

A RESEARCH PAPER SCORING RUBRIC EXAMPLE

Student _____

Sources: R. Pavlica (2001); APA Publications Manual (2010); Society for Science and the Public (2018); D. Keith (2011-2018)

STUDENT TEACHER

Fundamental Paper Structure

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- Name your doc file "**LASTNAME.FIRSTNAME.AREACODE**" (the area code of your own phone number)
- Your default format should be an adaptation of the **American Psychological Association (APA)** style
- **Do ask your mentor** if your discipline preferentially uses another style, and if your mentor prefers that you use it, then you can **defer to your mentor**. You will need to learn that style so ask for a sample paper or two.
- **Four alternatives** to APA style:
 - AIP (American Institute of Physics)
 - ACS (American Chemical Society)
 - AMA (American Medical Association)
 - AMS (American Mathematical Society)
- Links to other styles can be found at: <https://subjectguides.library.american.edu/c.php?g=175008&p=2628912>
- For STS, **set 1" margins** (NOT 1.25"), **12 pt TNR font**, **1.5 line spacing** (reduce to 11pt only if needed)
- **Insert page # and date of draft at lower right in footer** (remove draft date before submitting to STS)
- Use multiple **APA style tiered headings** (Google: "Owl Purdue APA headings") to organize your paper
- **Use no photos of people** (including yourself) unless they are from your data set and necessary
- **Generally, use the passive voice**. Exception: if the 1st person plural [I, we] is used in peer-reviewed papers in your discipline, you should definitely take advantage of this to showcase important contributions. This helps judges to discern what you were personally responsible for in the project, which is critically important.
- **2MB limit** for the final paper. Use Photoshop, etc., to reduce each photo/figure size to 75-150KB maximum.
- **Limited to 20 Pages**, less title page, abstract, and bibliography/references - its okay to exceed this limit initially
- **Proof** for grammar, spelling, and context (this is very important - do the sentences make sense in order?)
- **Your teacher should not find a single spelling/grammar error**, so get help from a trusted friend if this is not your strong suit. Just one error (e.g., effect vs. affect, or insignificant vs. non-significant) can lose the respect of your reader (and disqualify your work in the eyes of a judge).

Review of Literature (ROL)

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- The words "Review of Literature" or "Introduction" form a **Tier One** heading (see Table 1 on last page)
- A strong ROL is typically **five to fifteen concise paragraphs** in length
- Each paragraph expresses **only one main idea or concept**
- Each paragraph contains **one or multiple appropriate citations** from peer-reviewed literature
- You need to **cite and document all sources** that you have consulted, even if you present the ideas in your own words; you do not have to cite "common knowledge" in the field (e.g., you should not cite a fundamental physics equation, or a biological process taught in every college biology class). See Table 1 (last page) for examples.
- The paragraphs must form a **logical sequential funnel** from the most general relevant idea/concept to the most specific. The ROL leads the reader directly to the Objectives and Hypothesis(es) - it has no other function.
- **Avoid any teaching** in your writing. It can appear condescending to your reader.
- The ROL must include **only what is necessary** for understanding the context of your project
- Overview of the research problem **is defined early** in the ROL
- Uses multiple cites for emphasis on key ideas. Example: (Finkleheimer, 2014; Schnikelfritz, 2018; Jones, 2017)
- The funnel must demonstrate a **credible "critical mass"** of citation to support the research hypothesis(es)
- The ROL should be fundamentally understandable by the **informed** lay reader while being directed towards the professional audience. It is to be **written at the university level**

Objectives

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- The word "Objectives" forms a **Tier One** heading
- Objectives are the **key tasks** that you intend to accomplish (e.g., "Create a statistical model that will...")
- Objectives are helpful but not required. Some engineering papers use objectives in lieu of a hypothesis(es)
- Objectives are pithy and usually **numbered** (not lettered and not written in prose)
- Each term in the objectives must have been **referenced in some manner in the ROL** for continuity
- Objectives can also be **referred back to** in the discussion and/or conclusion to reinforce validity

Hypothesis(es)

5

- The word “Hypothesis” forms a **Tier One** heading
- It should be stated in proper form (H_1 , H_2 , etc.) with a null (H_0), when appropriate
- The hypothesis(es) logically and directly **follow from the end of the ROL**
- The hypothesis(es) **must** be stated in a manner that can be **tested**
- Engineering projects do not always have a testable hypothesis, and use some form of objectives instead
- Include the **null** if appropriate. The null hypothesis states that there is no statistical difference between the population groups that isn’t caused by random fluctuations
- Each term in hypothesis(es) **has to have been referenced in the ROL**

Methods

10

- The word “Methods” forms a **Tier One** heading
- The methods section is a **succinct, prose description** of the methodology designed to show **reproducibility**
- The methods section is generally written in **past tense**
- It must include sufficient detail for **complete replication** of the experiment, however: All standard lab techniques should simply be named as such. E.g., there is no need to describe all the steps of PCR or electrophoresis.
- Write your methods in **passive voice** (the subject of the sentence is acted on by the verb. For example instead of “The pitcher threw the ball,” the passive voice would state “The ball was thrown by the pitcher.”
- Exception to the above: **Use first person for key personal contributions** and where appropriate to the discipline
- Flow charts, figures, and photos are used to **help the reader** where needed
- **Substances, quantities, dilutions, surveys, and the like**, are **described**, in the style customary for the discipline
- There is no need to include a full survey, but sample questions can be most helpful to your reader
- **Does not get bogged down in details**. Simply say you used a 1 Molar solution; you do not need to describe how to make a 1 Molar solution. If you used the same method as another researcher, cite their paper and simply state what changes you made to their protocol, if any.
- Cite **all important equipment**: E.g., “A flow cytometer (Model 34, Beckman-Coulter) was utilized...”
- Clearly and completely **differentiate between work done by you and work you had assistance with**. You would not do this in a peer-reviewed journal article, but this is a high school paper - the form absolutely requires this.
- Clearly & accurately delineate and highlight **unique contributions** made by you wherever appropriate

Results

15

- The word “Results” forms a **Tier One** heading
- If you copy a table or figure verbatim from a source, write **“Reprinted from...”** in the caption. If you alter it in any significant way, write **“Adapted from...”**
- **Tables** are always captioned **above** the table. They are referenced in-text **before** the table appears, at the end of the relevant sentence like this: **(see Table 2)**. Or, in a sentence like this: **“As seen in Table 2, BMI increased an average of 14% over time...”**
- Left justify the table title above the table, in 10 pt. font, in the format below (the bold and colored font are just used here for clarity - you should use black and not bold). Note where italics and punctuation are used:

Table 2

BMI at Time One and Time Two (Reprinted from NIH, 2014)

- Significant data ($\alpha = 0.05$) **should have an asterisk** next to the number. Use more asterisks for lower values of alpha (e.g., if $\alpha = 0.01$ use two, if $\alpha = 0.001$ use three)
- The meaning of the asterisks is placed as a **note below the table**, left justified: “Note. * $p < .05$. *** $p < .001$.”
- Figures include **maps, graphs, charts, drawings, and photographs**
- **Figures** are captioned **below** and referenced in-text **before** the figure appears, at the end of the relevant sentence like this: **(see Figure 2)**. Or, in the sentence like this: **“Figure 2 shows the correlation of...”**
- Left justify the figure title in 10 pt. font, in the format below. Note where italics and punctuation are used:

Figure 4. Correlation of response rate to dosage (Adapted from NIH, 2014).

Results (continued)

- If you created the figure in its entirety, **cite yourself in the figure caption**: (“Figure by student author”)
- Each figure can have a caption explaining briefly **what your reader should observe**. Be kind to your reader
- **Equations** are double-spaced above **and** below and centered L-R, with the equation # at R margin like this:

$$F_{\text{net}} = mv^2 (a^3 b^3) \quad (1)$$

- **All data is to be summarized in tabular and figure form** (this is mandatory)
- **Key results must ALSO be described in textual (prose) form** in addition to tables and charts (this is mandatory)
- Tables and figures **must stay within the 1" margins** of the page
- **Graphs have keys** and are **sufficiently large** to be kind to your reader - help your reader to rapidly understand
- Results are **free of any and all conjecture** and interpretation - absolutely **no opinions** are allowed here
- Results must be pithy, concise, and clear to the reader

Discussion

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- The word “Discussion” forms a **Tier One** heading
- The discussion interprets the data shown in the results **and explains their relevance** to your hypothesis(es)
- Here it is desirable to provide **logical opinion** (the immediate picture, the bigger picture)
- Discussion can effectively be **organized by your objectives and/or hypothesis(es)**
- Always refer back to your hypothesis(es). **Each hypothesis must be supported or refuted** in the discussion. E.g., “For our first hypothesis that...we reject the null in favor of...”
- Engineering projects without a hypothesis can **refer back to objective**. This provides the reader with continuity.
- Limitations of the study are discussed **without apology** (do not use “Unfortunately...”, “However...”, etc.)
- **Include relevant failures and challenges** (think “Thomas Edison”), and how you dealt with them. This is sometimes done in peer-reviewed journals but it is very important in a high school submission.
- If you truly found something new, **check with your mentor first** and then say so: “We report a novel finding,” or “This result is heretofore unreported in the literature.”
- Finally, the **application** of what was learned should be discussed. **How can science now generalize** from what was learned from your study

Conclusion

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- The word “Conclusion” is given a **Tier One** heading
- Restate your thesis **and** summarizes your main points of evidence. **Include all novel discoveries**.
- Mention important future research - but only if it is relevant
- If you plan on **continuing the research**, that should be noted here, but only if you really are
- The conclusion is typically no more than two paragraphs
- Imagine that the reader has come to the conclusion section **without reading your paper**. Will they understand the importance and relevance? Does the section convey the BIG BANG of the work? **It must do so!**

References

- The word “References” is given a **Tier One** heading
- Complete references should be provided in **APA format** unless you have chosen a different format with your mentor
- Use 1.5-line spacing throughout
- Example (retrieved from owl.purdue.edu):

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Cummings, J. N., Butler, B., & Kraut, R. (2002). The quality of online social relationships. *Communications of the ACM*, 45(7), 103-108.

TOTAL PAPER SCORE

_____ 100 _____

Table 1

Examples of in-text citations (APA, 2010)

| Type of citation | First citation in text | Subsequent citations in text | Parentetical format, first citation in text | Parentetical format, subsequent citations in text |
|---|--|---------------------------------|--|---|
| One work by 1 author | Walker (2007) | Walker (2007) | (Walker, 2007) | (Walker, 2007) |
| One work by 2 authors | Walker and Allen (2004) | Walker and Allen (2004) | (Walker & Allen, 2004) | (Walker & Allen, 2004) |
| One work by 3 authors | Bradley, Ramirez, and Soo (1999) | Bradley et al. (1999) | (Bradley, Ramirez, & Soo, 1999) | (Bradley et al., 1999) |
| One work by 4 authors | Bradley, Ramirez, Soo, and Walsh (2006) | Bradley et al. (2006) | (Bradley, Ramirez, Soo, & Walsh, 2006) | (Bradley et al., 2006) |
| One work by 5 authors | Walker, Allen, Bradley, Ramirez, and Soo (2008) | Walker et al. (2008) | (Walker, Allen, Bradley, Ramirez, & Soo 2008) | (Walker et al., 2008) |
| One work by 6 or more authors | Wasserstein et al. (2005) | Wasserstein et al. (2005) | (Wasserstein et al., 2005) | (Wasserstein et al., 2005) |
| Groups (readily identified through abbreviation) as authors | National Institute of Mental Health (NIMH, 2003) | NIMH (2003) | (National Institute of Mental Health [NIMH], 2003) | (NIMH, 2003) |
| Groups (no abbreviation) as authors | University of Pittsburgh (2005) | University of Pittsburgh (2005) | (University of Pittsburgh, 2005) | University of Pittsburgh, (2005) |

HELPFUL USAGE TIPS (BEING KIND TO YOUR READER)

~Avoid the use of “unfortunately” or “however” in your paper, unless either word clearly works in your favor. Students often use an apologetic tone when describing results that were not desired. This actually reduces the effectiveness of your writing. Let the science be what it is. Let it speak for itself.

~Use phrases such as “in other words...”, “this is important because...”, “notice that...”, etc., to help your reader recognize key points

~Use “if” when you mean “if this, then that”; use “whether” when you mean “whether or not”

~Know the difference between **effect** (noun), effect (verb), affect (verb) and affect (noun - used in psychology as in, “He had an unusual affect.”)

~Use “i.e.” when you mean “that is to say” and use “e.g.” when you mean “for example”

~The word “irregardless” is informal and should not be used. Use “regardless.”

~Insignificant and non-significant are entirely different concepts. Don’t interchange them.

~In American English, the period and comma belong inside the parentheses (“I asked him for the car.”)

~The phrase “heretofore unreported in the literature” is powerful. Be REALLY sure that you are correct.

FEELING OVERWHELMED? WHAT TO DO FOR YOUR NEXT EDIT

If you feel stressed because your paper needs a lot of work, choose only *ONE* area of the paper that seems in need of improvement (e.g., spelling and grammar, tables and figures, interpreting the statistics, etc.). Focus on that area for your next draft. Approach the paper the same way you probably approached conducting your research: pay attention to the details one step at a time. Remember, there exists a finite number of parts to a successful research paper. If you tackle one part or issue at a time, you WILL get to the finish line!