

Simple Studies: AP Research Study Guide

Step 1: Pick a Research Topic

- ★ Before making a research question, you must find a viable and specific topic that is creative and interesting.
 - Once you find this topic, create a “What/Why/In Order To Statement”
 - A “WWIOT Statement” that exceeds the rubric is one that identifies a focused topic in a proper scope, an insightful question, and a valuable “so what” that targets their specific discipline.
- ★ After your WWIOT Statement, create your Problem Statement.
 - This is when you contextualize your topic, introduce a problem, and insert a question that needs to be answered.
- ★ Begin contemplating research questions in the summer for a head-start
- ★ Start by brainstorming ideas that you are truly passionate about, but keep in mind that your school may be on a tight budget with limited resources
 - It helps to communicate with your AP Research teacher (or other school staff) to inquire about the budget and resource constraints!
- ★ Some teachers recommend staying away from human studies (Ex. Effect of sleep on GPA) because it leaves a lot of room for inaccuracy and incomplete results; however, this DOES NOT mean they are out of bounds.
- ★ Question must not be too broad or too specific
 - “How does plastic affect the environment?” is too broad
 - “Do punctuation marks improve one’s grammar in writing?” is too narrow
 - “How does the growth of *E. coli* affect a specific yeast?” is viable
- ★ Question must be testable; ensure that you can design and conduct an experiment to answer a question that fills a gap and brings value to a certain community
 - “What is the most popular sport in your school?” is not viable because it does not address an issue or solve a problem
 - “What is lactic acid?” is not viable either because it can be answered with a simple Google search

- “How does the yeast *S. boulardii* affect the growth of *E. coli*?” is viable because an experiment can be conducted to answer the question and possibly fill a gap in the scientific community
- ★ Make sure to conduct sufficient background research before deciding on a question to ensure that the question has not been fully answered already AND brings valuable insight to further a purpose
 - Try to stay away from blogs, magazines, and simple Wiki search pages when conducting background research; these can often be opinion-based or even inaccurate
- ★ Having one or two back up questions (that follow the above criteria and steps) will never hurt; most students go through several questions before they are able to finalize one.

Step 2: Finalize Materials, Methods, and Budget

- ★ This is a crucial step as many students tend to get stuck here and are even sometimes sent back to the ‘drawing board’; **everything in this step is to be approved by your teacher**
- ★ In order for the research question to be approved, it must not only be testable in general, but also testable within your classroom or lab setting.
 - *This is where you must run it by your classroom teacher and actively communicate with them so that you can make necessary revisions to your question.
- ★ The methods used to answer the research question must be legitimate; in other words, you can not just make up a method sequence to find results as you are required to base it upon an expert in the field
 - Modifications can be made if you are changing a singular variable to fit the needs of your research purpose or budget/resource constraint.
- ★ It is to your advantage to keep track of ALL the materials that you will need for your experiment, including basic materials like rulers and tape; it is important to keep in mind that you will be sharing a lot of materials with your classmates!
 - Use a spreadsheet to note down the materials, make, cost, and quantity

- Your teacher is likely to come up with their own system so make sure to follow exactly what he/she asks for.
- ★ The back-up question(s) may come handy in this step in case your research question does not get approved for budgetary reasons
- ★ If everything works out well, you will be required to write a research proposal that thoroughly outlines the research question, the purpose of your project (including the gap it fills), the materials required, and the methods used; as long as you followed through with the previous steps accurately, the proposal should be a piece of cake (of course, follow the format that your teacher demands)

Step 3: Prepare a Calendar

- ★ Before you begin implementing your research methods, it is crucial that you create a timeline that is as specific as it can be.
 - Use a digital calendar application (like Google Calendar) to note down your daily tasks from the start to finish. Most teachers will let you know the approximate day or month they would like you to finish your inquiry methods, so use your calendar to divide the work as needed
 - Many experiments will have particular constraints or duration requirements that may hinder you from being as effective as you would like to be; for example, some procedures may take up the whole class period, while others may require an entire day of waiting before you can perform the procedure
 - Make sure to consider ALL pre-lab procedures and try to work before or after school and even during free periods IF the teacher gives you permission; this gives you time to manage any tasks that may require special attention
 - For example, preparing organism cultures takes time and in order to use it, you must prepare them a day before
 - Sterilizing materials also takes up at least a couple of hours, so make sure to get this out of the way before you plan to perform the lab
 - AP Research is extremely unique for every student, and the time it takes to finish the project differs depending upon the project

- Talk to your teacher for any special adjustments and create a calendar that reminds you of every little task that you need to do on an hourly basis!

Step 4: Follow through with Steps

- ★ This step is self-explanatory, but keep in mind that your calendar can drastically change once you put the inquiry methods into practice
- ★ Every student experiences some kind of setback at some point in their research process, whether this be a procedural revision or data inconclusivity; however, most students realize that all the theoretical steps from before may not entirely cooperate with the real-life circumstances at hand.
 - For example, a material shortage may cause a student to revise the number of trials they conduct.
 - An abrupt school closure may affect the feeding schedule of a student's research organism, causing it to die.
- ★ In any case, these setbacks should not be stressful to you as long as you are putting in your best effort in the steps that you have control over.
 - It should be noted that you have the chance to explain any unforeseen circumstances in your paper, given that they affect your experimental design and/or results.

Step 5: Start (or Continue) Writing Research Paper

- ★ It is always recommended to start early. The first few sections of your research paper (introduction, literature review, purpose, materials and methods) can be written before implementing your research methods.
 - The first few sections are simply an elaboration of your research proposal, so you already have an outline at your disposal
- ★ You do not always have to wait until you have completely finished your experiment to write beyond the ‘materials and methods’ section of your paper
 - At some point during your data collection, you may begin to see patterns or trends that are consistent throughout your trials. Your results are likely to stay the same for the rest of the project, so you begin to use these results and finish writing the rest of the paper (conclusion, limitations, implications, etc.)
 - Of course, if you see inconsistency with your results then you should wait until all results have been obtained
 - *See later section for writing tips!

Step 6: Put together Presentation

- ★ You will feel a lot less overwhelmed if you begin putting the presentation slides (and writing a script down) as you write your paper and continue with your experiment
- ★ Research timelines can only give you a rough estimate of when you should complete your tasks; unforeseen circumstances usually always push your project back a little (and that’s okay!), so it would be to your benefit to work on your presentation and paper **ALONGSIDE** your experiment--not after!

Step 7: Rehearse and Finalize

- ★ Congratulations on getting to the very final step! Of course, this last part is just as important as the others because you absolutely must look over your work and polish your paper and presentation.

- Although you should already have looked at your rubric, this is the part where you must make sure you understand what is being asked of you and making sure you have included everything that you need
 - *breakdown of rubric will be shown in following sections

How to write the paper

1. The BEST way to ensure that you have covered all the important sections needed by the rubric is to follow a logical structure of a typical scientific paper. This usually consists of:
 - **Introduction:** introduce the context around your research topic and make it relevant so that you make clear that your topic isn't random but instead, actually plays an important role in the topic area/community
 - **Literature Review:** include the varying perspectives that stakeholders in the topic of research hold. Describe and explain the existing body of research regarding the topic, and make clear of what gap you intend to fill with your experiment in this area
 - **Hypothesis:** based on your literature review, why do you predict the results that you do?
 - **Materials and Methods:** make sure to include the specific paper from which you derived your method (this provides it legitimacy) and justify *why* you chose the method that you did and any changes that you made to the procedure from which you took inspiration.
 - **Results:** use relevant data tables, bar graphs, charts, and images from your experiment and convey the significance/insignificance of your results
 - **Conclusion/Discussion:** explain what your results mean and how they may possibly make a difference/impact in your field of study
 - **Limitations:** describe and explain possible barriers to the validity of your research; this can be regarding budget, supplies, unforeseen circumstances, lack of significance of data, etc., and why you were not able to control/help these limitations
 - **Implications:** explain the ultimate impact of your research study in its field and how it changes/influences/validates/negates something of significance

- **Future Research/Steps:** discuss the possible next steps that can be taken as a result of the implications of your study. If there is some inconclusiveness, what can be done to solidify your research? If your research disproves something, how can this be explained?
 - **References:** citations are part of the rubric! Make sure you follow a consistent style (either APA or MLA throughout)
2. Peer-editing is a life-saver in AP Research because your class teacher is not allowed to help you with any part of your research process besides grading and technical responsibilities; your classmates know the rubric just as much as you do (maybe more or less), so they are the best critics besides your teacher
 3. It is extremely important to maintain a decent writing style, and this includes the vocabulary, grammar, and word choice in the paper
 - Maintain an academic writing style while ensuring that your vocabulary is catered to a lay-reader.
 - Your graders are not likely to spend time with a dictionary for every scientific word they come across, so make sure you either explain that fancy word in your paper
 - It is OKAY to have a couple grammatical errors in your paper, but if this is a consistent pattern throughout, then you can not expect to earn full points in that section of the rubric.
 4. Staying within the word count constraints is ideal for you; writing too less simply can not get you full credit while writing too much will end up annoying your grader (who probably has to grade hundreds of other papers in the same sitting!)
 5. It is not mandatory to put your research question in a specific place, but you absolutely must make your question clear to the grader and some point in your paper, preferably before you discuss your methods. Graders are not looking to play the guessing game and even though it may be clear to you what the question is, you can not expect the grader to infer the question; you are much better off stating your question explicitly.
 6. Incorrect formatting is not the end of the world, but it is still a good idea to ensure that you do not have any inconsistency with your formatting, whether this be with titles,

subtitles, headings, indentations, etc. A well-organized paper is simply easier to follow and doesn't instantly turn off the grader, so you have a better chance of impressing them!

➤ *How to create a presentation*

1. Creating a presentation is not at all a hard task once you organize your paper, as it follows a similar structure in a different format
 - Introduction/context of your research
 - Existing body of research
 - Hypothesis
 - Materials and methods
 - Results
 - Limitations
 - Implications
 - Future directions
2. Keep in mind that this is an academic presentation and must be created as such; your slides can obviously look attractive, but not to the point where it impedes the content of your presentation
 - Do not include images unless you will be explicitly mentioning/describing them in your presentation
3. It is a general rule to minimize the number of words on your slides; bullet points are recommended for the audience to follow your points alongside listening to what you have to say
4. The infographics that you add must not be complicated; the whole point of including them is to make it easy for your audience to comprehend your results, so include relevant labels for the axes and easily comprehensible graphs/charts/tables
5. Presentation skills are brownie points! If you are comfortable without a script and can confidently talk about your research project for 15 minutes, then that is awesome! However, it is still to anyone's advantage to make a pre-written script and/or bullet-point list so that you don't have to worry about on-the-spot talking/spacing out on the day of the presentation

6. It is very helpful to keep in mind that you are the only expert in your topic of research (in the room!), so you have every right to be confident while giving your presentation; own your presentation!

