questions, and hunches. Using academic databases to explore academic literature. |  |
| 2 | The nature of evidence in research studies. Correlation, causation, and eliminating hypotheses. Description, observation, and controlled comparisons. Critiquing existing studies. Refining interests using research searches. | "Motivation for research" |
| 3 | The nature of designed experimentation. Attending to rival explanatory hypotheses. Statistical and practical significance. Conceptualizing and operationalizing basic constructs. | “Overall research question |
| 4 | Critiquing research designs. Refining questions and hypotheses. Basic statistical analyses. Measurement. Using literature to define and refine methods. | “Anticipated results”. |
| 5 | Continue work of week 4. | “Approach” |
| 6 | Organizing literature to make a solid case for your significance, purpose, questions, methods, and anticipated results. | “Significance”, “Literature Cited” |
| 7 | Catch-up. Last minute edits. Practicing presentations. Presentations in front of peers and invited audience. | Finished proposal and presentation |