## Teaching Notes

### By *Mirayda Torres-Avila*

*Contact information*

**Course Information**

Department: Biology

Level: **Upper Undergraduate**

Course type: **Lecture**

Students: **Majors**

Number of Students: 30

**Module Information**

Original Module Name:

1. Basic Statistic Review
2. Research Article Analysis

Link to Original: n.a.

Modified Module Name: Data analysis: Statistics and Graphs

Files associated:

1. Flip-Classroom: Research Article
2. Class Worksheet: Analysis of Per capita CO2 emissions

Modification Learning Goals:

* On the completion of this activity, students will be able to
	+ **Connect** between result, conclusions and implications of the research article.
	+ **Identify** essential figure and tables in the research article.
	+ **Describe** effects of the increment of carbon dioxide.
	+ **Organize and analyze** statistically data.
	+ **Create and describe** figure to present the results.

**Teaching Notes**

*(Think about what you would like to read about this activity if you came back to it in 2 years)*

Suggestions for this section (not all required, and extras always welcome):

* What did you change and why?
	+ In this lesson, I am using backward design with flip and active learning teaching strategies. Students will develop previous knowledge on the topic by reading a research article (flip). Students will work in-group of three during class to evaluate, present, and describe the data (active learning).
	+ I merged the topics of two activities in the course: (1) Argumentation strategy to read research articles (Lacum, et al., 204) and (2) Basic statistics review. The argumentation strategy was homework and we discuss in class. The basic statistic review was a discussion in class.
	+ In the new modification, (1) both activities will be on the topic of atmospheric carbon dioxide, (2) students will read a research article on the topic and answer some question before the lecture. In class, student will be grouped in-group of three to discuss their answers (3). With the same group organization, students will use data from the Global Carbon Project. Students will statistically evaluate the data, create graphs, and describe the data and results (4).
* How did the activity go?
	+ Due to the COVID-19 situation, I will be implementing this activity during the summer I and II.
	+ What went well and why?
	+ What went wrong and why?
* What was the prep like?
	+ How much time went into prep?
		- Organizing groups in blackboard.
	+ Did you have to do any prep (i.e. grow cultures, grow seeds, order supplies) ahead of implementation?
* Would you do this activity again?
	+ What would you change in the future?
* What do you wish you’d known before you ran the activity?
* Is there anything else you would like to make note of?
* How does this activity fit in your overall course curriculum?
	+ This activity covers several learning objective of my course with more dynamic methods.
* In what ways, if any, did you modify your teaching practice with this activity?
	+ I developed a stronger structure for these activities.

**Reference:**

**Reference reading:**

Prestwich, K. N., & Sheehy, A. M. (2015). *Integrating Concepts in Biology*: A Model for More Effective Ways to Introduce Students to Biology. *CBE Life Sciences Education*, *14*(3), fe3. <https://doi.org/10.1187/cbe.15-04-0102>

* Section 30.3: How does increasing atmospheric carbon dioxide disrupt ecological systems?

**Teaching Strategy Reference:**

Van Lacum, E. B., Ossevoort, M. A., & Goedhart, M. J. (2014). A Teaching Strategy with a Focus on Argumentation to Improve Undergraduate Students' Ability to Read Research Articles. *CBE life sciences education*, *13*(2), 253–264. <https://doi.org/10.1187/cbe.13-06-0110>

**Research Article to Discuss:**

Weyant, C., Brandeau, M. L., Burke, M., Lobell, D. B., Bendavid, E., & Basu, S. (2018). Anticipated burden and mitigation of carbon-dioxide-induced nutritional deficiencies and related diseases: A simulation modeling study. *PLoS medicine*, *15*(7), e1002586. <https://doi.org/10.1371/journal.pmed.1002586>

**Data:**

Hannah Ritchie and Max Roser (2017) - "CO2 and Greenhouse Gas Emissions". Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions' [Online Resource] – <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>

* PER CAPITA CO2 EMISSIONS (GLOBAL CARBON PROJECT; GAPMINDER; UN)
	+ Data published by OWID based on the Global Carbon Project; Carbon Dioxide Information Analysis Centre (CDIAC); Gapminder and UN population estimates

**PART I. Homework: Argumentation**

Instructor note: Students will read the research article and answer this question individually. Students will be organizing in-group of three and they will discussion their answers.

**Connection between results, conclusions and implications**

**Objective:**

On the completion of this homework, students will be able to

* **Connect** between results, conclusions and implications of the research article.
* **Identify** essential figure and tables in the research article.
* **Describe** effects of the increment of carbon dioxide.

**Research Article:**

* Weyant, C., Brandeau, M. L., Burke, M., Lobell, D. B., Bendavid, E., & Basu, S. (2018). Anticipated burden and mitigation of carbon-dioxide-induced nutritional deficiencies and related diseases: A simulation modeling study. *PLoS medicine*, *15*(7), e1002586. <https://doi.org/10.1371/journal.pmed.1002586>

**Instructions:**

* Go to http://www.ncbi.nlm.nih.gov/pubmed and search for the research article using the title name.
* Make sure you have the correct article by looking the name of the author and journal.
* In the right side, click under “Full text links” to get the PDF version of the article.
* Answer this question using this research article.
* Press “Homework” to see the rubric and submit your homework.

**Questions:**

1. Identified in the research article the motive, objective, main conclusion, and implication.

|  |  |
| --- | --- |
| Move | Summary |
| Motive |  |
| Objective |  |
| Results |  |
| Main conclusions |  |
| Implication |  |

1. Do you think the main conclusion and implication were related to each other?
2. How certain do you think the authors were about their main conclusion?
3. Identify the most essential figure or table, and justified their choice. Justify your answer.

**PART II. Data Analysis**

Instructor note: In-group of three students will analyze and describe the data using Excel or JAMP.

**Objective:**

On the completion of this activity, students will be able to

* **Organize and analyze** statistically data.
* **Create and describe** figure to present the results.

**Instruction:**

1. Organize the data that you can evaluate the data by region and worldwide.
2. What kind of basic statistics you can use to describe your data?
	1. e.g. Mean, Median, Mode, sample size, Range, Variance, Standard deviation, etc.
	2. Perform the descriptive statistics with the data.
3. In your own words, describe the data.
4. What possible graph or diagram can you use to present the data?
	1. Thinks about 2 possible graphs or diagrams.
	2. Show representation for the data by region and worldwide.
5. What kind of statistical test can you use to compare all the regions?
	1. Perform the statistical test with the data.
6. In your own words, describe the results of your test.
7. Base on your previous reading and the results in this activity, what are the possible consequences of the increment of carbon dioxide.
8. Are the data and results of this activity supporting the conclusions of the paper? Explain.
9. What areas or data collection will you suggest for future research?