

Guide for Conducting Your Research Investigation

BUILDING YOUR RESEARCH INVESTIGATION

Statement of the Problem

Write a clear statement of the problem you intend to address in your research.

For example: *“This investigation was designed to determine whether spatial layout is influential in helping students learn an unfamiliar concept in physics. Specifically, we were interested in determining whether the spatial configuration of a diagram differentially influences learners’ comprehension of the principle of a circuit.”*

Rationale for the Problem

Search the literature and obtain 5-7 research articles which address the problem above. Summarize those articles. Then, weave the articles together into a rationale which addresses two issues:

1. Why the problem of your investigation is in need of research. Describe this from a theoretical and an applied point of view;
2. How the experimental approach of your investigation will determine the answer to the problem.

For now, your summary and rationale can be listed as bulleted points, and does not have to be written in final form. However, you will probably find it much easier to do your thinking in building your rationale if you write it in paragraph form as standard text.

Expectations/Predictions

List the hypotheses. The hypotheses should be written as predictions of what you expect to find as an outcome of your experiment.

Experimental Design

Draw out the experimental design of your investigation in boxes. For example:

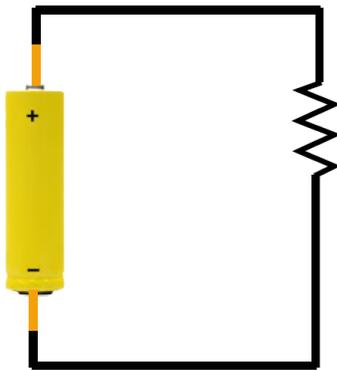
		Spatial Layout		
		Rectangle	Triangle	Ellipse
Type of Circuit	Simple			
	Series			
	Parallel			

The design above is an example of the way a two factor design would be shown. Note its features. One factor is “Spatial Layout”. This factor has three levels—rectangle, triangle, and ellipse. One factor is “Type of Circuit”. This factor has three levels—simple circuit, series circuit, and parallel circuit. Note also that the lines separating the levels of the spatial layout factor. The lines are solid. Note also that the lines separating the levels of the spatial layout factor. The lines are solid. Note also that the lines separating the levels of the type of circuit factor. The lines are dashed. When the lines are solid, it means that the factors are between-subjects factors—that is, there are separate groups of participants in each group. When the lines are dashed, it means that the factors are within-subjects factors—that is, all participants are going to see all three types of circuits. Finally, the design I used in this example is much too complex for what you will want to do for this seminar. The one factor of spatial layout would be sufficient.

Materials

Explain the materials you intend to use. You will need materials for your independent variables, and your dependent variable.

Materials for independent variables. Independent variables are always shown in the design. In the example above, you would need an illustration of a simple circuit shown in the form of a rectangle, triangle, and an ellipse. See an example of one of the illustrations—e.g. the rectangle—below.



Materials for dependent variable. Dependent variables are not shown in a design. Instead, they are the actual numbers that reflect differences in performance. These numbers actually get listed inside the boxes of the design, and are the values on which you perform statistical analyses. In simple terms, they are the measuring stick you use to show performance differences as a result of your treatments (levels) of your factor. So, you are going to have to come up with this measuring stick. For purposes of this seminar, you will build your measuring stick on your account in Qualtrics. However, before you begin building on Qualtrics, you want to identify the outcomes on which you want to see the effects of your independent variables (in the example above, type of circuits and spatial layouts). One outcome you might want to measure is whether people understand the function of these types of circuits differently and whether their understanding of the types of circuits is influenced by whether the circuits are shown as a rectangle, triangle, or ellipse. Therefore, one of your outcome variables is comprehension. Another outcome you might be interested in is problem solving. That is, you want to know whether people can solve problems about electrical circuits differently on the basis of their exposure to one of the nine conditions (e.g. simple circuit shown as an ellipse). Therefore, your dependent variables are: 1) Comprehension, and 2) Problem Solving.

Once you have identified your dependent variables, as explained above, then you can decide how you want to measure each of them. For comprehension, you might build a multiple choice test made up of 15 questions that measure how much the people understand—hence, their comprehension. For problem solving, you might build a multiple choice test of 10 problems that people have to solve. Once you have built these multiple choice tests, *then* you can build them on Qualtrics.

Collecting Data

Collecting data in this class is informal, and technically non-scientific. The data are exclusively for the purpose of instruction specifically for this class. Your “experiment” is not an officially sanctioned research experiment in the department. It is designed to only to teach. Therefore, you should feel free to ask your friends and family to go to your experiment and participate in it to collect your data.

You should also be aware that you need a minimum of 10 people for each of your design cells. That way, you can analyze your data with parametric statistical techniques—e.g. t-tests, ANOVA, etc.

Analyzing Your Data

Your data will need to be analyzed using SPSS. Since you will have clear hypotheses (see above), you will use specific statistical tests to analyze only those hypotheses. When all of your data have been collected, Kevin and I will help you with those analyses.

Once the data have been collected and analyzed, your entire experiment will be placed into either a PowerPoint or Prezi presentation to be made to the class for part of your course grade. Your entire experiment will also be written up in a report of the experiment, using APA style.

BUILDING YOUR POWERPOINT OR PREZI PRESENTATION

Your PowerPoint/Prezi presentation should contain basic slides. Those slides form the logical infrastructure of your presentation. You will, no doubt, have many more slides than these, but these basic slides must be present (or implicitly clear from their contents) in the following order:

1. Statement of the Problem
 - a. This slide states the exact problem the research was designed to investigate.
 - b. Add slides which provide definitions of variables or concepts, if necessary.
2. Research Background
 - a. These slides contain the research that forms the basis of the problem.
3. Hypotheses
 - a. This slide (or slides) make clear the hypotheses your research is designed to test.
 - b. Add slides which provide a rationale for each hypothesis.
4. Method Section
 - a. Participants
 - b. Experimental Design
 - c. Materials
 - d. Dependent Variables (as outcome variables, with examples of scales, questions, etc. for each)
 - e. Procedure

- f. Data Source
- 5. Results
 - a. These slides will contain the statistical results of your analysis
 - i. Each result should be presented by hypothesis.
 - ii. Each slide containing a result should present the:
 - 1. Hypothesis
 - 2. Outcome variable as measured
 - 3. Means and Standard Deviations
 - 4. Graph of the result
 - 5. Statistical results in statistical terms
 - 6. The written as a clear statement
 - b. Summary slide of all the findings
 - c. A separate slide of the *interpretation* of each hypothesis based on the findings.
- 6. Discussion
 - a. These slides should contain an identification and small explanation of the limitations based on theory and/or methodology
 - b. These slides should contain recommendations for future research relative to the way the study should be re-designed and/or conducted to answer questions that emerged from this research.
- 7. References

WRITING UP YOUR RESEARCH

Your experiment will be written up in a report. This report will be prepared as a word document, closely following the style manual of the APA. The contents of the report will contain the content from which you built your PP/Prezi presentation, elaborated and extended where it is necessary to do so. That is, all the content in your presentation should be comprise your paper, written in paragraph form with any necessary sentences added to make the paper a coherent document. You may include any tables or figures you wish, but only put in a few that are absolutely necessary for comprehension of what you have written. The paper must be typed double-spaced, single-sided.

I suggest writing your paper in sections as soon as you have completed the corresponding section you are building for your PP/Prezi presentation. I also strongly suggest that *the paper follow the PP/Prezi*—not the other way around. The presentation will be of much higher quality that way, and your paper will *be much easier* to write.

Also, there are a number of Internet-based resources to help you with APA Style. A few I found are:

1. <https://owl.english.purdue.edu/owl/>
2. <http://www.apastyle.org/learn/tutorials/basics-tutorial.aspx>
3. http://www.vanguard.edu/uploaded/research/apa_style_guide/apastyleessentials.pdf