

Final Project: Written Report



Plant the Moon & Plant Mars
CHALLENGES

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PTM Written Report Requirements

You have only just begun – Let's start thinking about the end!

- Make sure you don't wait until the last minute to complete the written report.
 - Have time for reworks & teacher review
 - Have students do rewrites and give feedback over the next few weeks
 - The more students review/revise work = increased quality of results
- The final report requirements vary based on the age group you have participating in PTM
- 4 different categories - Each level has very specific requirements
 - Elementary - page 37
 - Middle School – pages 38 – 39
 - High School – pages 40 – 41
- Use the PTM Guide, and review it with your students



Where to Start?

Familiarize yourself with APA-7 Format

APA-7 is the format most used by professionals for setting up the formatting parameters for a scientific paper.

Title page

Margins

Tables / Charts

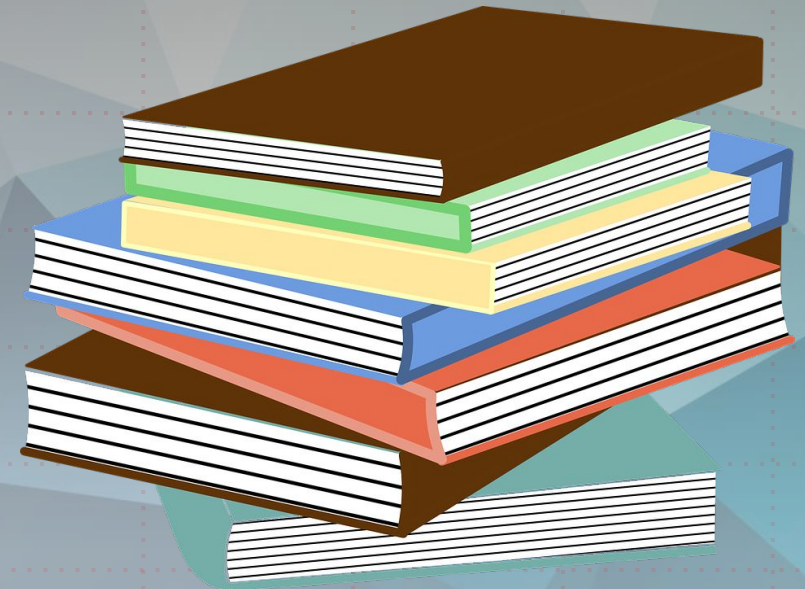
Spacing

Font

Citations / References

Make citations easy using Citation Machine

- <https://www.citationmachine.net/>



Sources

Use primary sources not secondary

A **primary** source is an original object or document, first-hand information or raw material.

A **secondary** source is something written about a primary source.

- As a rule of thumb, any source that interprets, reviews, analyses or discusses any kind of data or information, can be considered a secondary source.

No
Wikipedia

PRIMARY LITERATURE



- Original research and/or new scientific discoveries

- Immediate results of research activities
- Often includes analysis of data collected in the field or laboratory

EXAMPLES:

- Original research published as articles in peer-reviewed journals.
- Dissertations
- Technical reports
- Conference proceedings

SECONDARY LITERATURE

- Summarizes and synthesizes primary literature
- Usually broader and less current than primary literature



EXAMPLES:

- Literature review articles
- Books

Since most information sources in the secondary literature contain extensive bibliographies, they can be useful for finding more information on a topic

TERTIARY LITERATURE

- Summaries or condensed versions of materials
- Usually with references to primary or secondary sources
- Good place to look up facts or get a general overview of a subject

EXAMPLES:

- Textbooks
- Dictionaries
- Encyclopedias
- Handbooks



Scientific Paper Best Practices

Review the rubric and understand what information is required

Be Specific – Make sure you are clear in what you are writing about, and it is in the correct section.

Avoid repeating the same information over and over

Watch your word / page count – Make sure you meet requirements with quality writing, not a paragraph with nonsense – see above.

Avoid Personal Pronouns – Personal pronouns are generally avoided in scientific writing. I have included a chart for your review.

Personal pronouns represent people or things.

	subjective	objective	possessive	reflexive
singular	I	me	my mine	myself
	you	you	your yours	yourself
	he	him	his	himself
	she	her	her hers	herself
plural	it	it	its not used	itself
	we	us	our ours	ourselves
	you	you	your yours	yourselves
	they	them	their theirs	themselves

Parts of a Scientific Paper

- The PTM Final Project requirements align with a traditional scientific paper.

These sections
you can start
now!

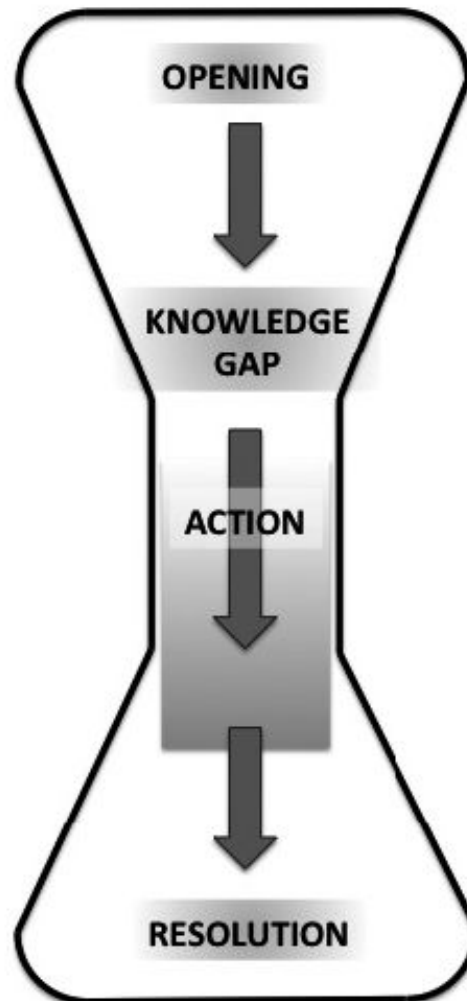
BACKGROUND &
EXPERIMENTAL
DESIGN

QUESTION &
HYPOTHESIS

EXPERIMENT &
PROCEDURES

RESULTS

ANALYSIS &
CONCLUSIONS



INTRODUCTION

*INTRODUCE RELEVANT LITERATURE
EXPLAIN WHY YOUR STUDY IS NOVEL
HYPOTHESIS*

MATERIALS AND METHODS

*INTRODUCE STUDY SYSTEM
EXPLAIN METHODS SUCH THAT A READER
COULD RECREATE YOUR STUDY*

RESULTS

*OBJECTIVELY STATE FINDINGS
FOCUS ON BIOLOGICAL RESULTS
USING STATISTICS FOR SUPPORT*

DISCUSSION

*INTERPRET YOUR RESULTS
TIE YOUR RESULTS BACK TO THE LITERATURE
BY ANSWERING THE KNOWLEDGE GAP*

CONCLUSIONS AND IMPLICATIONS

So where do we
start? What can
we write now?
How to prepare
for the final
submission?

Introduction & Hypothesis

The Good News - The introduction can be built off of the initial experimental design.

- Students can be working on this section now
 - Writing
 - Hypothesis
 - Investigating journal articles / primary sources
 - Rewriting for concision and clarity

TABLE 1. Constructing a hypothesis.

A hypothesis is a testable explanation of an observed occurrence in nature, or, more specifically, *why* something you observed is occurring. Hypotheses relate directly to research questions, are written in the present tense, and can be tested through observation or experimentation. Although the terms “hypothesis” and “prediction” are often incorrectly used interchangeably, they refer to different but complementary concepts. A hypothesis attempts to explain the *mechanism* underlying a pattern, while a prediction states an expectation regarding the results. While challenging to construct, hypotheses provide powerful tools for structuring research, generating specific predictions, and designing experiments.

Example:

Observation: Brown-headed cowbird nestlings refrain from ejecting host offspring from the nest even though those offspring compete for limited parental resources.

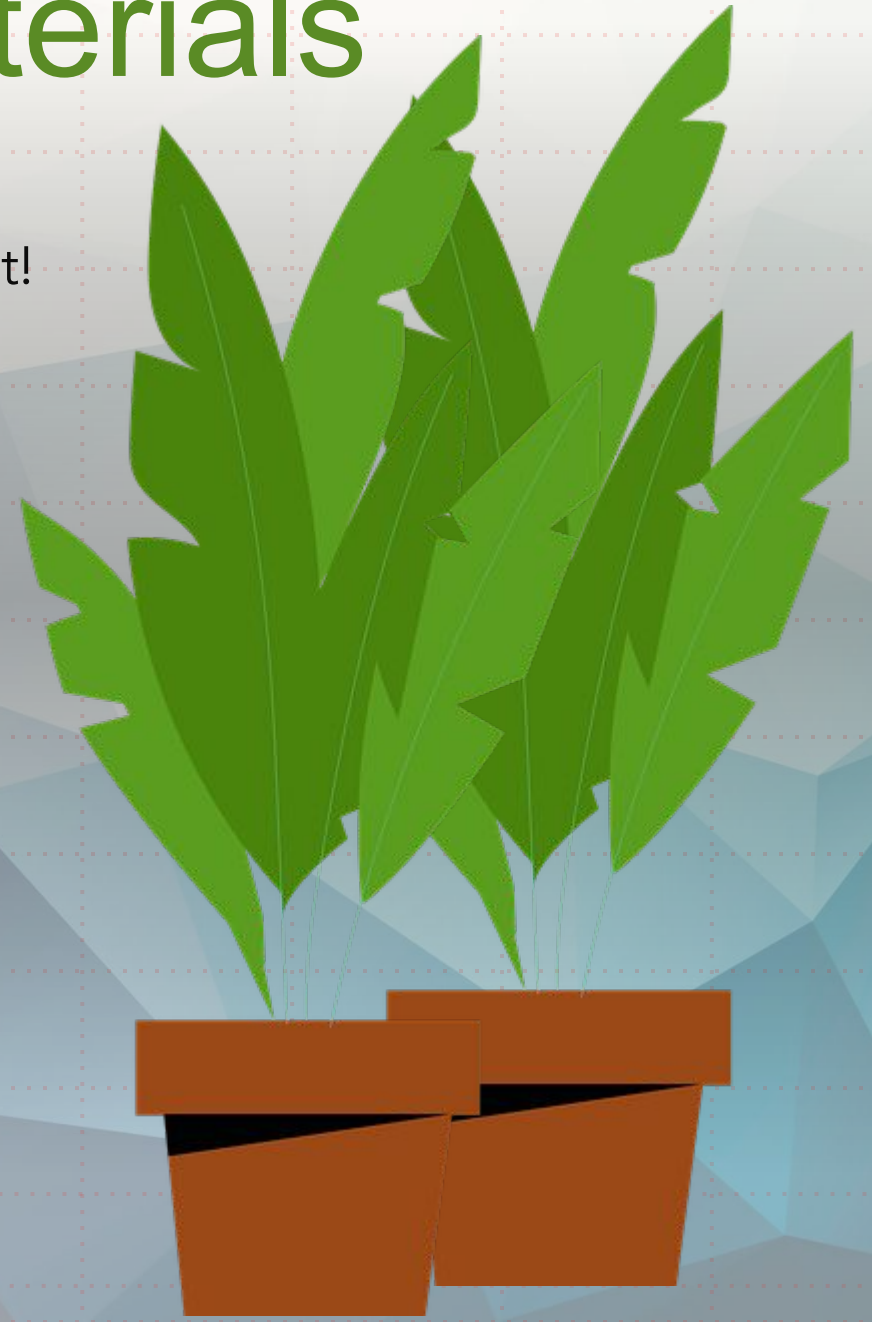
Research question: Why do nestling cowbirds tolerate the presence of host offspring in the nest?

Hypothesis: The presence of host offspring causes parents to bring more food to the nest.

Prediction: Cowbird nestlings will grow at a faster rate in nests that contain host offspring.

Methods and Materials

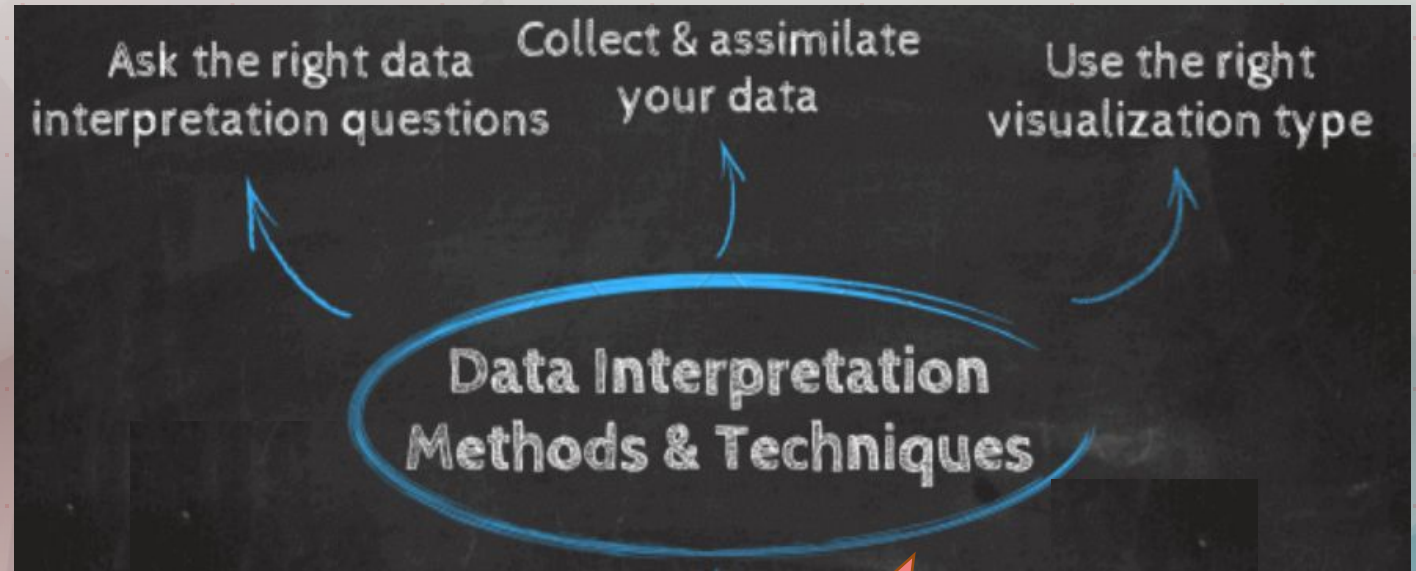
- A highly detailed description of what you did and how you did it!
 - This is very important for repeatability
 - Should be written in the past-tense
 - No personal pronouns
 - This is a great time in the competition to write this section
 - Most of the work is completed
 - Everything is fresh in their mind
 - As new steps are performed it is easily updated
- Don't forget about the data collection
 - how you will collect the data is part of the methods and materials
- Rewrite, Rewrite, Rewrite...



Data Collection

Data Analysis Prep

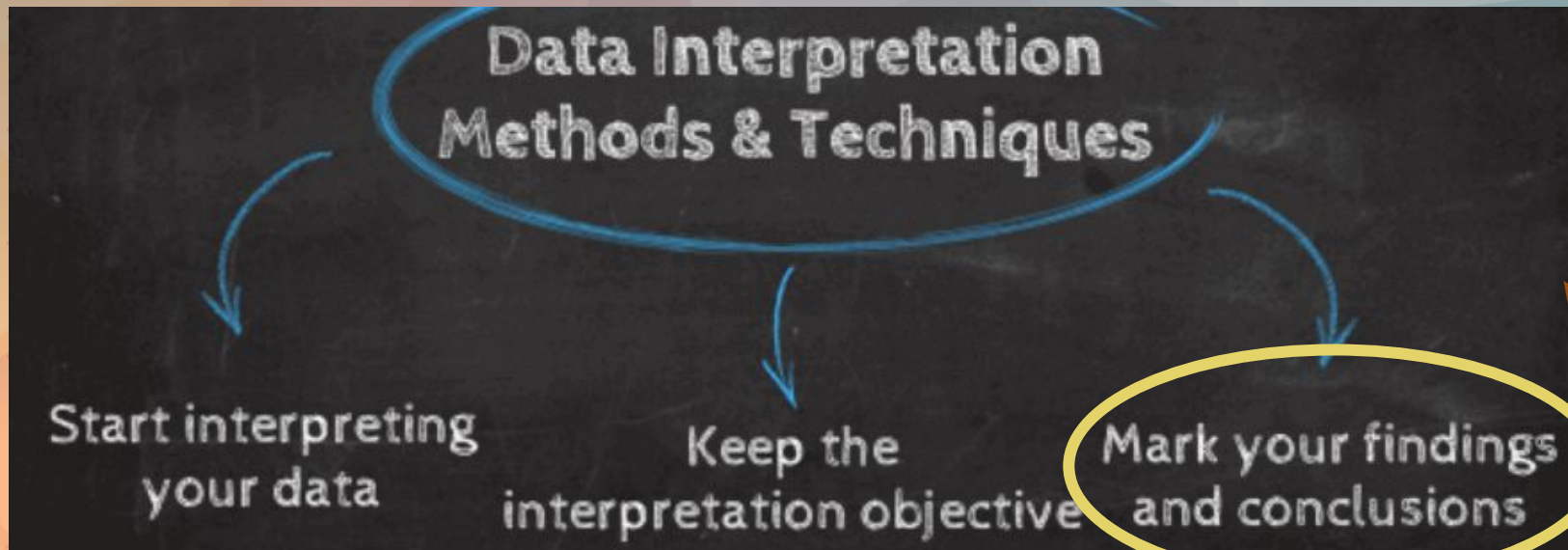
- Make sure you are collecting the right data and multiple kids know how to collect data.
- Data needs to be collected when most appropriate, not the school schedule.
- Have students make a paper copy of data collection protocol (and watering protocols) and leave it with the plants.
- Start laying the foundation for the statistics that will have to be performed
 - Do your students know how to use google sheets to analyze data?
 - Does your school have access to stat or math programs? Data Classroom?
 - Do your students know or understand which test would be the best statistical test?



Now Is The Time

Results

- Some data are collected during the 8 weeks.
- Some are collected at the end of the growth period.
 - Present the data (no interpretation – save for discussion)
 - Keep the analysis objective (pure)
 - make sure the analysis is appropriate
 - Lay the framework for the discussion



Put in the
Conclusion

Conclusion

- Do not simply summarize the points already made in the body
- Interpret your findings at a higher level of abstraction.
 - Show whether, or to what extent, you have succeeded in addressing the need stated in the intro.

Use the C.S.I. Method (Claim, Support, and Interpret)

- Make a claim
- Support your claim with the data
- Interpret the data and how or why it supports (or does not support) your claim.
- Connect your claim to independent research, documented with citations.



In-text Citations

- Cite everything appropriately with intext citations (see example below)

It's better to have too much cited, than not enough.

Do not use direct quotes - if it paraphrased in your words (a summary of what the author said).

1) Place direct quotes within quotation marks.

"The systematic development of literacy and schooling meant a new division in society, between the educated and the uneducated" (Cook-Gumperz, 1986, p. 27).

4) Place the period AFTER the citation.

2) Use parentheses to enclose the in-text citation.

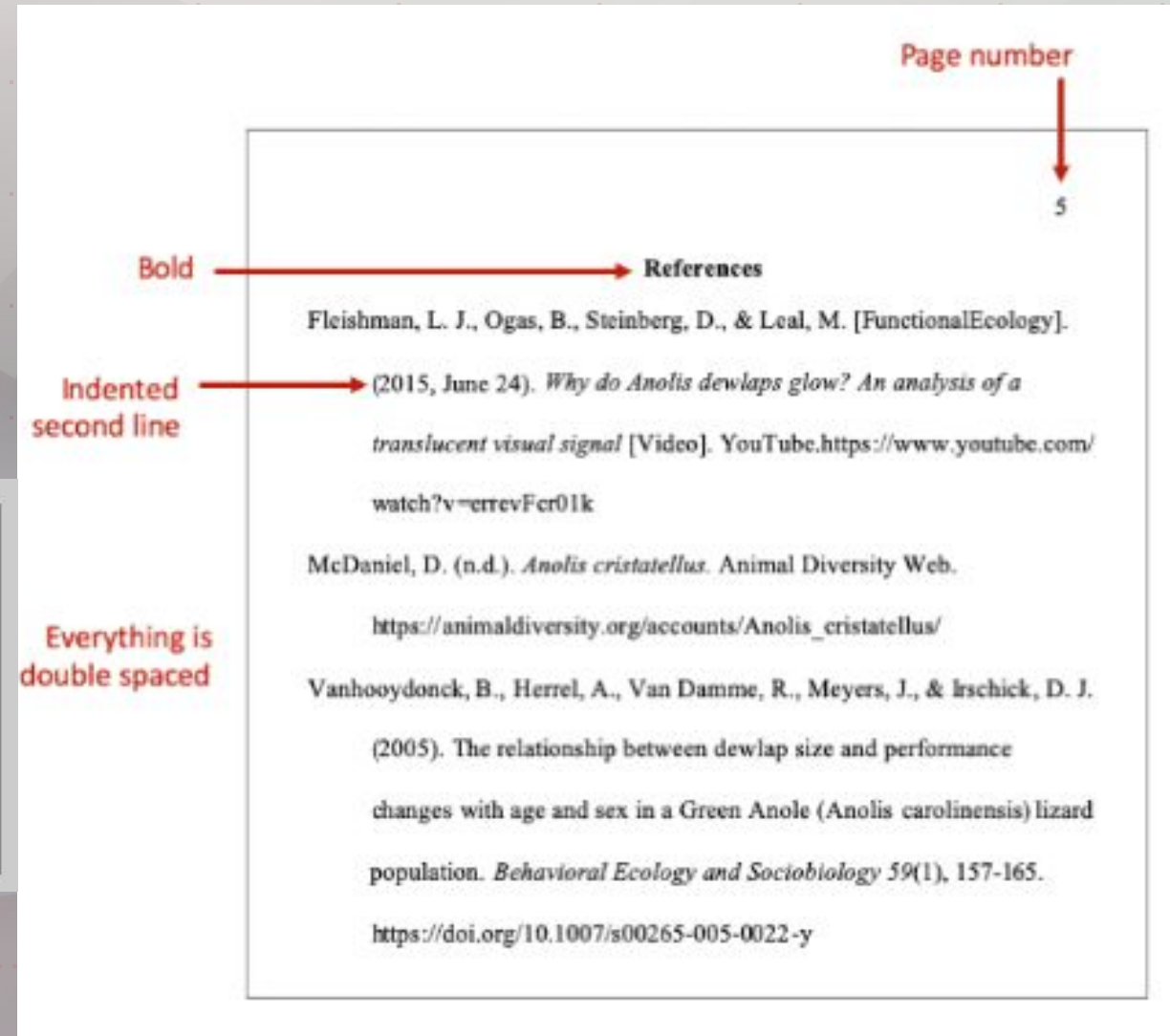
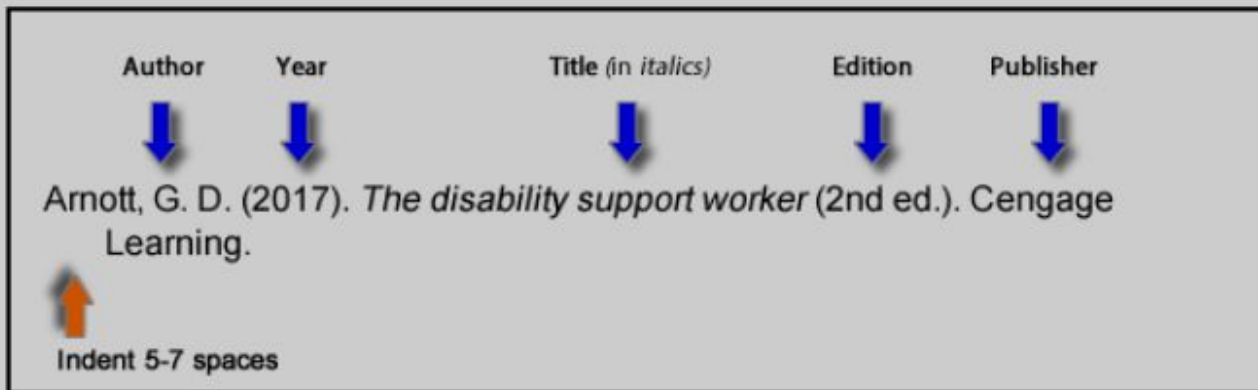
3) Use commas to separate the last name, year, and page number.

Make citations easy using Citation Machine
- <https://www.citationmachine.net/>

Citations / References

Cite everything appropriately

- Intext citations should match the citations on the reference page.
- They should be alphabetized by author's last name
-



Questions – email me amy.goodyear@lcps.org

Resources

- APA-7 Student Guide <https://acrobat.adobe.com/link/review?uri=urn:aaid:scds:US:36b492ce-e3a>
- Citation Machine Website - <https://www.citationmachine.net/>
- How to write a scientific paper - <https://acrobat.adobe.com/link/review?uri=urn:aaid:scds:US:efefbc64-2531-398d-9112-540ff718f1e7>
- Statistics for Biology experiments - <https://acrobat.adobe.com/link/review?uri=urn:aaid:scds:US:b42e14a2-f371-340d-985e-d7e25426d92b>
- HHMI Bio-interactive Statistics - <https://www.biointeractive.org/professional-learning/educator-voices/using-hhmi-mathematics-and-statistics-biology-guide-classroom>
- HHMI Spreadsheet tutorials –
 - Tutorial 1 - <https://www.biointeractive.org/classroom-resources/spreadsheet-tutorial-1-formulae-functions-and-averages>
 - Tutorial 2 - <https://www.biointeractive.org/classroom-resources/spreadsheet-tutorial-2-autofill-data-cell-references-and-standard-deviation>
 - Tutorial 3 - <https://www.biointeractive.org/classroom-resources/spreadsheet-tutorial-3-column-graphs-error-bars-and-standard-error-mean>
 - Tutorial 4 - <https://www.biointeractive.org/classroom-resources/spreadsheet-tutorial-4-ttest>
 - Tutorial 5 - <https://www.biointeractive.org/classroom-resources/spreadsheet-tutorial-5-histogram>