



## Supplemental Materials

for

### **Advancing Metacognitive Practices in Experimental Design: A Suite of Worksheet-Based Activities To Promote Reflection and Discourse in Laboratory Contexts**

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## Appendix 1. AMPED Exercises

### AMPED #1

Name: \_\_\_\_\_

**Instructions:** Please complete the following questions to the best of your ability. Please work individually at first, as we will have time to share and discuss responses as a class momentarily.

1. This semester, you will be working as a team to explore a novel question within the biomedical and public health fields. In your opinion, what are your strengths and weaknesses when it comes to working in teams, and how will these characteristics impact how you engage with your team in this course? What information do you want your teammates to know about you that you think will help make the group more effective at accomplishing its goals, and why?
2. In your own words, how would you describe yourself as a scientific researcher? What do you perceive your role as a scientific researcher to be, and how do you believe this perception aligns with more “traditional” views of what a scientific researcher is/does?
3. What biomedical and/or public health questions are of importance to you and would you be interested in exploring in the context of this course? What motivated you to choose that/those question(s)?
4. What do you hope to gain from participating in this course, and why? How are your own expectations and goals (dis)similar to those of your teammates? How will you work together to ensure that everyone’s expectations are met and your goals are achieved?

**AMPED #2**

**Name:** \_\_\_\_\_

**Instructions:** Please respond to the following questions to the best of your ability. There are no right or wrong answers, and you will have an opportunity to share your thoughts with your group once you have completed the assignment individually.

1. What research question has your team proposed to explore? What source(s) of information did your team draw upon to generate that research question, and why?

2. Propose one hypothesis that is aligned with your research question. Write that hypothesis in the space below.

→ → PLEASE FLIP TO THE BACK SIDE → →

3. With the hypothesis you generated in mind, please complete the following table, citing specific evidence that indicates how your hypothesis addresses and/or meets each of the criteria listed.

Criterion	Evidence that Criterion was Met
1. Hypothesis must be written in the form of a statement.	
2. Hypothesis must be testable.	
3. Hypothesis must be falsifiable.	
4. Research question (and subsequent hypothesis) should address a current gap in the literature.	

4. Did your hypothesis address/meet all of the criteria in the table above? If not, what steps did you take to revise your hypothesis, why, *and* what is your new hypothesis?

5. **Once everyone has finished, take a moment to share your hypothesis with your teammates. Record the final hypothesis that your team agreed upon in the space below, and complete the table to indicate how that hypothesis addresses/meets all of the criteria listed.**

Criterion	Evidence that Criterion was Met
1. Hypothesis must be written in the form of a statement.	
2. Hypothesis must be testable.	
3. Hypothesis must be falsifiable.	
4. Research question (and subsequent hypothesis) should address a current gap in the literature.	



3. In general, what challenges have you encountered within the past week, and/or what questions do you wish to discuss with us [your course instructors]? How would you propose to overcome those challenges; please provide a rationale for your decision(s).

4. In the space below, please create an outline or representation of what you plan to accomplish within the next week (prior to our PI meeting):

Beyond it simply being the “next step” in the research process, why did you choose to focus on the tasks that you have illustrated above?



9. What type of figures/tables will you use? Why?

### **Data Analysis: Statistics**

1. Perform the appropriate statistical test(s), as identified in item #8 on the previous page. Then, please answer the following questions for all tests performed.
  - a. What is the alpha level for this test?
  - b. What is the value of your t-statistic, F-statistic, etc.?
  - c. How many degrees of freedom are there?
  - d. What is your  $p$ -value?
  
2. Is your  $p$ -value statistically significant? How do you know?
  
  
  
  
  
  
  
  
  
  
3. Is your null hypothesis supported? How do you know?

### **Data Analysis: Qualitative Data**

1. Create a list of codes for your dataset. Each code represents a theme within the data. Working together, eliminate any redundant codes until you have a finalized list, and record that list below:



2. In the space below, create a table that indicates the percentage of responses that belong to each theme:

3. Jot down some example quotes for each theme (or a reference to who said them) in the space below:

## Guidelines for the Final Progress Report

### Overview

Each team will prepare a written progress report that summarizes the research that they have conducted to-date. This will be in the format of a National Science Foundation (NSF) end-of-year summary document, which is a required obligation for all NSF grant recipients. You will receive a total grade for the lab report, but 80% of that grade will be your individual contribution and 20% will be a group grade. The individual grade will be based on your writing style as well as the content of the section that will be your primary responsibility, as outlined below:

Principle Investigator – Project Overview (including references)

Protocol Expert – Intellectual Merit (including references)

Data Expert – Broader Impacts (including references)

Analysis Expert – Research “Highlight”

### Required Components

#### ***Project Overview***

In this section, your team will want to include appropriate background information (from the primary literature) for your research topic and explain your specific research question(s). You will need to succinctly explain the research that has already been conducted on the variable you are testing. You will also need to explain the importance of your research. Please keep in mind that this overview should be specific to YOUR research project.

#### ***Intellectual Merit***

What new knowledge will be generated as a result of your team’s initiative, and how will that knowledge enrich and extend the current research base in the field? In other words, what contribution will your research make to advancing the community’s understanding of the topic in question? In this section, please also briefly describe how the work [to be] completed will lead to new and innovative questions, and discuss what these questions will be and how they will be addressed (methodologically).

#### ***Broader Impacts***

The “Broader Impacts” criterion encompasses the potential of your team’s research to benefit society and contribute to the achievement of specific, desired societal outcomes. Within the context of this course, such outcomes could include: (a) direct implications for community partners and/or members; (b) establishment of *new* partnerships; and/or (c) increased public scientific literacy and public engagement with STEM. In short, your objective within this section is to highlight in what way(s) your research outcomes are [or are anticipated to be] applicable *outside* of the classroom.

#### ***Research “Highlight”***

Please select one finding that you believe best illustrates the outcomes of your research. In this section, you should briefly describe this finding and its relevance in generating new knowledge in the field (i.e., why is this data “important?”). Your description should include **both** a figure/table as well as written text. **If your team has not completed all data collection and/or analysis, please provide a written summary here with regard to what your anticipated findings will be.**

#### ***References***

Please do not forget to include all references with your submission. References should be provided in APA format.

## FINAL PROGRESS REPORT RUBRIC

<b>TITLE</b>	<b>Points Possible</b>	<b>Points Earned</b>
Clear and to the point?	_ 5 _	_____
<b>PROJECT OVERVIEW</b>		
Introduced general "problem"?	_ 5 _	_____
Brought in relevant background information?	_ 5 _	_____
Explained rationale for conducting the study?	_ 5 _	_____
Adequate review of the primary literature?	_ 5 _	_____
Stated hypothesis/purpose of the study?	_ 5 _	_____
<b>INTELLECTUAL MERIT</b>		
Defines new knowledge to be generated?	_ 5 _	_____
Positions new knowledge within literature base?	_ 5 _	_____
"Next Steps" described in detail?	_ 5 _	_____
<b>BROADER IMPACTS</b>		
Connection to broader community is discussed?	_ 10 _	_____
Impacts are reasonable given nature of research?	_ 5 _	_____
<b>RESEARCH "HIGHLIGHT"</b>		
Results summarized in writing?	_ 5 _	_____
Tables/Figures clearly present the data?	_ 5 _	_____
Tables/Figures are in the proper format?	_ 5 _	_____
Results are placed in a larger conceptual context?	_ 5 _	_____
<b>OVERALL QUALITY</b>		
Appearance and organization	_ 5 _	_____
Clarity and conciseness	_ 5 _	_____
Grammar and spelling	_ 5 _	_____
Literature cited in proper format	_ 5 _	_____

**COMMENTS:**

**AMPED #6**

Name: \_\_\_\_\_

**Instructions:** One important aspect of your work next semester will be to engage with the local community through one or more outreach efforts. In order to prepare for this experience, please take a moment to address the questions below with your team. Once you have completed all items, please **create a concept map/flowchart** that illustrates your ideas.

1. As you consider the type(s) of public health/community outreach that you anticipate engaging in during the semester, what goals and sub-goals are you attempting to achieve? Why?
2. Who will be involved in the outreach initiative? Why? What role will those individuals have as part of the initiative, and why are those roles important to helping you achieve your short- and long-term goal(s)?
3. How will you ensure that the views and contributions of all stakeholders are valued equally?
4. Are you planning to collect any data/information from individuals participating in the outreach effort? If so, what information do you plan to collect, how will you collect it, and how will you ensure that the findings are disseminated appropriately?
5. Overall, what will the societal/broader impact(s) of your effort be? Why is/are those impact(s) important and/or relevant (i.e., why should anyone care)?

**Appendix 2. Individual Development Plan (IDP)**

**Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Major:** \_\_\_\_\_

**Year in School:** \_\_\_\_\_

**Professional/Career Objective** (i.e., specific position within a university, industry, government, or something else)

<i>1<sup>st</sup> Choice</i>	
<i>2<sup>nd</sup> Choice</i>	

**Plans for a Terminal Degree, if applicable** (e.g., Ph.D.; M.D.-Ph.D.)

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**Mentor**

Please list your primary CURE faculty mentor who will enhance the training experience by supporting your development in various skill sets.

<i>Name of Primary Mentor</i>	
<i>Department &amp; Institution</i>	

The IDP is meant to cover various areas of training including Coursework, Research, Professional Development, and Other (which is customized by the student, e.g., graduate school preparations).

The student and the mentor(s) will assess the skill set of the student in each of these areas and then define goals to address the skills to develop. In addition, the entire training period needs to be considered in the IDP, as goals may have a particular sequence or necessary timeframe for success. The mentor(s) will guide the student in how to meet these goals to best achieve the desired academic and/or career outcome.

The student will meet with the mentor(s) to ensure that the goals are specific, realistic, and are met in a timely manner. Goals will also need to be reassessed to address the particular needs of the individual and to reflect the changing nature of research and/or the student's academic and career goals.

**Training Skills Assessment (to be completed initially by the student)**

Please list your skill strengths and areas for improvement. After completion, please share with your mentor(s) for feedback.

**Skills Self-Assessment**

Area of Training	Current Strengths	Areas for Improvement	Mentor Comments
<b>Coursework/Skills Development</b> (e.g., working with others; learning content independently; time management; writing; reading; math; multitasking; seeking help when needed)			
<b>Research</b> (e.g., problem-solving; analyzing data for patterns; organizing research projects; discussing scientific concepts; defending an idea; working independently; teamwork; critical thinking; creating a poster; academic writing; PPT skills)			
<b>Professional Development and Outreach</b> (e.g., networking; involvement in professional societies; workshops; conferences)			

**Goals (to be completed initially by the student)**

As an IDP is an overall plan for training, setting goals for the upcoming year is crucial in order to progress and build upon goals in successive years. Keep in mind that certain goals for a career may need to be met on a timely basis.

AY 2018 - 2019	
Fall 2018	Spring/Summer 2019

**Planning (to be completed with the mentor)**

The student will work with their mentor(s) to create **three** goals and specific action steps in each area below to address and gain the skills necessary for their anticipated career. This plan should be assessed and revised regularly.

**Time Frame Covered by this Plan:** \_\_\_\_\_

<b>COURSE/SKILLS</b>	<b>Action Step</b>	<b>Frequency (i.e., weekly)</b>	<b>Target Completion Date</b>
1.			
2.			
3.			

<b>RESEARCH</b>	<b>Action Step</b>	<b>Frequency (i.e., weekly)</b>	<b>Target Completion Date</b>
1.			
2.			
3.			

<b>PROF. DEV.</b>	<b>Action Step</b>	<b>Frequency (i.e., weekly)</b>	<b>Target Completion Date</b>
1.			
2.			
3.			