

Class activity: Learning about the scientific article and how it relates to the scientific method

This reading guide follows the model presented in John Bean (2011) book, Engaging Ideas.

Chosen article: Psychological and Behavioral Changes during Confinement in a 520-Day Simulated Interplanetary Mission to Mars

Basner, M, Dinges, D.F., Mollicone, D.J., Savelev, I., Ecker, A.J., Antonio, A.D., Christopher W. Jones, C.W., Hyder, E.C., Kan, K., Morukov, B.V., Sutton, J.P. (2014). Psychological and behavioral changes during confinement in a 520-day simulated interplanetary mission to Mars. *Plos One*, 9(3), e93298-e93308 DOI10.1371/journal.pone.0093298

Background: Mars One mission (note that this company has declared bankruptcy not long after I prepared this activity). The gained knowledge is still valuable.

<https://www.mars-one.com/mission/roadmap>

“Mars One has developed a mission to establish a human settlement on Mars built entirely upon existing technology. While the integration of systems proven in prior missions does greatly improve the chance of success, it by no means eliminates the risk or challenge of such an incredible endeavor. Sending humans to Mars remains a phenomenal undertaking by all standards and, as such, presents very real risks and challenges”. (From Mars One site).

Note that scientific articles (also referred to as a peer-reviewed journal articles) are written for other experts. It is not intended for a general audience. This would explain why many of them are difficult for college students to understand. This exercise is to teach you what is a scientific article and help you understand the gist of the information. On purpose I choose an article that was less difficult than most scientific articles. I also chose a topic that you will most probably find interesting.

1. Remember that in class we saw that one begins research by asking questions. From these initial questions, the researcher will review all the studies that were done on those questions (your topic of interest) in order to develop an understanding of what we know up to now on the question(s). This is called a literature review. Look at the References section at the end of the article. You will note that it contains all the sources that the authors referred to in their article. In this article the author uses numbers at the end of the sentence ([1]) to refer to a specific source. This is not APA format. APA format uses in-text citation such as (Beans, 2011, p. 171). We will talk about the format of in-text citations later in the course. Note that sources are also referred to in the discussion. This is common. It helps the researchers set their results in the context of what science already knows. It also helps the author explain their findings.
 - A. **If you could read one of the research studies reviewed in the introduction which one would you select and why?**

2. Read the title of the article and the abstract. The title lets us know that the researchers measured the psychological and behavioral changes during a 520-day confinement in a simulated interplanetary mission. That sounds like a long time! Now read the abstract.
 - B. **What do you think is the role of the abstract?**

3. Read the introduction. Try to understand the gist of each paragraph. This introduction reviews some of the previous research (source indicated with number in between [] at the end of a sentence). In

the introduction, the authors describe what is known and unknown on the topic and what theory has been developed from the findings of previous research. It will also discuss some of the limitations of previous studies. In this article, you will see that not much is known on their research question.

C. What aspects of a mission context, according to NASA, bring the most risk to a crew and mission?

4. Basically, the researchers are going to measure the psychological (for example mood states, depression, how others perceive you) and behavioral (for example level of activity, concentration, sleep cycle) changes of the 6 crew members in this long confinement made to mimic a flight to Mars. Read the hypothesis on page two.

D. Restate the hypothesis in ordinary rather than scientific language. In other words, make the hypothesis understandable to your kid brother or sister.

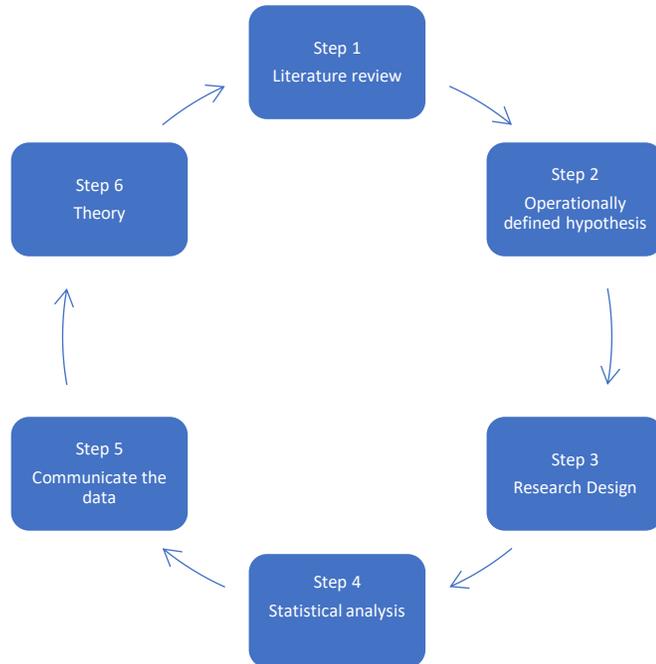
5. Under Materials and Methods you will typically find information on the subjects, the procedure and materials used in the study. Remember that one step in the carrying out of a study is to operationalize the hypothesis. You will find this information described in the method and material section. The material section describes the different tests used to measure psychological aspects like mood states and behavioral changes like reaction time and attention. The psychological tests are called scales, inventory, or questionnaire and are developed to measure something. The operational definition of depression for example would be a score above a certain point on the 20 questions Beck Depression Inventory. Most inventories in its conception are tested on a lot of people to make sure that it gives consistently a true measure of depression (or whatever you are measuring).

E. Describe the lucky subjects who spent 520 days in confinement. Would you have volunteered to participate in such a study?

F. What did the researchers do to simulate a Mars mission environment? Was it, in your opinion, a good simulation?

- G. Name two variables (a variable is an aspect one is studying) measured in this study and how it was measured.**
6. After collecting the data, you need to analyze it. Skim the statistical analysis and results section. Focus only on what you can understand; don't worry about what you don't understand. These sections are aimed at experts in experimental design and statistical methods. Focus on some of their findings.
- H. From the result section, indicate two interesting results the researchers obtained.**
7. While the result section is difficult to follow, the discussion section will normally describe the findings in clearer terms. This is the section I normally tell students to jump to once they have understood what the study is about and how they did it. The discussion will tell the reader whether the hypothesis was supported or not. They will also describe how their findings compare to what we already know about this topic.
- I. Did the average amount of sleep of the subjects increased with time of mission? Was this increase the same for all subjects? What is one explanation for the increase in sleep time during the mission?**
- J. Was there an increase in psychological difficulties (depressive symptoms and psychological distress)?**
- K. Was there a lot of conflicts reported between members of the mission?**
8. At the end of the discussion section you will find a limitation section. It describes some of the problems with aspects of the present research.
- L. What is one of the main limitation of this study**

9. In what way does the scientific article relate to every step of the scientific method? In other words, which part of a scientific article deals with each step of the scientific method? In presenting their results in a scientific journal, which step of the scientific method are the researchers addressing?



References

- Basner, M, Dinges, D.F., Mollicone, D.J., Savelev, I., Ecker, A.J., Antonio, A.D., , Christopher W. Jones, C.W., Hyder, E.C., Kan, K., Morukov5, B.V., Sutton, J.P. (2014). Psychological and behavioral changes during confinement in a 520-day simulated interplanetary mission to Mars. *Plos One*, *9(3)*, e93298-e93308 DOI10.1371/journal.pone.0093298
- Beans, J.C. (2011). *Engaging ideas: The professor's guide to integrative writing, critical, thinking, and active learning in the classroom*. San Francisco, US: Jossey-Bass