

Scientific Methods

Learning Objectives:

- 1) Identify the common components of the methods section of scientific research.
- 2) Explain how to test a scientific hypothesis.
- 3) Create step-by-step instructions on how to perform the self-experiment.

General Overview of Methods:

How will you perform your experiment? What equipment do you need to use to collect data? Remember, the steps outlined in your methods need to be as detailed as possible. If I wanted to perform your study on someone else, I would know exactly what steps to take to recreate the study by looking at your methods. Are you using methods similar to another study?

Instructions:

For this section of your scientific project, you are expected to write a detailed description of the steps you will take to test your hypothesis and perform your self-experiment. Remember to be as detailed as possible.

- For example, if your dependent variable is heart rate, how will it be measured? Will you use a Fitbit, Apple watch, or taking your own radial pulse (count your heartbeats)? You can do this by counting beats over 30 seconds and multiplying by 2 or will you count heartbeats over the whole minute?
- The more detailed you are about the process, the better.

Format Requirements:

- Please restate your hypothesis at the top of your paper before you begin to explain your methods.
- For examples of how to write your methods, read the methods section of other published scientific literature.
- If you will be using similar methods to another study or a survey that you did not create, YOU MUST CITE YOUR SOURCES (in APA format*).

Include the following **subheadings**:

1. **Participant Information:**

- This will be about YOU, since you will be the only participant in your experiment. Identify demographics that you feel are important to the experiment (female, 18 years old, full-time college student, student athlete, moderately active, vegetarian, family history of heart disease, etc.) It is not necessary to identify every personal descriptor – just those that you feel are pertinent to your study.
- You are the only **participant**, therefore you will not remain anonymous like participants would in typical scientific research. Because of this, you are not required to share personal information that you do not wish to disclose. If there is personal data you feel is pertinent to your experiment that you do not want to disclose, you must state so explicitly (“For the confidentiality of the participant, ____ and ____ demographic data has not been disclosed”).

2. **Materials**

- What equipment will you need? Include every material you will need to complete your experiment. You should specify brand whenever possible; e.g. Hand weights, elliptical trainer, timer.
 - Make sure to provide precise product information you are using in this section. For example, stop watch by Extech, model number 365510.
3. **Procedures**
- Create exact step-by-step instructions you will follow to complete your experiment
 - Must include testing intervals- how long will the study last? How frequently will you collect data? Will you collect data before and after your intervention?
4. **References**
- You must reference any work or scales, tests and measures you did not design
 - Follow this link for information on APA format for in-text citations and reference lists:
https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/general_format.html

Examples

Example 1:

Hypothesis:

My hypothesis states that if I practice mindful meditation for 15 minutes each day, my resilience and ability to cope with stress will increase, as measured by the Resilience Quotient Test (RQT) and Perceived Stress Scale (PSS).

Participant:

For this experiment, the main participant will be myself. I am a 21 year old female, a full-time college student, and have been diagnosed with General Anxiety Disorder (GAD) and dysthymia.

Materials and Procedures:

The experiment will be carried out for 14 days, from August 15, 2018 to August 29, 2018. The meditation will be done in my apartment room, for 15 minutes using a timer app on my phone each morning upon waking up. I will complete the RQT and PSS prior to the beginning of the period and complete them again at the end of the period.

This study's two scales include the Resilience Quotient Test (RQT) and the Perceived Stress Scale (PSS).^{1,2} The PSS includes 10 questions designed to measure the level of stress the individual has been experiencing within the previous month. Adding the items on the PSS gives a score ranging from 0 to 40. A higher score indicates an increased level of perceived stress.¹ The RQT includes questions that identify one's personal resilience in situations of change and potential stress. Results are categorized into eight dimensions with an overall score, ranging from 32 to 192, for interpretation. A higher score indicates a higher level of resilience and ability to effectively deal with change.² At the conclusion of the experiment, results pre-test and post-test will be compared.

References

1. Mahon M, Mee L, Brett D, Dowling M.(2018) Nurses' perceived stress and compassion following a mindfulness meditation and self compassion training. *Journal Of Research In Nursing* [serial online]. (8):572-583. Available from: CINAHL Plus with Full Text, Ipswich, MA. Accessed August 14, 2018.
2. Hwang W, Lee T, Kwon J, et al.(2018) The effects of four days of intensive mindfulness meditation training (Templestay program) on resilience to stress: a

randomized controlled trial. *Psychology, Health & Medicine* [serial online].23(5):497-504. Available from: CINAHL Plus with Full Text, Ipswich, MA. Accessed August 14, 2018.

Example 2:

Methods

Hypothesis:

If I increase the consistency of my sleep schedule by going to bed at 11pm every night for two weeks, then I will get better quality of sleep measured by hours of restful sleep time recorded through a sleep app on my Apple Watch.

Participant:

The participant is a 19 year old female college student attending school full time with no past experiences of any kind of sleeping disorder or family history of it. She has never been diagnosed with any kind of chronic sleeping problems as well and lives in the single bedroom in an apartment complex on college campus with one other person.

Materials:

- a. A device to measure and track your sleep quality. (Apple Watch series 4 from Apple and Sleep Watch app by developer Bodymatter, Inc)
- b. Notebook to log the hours of restful sleep achieved each night during the weeks.
- c. An environment suitable for sleep

The materials used in this specific study will be an Apple Watch series 4 from Apple with the Sleep Watch app by developer Bodymatter, Inc installed. A simple diary to write down the hours for calculation, and a private bedroom in the on-campus apartment, Vista Del Campo Norte.

Procedures:

To start off the study, the participant will maintain her normal sleep schedule for a whole week wearing an Apple Watch. Her hours of restful sleep each night will be monitored by an app called Sleep Watch on her Apple Watch. She will also be required to record the hours of restful sleep achieved each night in a sleep diary¹. I will be using this data as a comparison for improvement and change at the end of the experiment. After one week of the previous sleep schedule the participant will now adopt a new consistent sleep pattern by going to bed every night at 11pm exactly for two weeks, and the hours of restful sleep during this time will be measured the same way through the Sleep Watch app. The subject will then again be required to be write down the hours of her restful sleep as given by the Sleep Watch app in her diary. At the end of the two weeks the average number of restful sleep hours will be calculated for each week separately and individually including the week of no change. These three numbers will then be lined up in chronological order to examine whether the quality of sleep has improved or not based on if the average hours of restful sleep has increased. This is the result that will either support or debunk my hypothesis.

References:

1. Wright R.(2010) Sleep consistency as a mechanism for improving inhibitory system strength. *Stress & Health: Journal Of The International Society For The Investigation Of Stress* [serial online].26(3):198-199. Available from: Academic Search Complete, Ipswich, MA. Accessed August 21, 2018.

Rubric for Methods Section of Scientific Project

Descriptor	Superior	Good	Poor	Unacceptable	
Points	5	3	1	0	Total
Criterion 1: Validity	The methods will appropriately test what is intended, as outlined by the hypothesis.	The methods may test what is intended, as outlined by the hypothesis.	The methods only relate to one variable, and thus it is unlikely that they will test what is intended.	The methods do not relate to either variable stated in the hypothesis, or the hypothesis was not listed	
Criterion 2: Participant	Pertinent participant information is clearly outlined.	Some pertinent participant information is outlined.	There is very little information regarding participant.	There is no description of participant included.	
Criterion 3: Materials	All necessary materials are clearly outlined and identified by product manufacturer and model.	All necessary materials are clearly outlined, but are not identified by manufacturer and model.	Some necessary materials are missing from the methods.	No materials are identified.	
Criterion 4: Procedures and Replicability	The procedures are very clear, and all aspects of the methods would be easily replicated.	The procedures are somewhat clear, and most aspects of the methods would be easily replicated.	The procedures are vague, and the methods would be difficult to replicate.	The methods are not replicable based on the information given.	
Criterion 5: Formatting	Complete sentences, appropriate subheadings are used throughout the document, and references if needed.	Complete sentences are used, some subheadings are included in the document, references if needed.	Complete sentences are used, but there are no subheadings included and no needed references.	Methods are not written in complete sentences and no references.	
Criterion 6: Spelling and Grammar	The assignment is free from careless surface errors.	The assignment has occasional surface errors.	The assignment has several surface errors, but they detract minimally from the content	The assignment has numerous surface errors that distract from the content.	
				Total Possible Points	30