Chief Reader Report on Student Responses:

2021 AP® Research Free-Response Questions

- Number of Students Scored: 24,021
- Number of Readers: 474
- Score Distribution:

Exam Score	N	%At
5	3,293	13.7
4	6,102	25.4
3	10,179	42.4
2	3,407	14.2
1	1,040	4.3

- Global Mean: 3.30

The following comments on the 2021 free-response questions for AP® Research were written by the Chief Reader, Gregory Taylor Ph.D., Associate Provost at Purchase College, SUNY. They give an overview of each free-response question and of how students performed on the question, including typical student errors. General comments regarding the skills and content that students frequently have the most problems with are included. Some suggestions for improving student preparation in these areas are also provided. Teachers are encouraged to attend a College Board workshop to learn strategies for improving student performance in specific areas.

Performance Task: Academic Paper **Topic:** Varies by student

Max. Points: 10 **Mean Score:** 6.24

What were students expected to demonstrate in this performance assessment task?

This performance task was intended to assess students' ability to conduct scholarly and responsible research and articulate an evidence-based argument that clearly communicates the conclusion, solution, or answer to their stated research question. More specifically, this performance task was intended to assess students' ability to:

- Generate a focused research question that is situated within or connected to a larger scholarly context or community;
- Explore relationships between and among multiple works representing multiple perspectives within the scholarly literature related to the topic of inquiry;
- Articulate what approach, method, or process they have chosen to use to address their research question, why they have chosen that approach to answering their question, and how they employed it;
- Develop and present their own argument, conclusion, or new understanding while acknowledging its limitations and discussing implications;
- Support their conclusion through the compilation, use, and synthesis of relevant and significant evidence generated by their research;
- Use organizational and design elements to effectively convey the paper's message;
- Consistently and accurately cite, attribute, and integrate the knowledge and work of others, while distinguishing between the student's voice and that of others;
- Generate a paper in which word choice and syntax enhance communication by adhering to established conventions of grammar, usage, and mechanics.

How well did students address the course content related to this performance assessment task? How well did students perform on the skills required on this performance assessment task?

NOTE: The holistic rubric focuses on the following italicized course proficiencies. The bulleted list below illustrates how students demonstrated **strengths** with these proficiencies. It is worth noting that a data comparison with Reader survey results from the 2020 AP Research Reading demonstrates remarkable consistency in students' ability to show that they have understood and are capable of realizing the basic expectations of the required 4000-5000-word research paper.

- Overall, most students continue to demonstrate familiarity with and an ability to realize the core expectations of the academic paper. Extensive student effort was evident in most papers. Most students also continue to demonstrate consistency in application of the course's skills vis-à-vis past Readings, regardless of discipline.
- In ***Understanding and Analyzing Context***, most students developed appropriately clear and narrow research questions or project goals that might reasonably be addressed by a first-year undergraduate researcher. Most students were able to situate their inquiry topic in relation to previous scholarly findings and arguments, and indeed this was a notable strength in this year's papers, as students were able to demonstrate this skill even more fully than in 2020. Most students identified a scholarly gap to be filled by the student's research. Many students organized their literature reviews in such a way as to clearly clarify the gap to be filled by the student's research.

- In ***Understanding and Analyzing Arguments***, most students continue to review scholarly literature relevant to their inquiry very effectively, and some students are particularly adept at this skill. Most students were able to critically analyze scholarly work, and most were able to summarize multiple perspectives within the relevant scholarly literature on their research question or topic of inquiry. Some students developed sophisticated literature reviews in which they placed relevant, scholarly sources into conversation with each other.

- In ***Evaluating Sources and Evidence***, students mostly drew upon credible and relevant sources in situating their question within a larger context and in developing their arguments while demonstrating an understanding of and fluency with scholarly sources.

- In ***Research Design***, most students demonstrated an understanding of the need for a systematic method or approach to their question in order to generate data to analyze. Many students were able to choose a research method clearly aligned with the student's specific research question and to explain why (or how) the chosen research method would address the student's research question. Many students were also able to follow the steps of the chosen method correctly and systematically and to provide enough detail about this method to suggest that process could be reasonably replicated. Most students indicated an understanding of different types of data (e.g., quantitative and qualitative) generated by different research methods. Some students were able to recognize and acknowledge the inherent limitations of a chosen method and of their own deployment of this method in conducting original research. Some students showed a clear understanding of ethical considerations, sample selection, and procedures for collecting data. Of those students who employed surveys as their research method, some convincingly demonstrated that surveys were an appropriate means of answering the research method, many employed questions (and response options) that aligned with the research question, and many sampled from an appropriate population given the research question or topic of inquiry.

- In ***Establishing* (Their Own) *Argument***, most students stated a clear argument or claim, and many students were able to recognize and acknowledge limitations in their own use of a chosen research method. Some students acknowledged the limitations of their ability to extrapolate conclusions from their evidence, and some were also able to recognize and acknowledge the limitations of these conclusions. Many were able to synthesize the results of their research to elaborate on a new understanding, and many were able to discuss the practical implications of the research findings. Some students discussed how the research findings expand upon or relate to what is already known in the discipline.

- In ***Selecting and Using Evidence***, most students provided evidence relevant to the topic of inquiry, and most were able to present evidence in a format that is typical of the discipline of inquiry. Most students clearly described how their research findings relate back to the research question, and most included tables, figures, or charts that effectively displayed key findings. Most students were able to support their conclusions using relevant and sufficient evidence from their own research. Many students were able to conduct appropriate statistical analyses, and many were able to describe statistical analyses correctly.

- In ***Engaging the Audience***, most students wrote in a style that was easily accessible to an educated, non-specialist reader, and most wrote in a manner that clearly communicated the student's ideas, and many wrote in a manner that enhanced reader engagement. Most students organized their papers in a manner that made it easy for the reader to follow the argument, the method/approach, and the examination of the evidence, and most clearly organized the paper's sections, headings, and visuals. Most were able to use organizational and/or design elements such as tables, figures, and charts effectively.

- In ***Applying Conventions***, most students followed the conventions of a discipline-specific style throughout their paper, and most adhered to established conventions of grammar usage and mechanics. Most consistently cited sources to support their arguments, many using appropriate citation style. Most students attended to ethical concerns relevant to the topic of inquiry or method of data collection.

What common student misconceptions or gaps in knowledge were seen on this question?

- Overall, students' ability to demonstrate fundamental research skills continues to improve every year, and most students seem familiar with task requirements as elaborated within the academic paper rubric. Mastery of more advanced skills, however, is less clearly evidenced in many papers, with (a) precise alignment of research method, (b) awareness of the context of the student's specific research question or project goal within the larger field of study, and (c) recognition of the limitations of various aspects of a particular question, method, body of evidence, and conclusion or new understanding, featuring among the higher-level skills that continue to challenge many Research students.

- In ***Understanding and Analyzing Context***, some students developed overly broad or exploratory topics, and some were not able to articulate clear or discernable research questions. Some students chose questions that were not practical, well-considered, scholarly, or appropriate to the student's level of expertise. Some students used hyperbole in discussing the importance of their topic or the novelty and significance of their findings. Some students employed multiple questions or changed their main question throughout the paper, making it difficult for them to focus their inquiry. Some students appeared to have retroactively formed their question after first deciding to embark upon a chosen method, such as a student survey on a current topic of interest. Many students asserted rather than demonstrated that a knowledge gap existed in the field of inquiry. Some students misrepresented the identified gap and/or used hyperbolic language when describing it, and many students identified a research gap not by locating it within the existing scholarly conversation but simply by noting that existing sources covered in their literature review did not address the specific narrow population or location convenient to the student's own inquiry process. More generally, many students seemed not to understand the point of identifying a gap within the field of inquiry fully, in assuming that identification of such a gap sufficiently justifies the importance or relevance of the research, rather than thinking more broadly about why certain questions might be worthy of deeper exploration in the first place.

- In ***Understanding and Analyzing Arguments***, some students did not firmly establish their research within a scholarly community, and some included only a minimal literature review or moved from an initial presentation of a research question or topic of inquiry to a description of method, omitting the literature review entirely. Some provided background information about the topic of inquiry rather than a review of the scholarly literature, while some discussed multiple works in their review of the literature but did not explicitly relate these works to one another or to their own argument or perspective.

- In ***Evaluating Sources and Evidence***, some students relied heavily on sources that were less than relevant or credible given the context of their inquiry, and some needed to devote more attention to sifting through evidence, excluding evidence that is less relevant to the research question. Some students neglected to include or discuss peer-reviewed, scholarly sources.

- In ***Research Design***, while most students clearly identified which method or approach they were using and most chose methods that were reasonably replicable, many did not convincingly defend that choice by addressing why it was most appropriately aligned to their particular research question. Many students seemed to have allowed their chosen method to drive their inquiry process, rather than having their choice of method flow from their narrowed research question or project goal. Some students seemed to choose an appropriate method for carrying out their research but failed to include sufficient detail in explaining their process in order to render their research replicable. Some students chose multiple methods (e.g., quantitative and qualitative) when a narrower approach might have served to answer the research question or address the topic of inquiry more convincingly. Some students did not seem well informed in rudimentary research methods or understand the range of methodologies open to them in carrying out their research.

Many students failed to deploy specific research methods correctly or convincingly, and many did not seem to understand the purpose and appropriately narrow application of content analysis, thematic analysis, and meta-analysis in particular. Many students employed the above methods incorrectly, as a means of extending their survey of existing literature into a paper-length discussion of published scholarship (without engaging the legitimate fields of historiography or meta-analysis of scholarship and criticism), rather than as a means of conducting original research.

Many students again employed surveys as a research method when it was not appropriate for answering their research question. Many students failed to establish a clear defense of the alignment of their survey method in relation to their research question convincingly and to explain why other possible methods would not have been better aligned. Many students insufficiently narrowed their survey questions in relation to their research question and research gap, and many papers were hindered by a sample size that was too small to render their conclusions generalizable or meaningful. Many students seemed insufficiently familiar with tools and methods of statistical analysis required to accurately analyze and draw conclusions from survey results. Most broadly, many students seemed to fall back on surveys as a convenient methodology to drive their research project, at times using opinion surveys of other students to address an overly broad question or topic of interest, and at times seemingly allowing their choice of a survey as a research method to drive (rather than inform) their inquiry process.

A few students who worked with human subjects did not indicate that they had pursued institutional review board (or human subjects research board) authorization, nor did they have sections in their papers that addressed ethical issues and explained how risks to subjects either had been minimized or avoided. Some students conducting surveys or interviews asked questions that were ethically problematic.

- In ***Establishing (Their Own) Argument***, many students failed to explain and defend their developing argument articulately through the course of the paper, and especially in their discussion of findings. Many were unable to generate data that sufficiently supported a new understanding, and many did not acknowledge that the conclusions or new understandings provided were insufficiently supported by evidence. Many discussions of conclusions and new understandings were hyperbolic, given the limitations of data and research (e.g., small sample size, insufficient data analyzed/coded). Many students provided a perfunctory or simplistic discussion of the limitations and implications of their research, and many students seemed to misunderstand that the type of limitations they should be focusing on stem from inherent limitations of a question, method, application of method, and generalizable conclusions, and not practical hindrances such as limited research time or limited access to equipment. Thus, as in past years, many students continue having difficulty with the more meta-cognitive dimensions of the academic paper task description, whether in elaborating on limitations of the current study and implications for future research or in tying their own research back to a conversation in the discipline.

- In ***Selecting and Using Evidence***, many papers that utilized surveys collected data from a convenient sample population or lacked enough responses to support a convincing argument. Many students seem to misunderstand the proper use of statistics and to misapply concepts such as mean value, standard deviation, and t-test. Many students made causal inferences based on correlational results, and many students insufficiently grasped the types of claims one can (and cannot) make with different types of research designs and different types of data. Many papers lacked scholarly sources, and many papers lacked sufficient scholarly sources to adequately support their argument. Some students seemed not to understand the differences between qualitative and quantitative data. Some students assumed the data would speak for itself or expected the reader to draw their own connections and conclusions, instead of explaining the meaning and significance of all presented data in relation to the research question or topic of inquiry, and clearly analyzing the data in a way that logically defended the new understanding.

- In ***Engaging the Audience***, some students overly relied on the convenience of auto-generated charts and graphs, especially those generated from Google Forms, and thus presented raw data at the expense of providing adequate summary information and enhancing the paper's effectiveness in communication. Some papers included graphs and charts that did not directly address answers to the research question, and some neglected to include other potentially helpful means of conveying information visually, such as comparison tables and figures. Some students did not label images, tables, graphs, or figures clearly or appropriately. A few students used images/figures but failed to describe or analyze them. A few students had issues with the organization of the paper. This made it difficult for the reader to follow the thread of the argument or the layout of the project design. A few students submitted papers/PDFs that were incomplete, missing pages, or in some other way were not final.

- In ***Applying Conventions***, some students inadequately considered or analyzed the ethical implications of their human subjects research. Many students did not properly cite and reference sources as per style guidelines, and some seemed to rely heavily on automated citation and reference generators. Some students cited non-scholarly sources, and many papers included only a few sources (e.g., two to four). Some students incorrectly formatted bibliographic information and in-text citations. A few students did not clearly differentiate between the voice of others and their own voice, and few students employed quotations or summaries of sources without integrating them into the paper in a cohesive way. Some students engaged in sloppy scholarship, though very few engaged in overt "cut and paste" plagiarism.

- In ***Applying Conventions,*** some students did not proofread their papers carefully and/or did not correct errors of grammar, style, or mechanics that interfered with communication. Some students submitted papers well over the 5000-word limit, detracting from clear and succinct communication of the student's ideas.

Based on your experience of student responses at the AP® Reading, what advice would you offer to teachers to help them improve the performance of their students on the exam?

- *Overall:* Teachers continue to do a wonderful job in helping students move from wrestling with the basics of systematic research to conducting original research using an explicit method or approach. Students have a good understanding of how to take the skills learned in AP Seminar and apply them in a substantively different way in AP Research. Teachers can help students facilitate this important skill transfer by continuing to emphasize how the writing, argumentation, and research tasks in AP Research differ from those in AP Seminar, thus requiring different strategies.

- *Rubric:* Establish a relationship with the rubric prior to teaching the course every school year. Require students to establish this same type of relationship. If students can use the rubric to help guide their thinking about published work and/or peers' projects, it will help them in making sure that their own projects meet the rubric's expectations. Have students score sample papers, or peers' papers, using the rubric so that they better understand the difference across scores, as well as the different components of each score. However, also make sure students understand that in order to achieve a particular holistic score, they must address the substance and not simply the terms of the rubric. In other words, they need to demonstrate that they understand the function and purpose of a required paper element (e.g., a "gap" in the existing literature), and are also able to apply it correctly and fruitfully, and that to achieve the related holistic score it is insufficient simply to mention the concept, or to assert that one has applied it rather than actually demonstrating that one has applied it.

- *Process:* Emphasize that research is a process, one that requires time, reflection, problem-solving, and revision. Teach students that the research process is a social and community-based endeavor, where researchers are in conversation with other scholars, and they can learn from each other's comments, ideas, and findings.

- *PReP:* Encourage students to use the Process and Reflection Portfolio (PReP) to document and reflect upon the process and to help stimulate their own creative thinking. Use the PReP to make that process visible, to prompt student reflection, and to enable you to provide both positive and constructive feedback.

- *Peers:* Encourage students to find peers to share ideas and drafts with. Utilize peer review early and often. This allows project development and writing to go through iterations, rather than be constructed in sections without revisiting them as students add to their papers. It also provides students with an opportunity to identify alignment issues early in the process. Peer review gives students valuable experience as presenters and as consumers of others' scholarly work. It also emphasizes the idea that research is an iterative and recursive process.

- *Expert advisors:* Encourage students to find expert advisors with whom to discuss their projects and to help students ensure they perform research appropriate to the field. Also encourage students to discuss their limitations/conclusions with an expert advisor. Readers noted that students who reported working with an expert advisor, particularly on methodology, performed better than students who did not.

- *Higher Education Institutions:* Reach out to nearby colleges or universities. This could help with understanding the importance of IRBs in addressing the challenges and risks of human subjects research, building relationships and research connections, and gaining access for students to start seeking access to databases or research librarians early in the process. They might also be good sources for expert advisers, oral defense panelists, and even venues for viewing or presenting student research.

- *Topics:* Encourage creative topics of study outside of the social sciences, especially in the humanities, arts, engineering, and technology, as the curriculum of AP Research is broad and comprehensive enough to accommodate work in multifarious disciplines. Remind students doing such projects that they need to be explicit about their method, approach, and process. Encourage students to read widely within their chosen area of interest before choosing their research question to narrow their topic more effectively and to more clearly identify whether and to what degree a gap in our understanding exists.

- *Research Questions:* Emphasize the importance of developing one explicit, precise, focused research question that is narrow enough to be studied within the scope of the project but broad enough to develop a new understanding. Doing so affects the rest of the research project, and thus is essential. Remind students that all elements of the research paper should relate to the research question and should speak back to their argument. Remind them to state their research question early and clearly to help the reader understand the direction and focus of the research project. Consider asking students to regularly update or reflect upon their research questions in their Process and Reflection Portfolios (PRePs).

- *Audience:* Remind students to write as if the audience for their papers is an intelligent, non-expert who does not know anything about this specific area. Remind students that as the author and researcher, it is their job to clearly convey what they did, why the approach they took is appropriate given the topic of inquiry, what they found, and what implications their conclusions have for our understanding of the question. It is not the reader's job to infer any of this from the paper; it's the student's job to be clear and explicit. Also remind students that there is no guarantee that their paper will be scored by an expert in that field, making it all the more important to write clearly and explicitly for an intelligent, non-expert audience.

- *Abstracts:* Remind students that abstracts are useful organizational tools but that they will not be scored as part of the paper. Have students verify that anything that appears in the abstract (if they choose to write one) also appears in the appropriate place in the body of the paper. Encourage students who want to write abstracts to do so after their papers are complete, and to do so as a summary of the paper, so that no new information, not already in the body of the paper, shows up in the abstract.

- *Introduction:* Emphasize revising the paper's introduction near the end of the research process to clearly identify the question that guides the project and to situate the question within a broader context. Remind students that introductions need to avoid broad generalizations and should also be informed by sources and evidence. Remind them that statements of fact or argument need to be cited, even in the introduction. Remind students that research yields new understanding incrementally, and credible researchers moderate their claims. This means that hyperbolic language regarding what they will do or what new understanding they have generated should be discouraged.

- *Scholarly Sources:* In order to build on what students learned in AP Seminar, review what constitutes scholarly sources and compare examples of scholarly and non-scholarly sources that address the same topic. Remind students that they should be including scholarly sources in their AP Research papers.

- *Literature Reviews & Establishing a "Gap":* Show students examples of literature reviews from published works or from previous years' student papers to help them understand how researchers review the literature in a way that suggests a debate or illustrates a gap in our understanding. Discuss the need to explicitly demonstrate that a gap in the literature exists, rather than just asserting it. Ensure that students understand that identifying a gap in the literature is not meant to justify a predetermined convenient research method, such as a survey of classmates. Remind students that the existence of a gap in the field of inquiry does not in itself render a related research question interesting or worthy of in-depth study. Encourage students to think more broadly about why certain questions might be worthy of deeper exploration in the first place.

- *Database Searches:* Help students consider database search strategies, as well as alternative database options. Spend time helping students conduct database searches and teach them that though they may not find articles that relate directly to their topic, they will find sources that relate closely. Consider encouraging them to access databases or to consult with research librarians at local institutions of higher education early in the process.

- *Research Design:* Remind students that they need to clearly explain which research design, method of analysis, or approach they have chosen, how the research will be carried out, and why it is the appropriate method to address the research question. Defending research choices—justifying the use of an approach and justifying the choices made within that approach—is critical but also needs the most reinforcing. Remind students that they are completing the task as laid out in the Course and Exam Description (CED), which means that the discussion of their methodology needs to be explicit, even when it is generally understood within the field or when scholars in that field typically don't clearly lay out or defend their methodological choices. A reader who is an intelligent non-expert should be able to easily understand that description and rationale and be able to reasonably replicate the approach.

- *Different Methods:* Help students understand that specific methods have specific requirements. For example, methods such as meta-analysis, content analysis, thematic analysis, statistical analysis, trend analysis, grounded theory, qualitative comparative analysis, systematic review, correlational analysis, and historical analysis (or historiography) have particular guidelines and procedures that must be followed. Students are using these methods—and especially content analysis and meta-analysis—without clear explanation of what they have done (and why) and without clear understanding of how these methods are appropriately deployed. Encourage students to read within their area to better understand appropriate methodology choices. Provide examples where possible, and close-read these samples to check for method explanation and alignment. Allow for time to teach deeply about different research methods (including modeling, building together, peer review) and to ensure that students have the ability to make an informed choice between them in addressing their research question or project goal.

- *Surveys:* Given how frequently students rely on survey methodology, teachers should devote significant class time to teaching effective survey construction and implementation in order to make sure students understand the purpose and applicability of survey research. Emphasis is needed particularly on question construction, effective sampling, and the need to justify all of the choices made along the way. Students should be encouraged to put all survey questions in the paper (or at least within an appendix). Note that if students survey adjacent populations (e.g., classmates), it should be for clearly defensible reasons, *vis-a-vis* the research project, and not simply for the sake of convenience. If surveying classmates or high school students does not represent a well-aligned method designed to answer the given research question fully, students should abandon this method for one that makes more sense. Finally, students need to defend their choice of a survey as their methodology, explaining why it is the appropriate choice given their question or argument. Remind students of the range of research methods available in addressing questions or areas of inquiry, and that ideally, a researcher begins by narrowing a research question and then proceeds to identifying an appropriate research method, rather than starting with a convenient method (e.g., a survey) and then identifying a question that is easily addressed with that method. Finally, also remind students that they will need to allow for time in their process to adequately analyze and assess survey results.

- *Statistical Analyses:* Teachers should remind students that they need to apply the appropriate statistical test to their question, justify that choice, and explain it clearly to the reader. Encourage students to always explain the meaning of their statistical results and to elaborate on what these mean for their argument. Students seem to focus more on describing how they performed a particular statistical test and what that test means rather than on describing and explaining the statistical result and its implications for their argument and conclusion.

- *Alignment:* Teachers should spend more time discussing the need for alignment throughout the study. For instance, some papers had methods that were not aligned with the question being asked, which led to evidence collected that could not speak to that question. This suggests that students may not be putting enough thought into justifying their choice of method as it relates to their research question. Alignment is an issue throughout the study; however, as occasionally conclusions drawn do not relate to the inquiry approach used, the literature evaluated, or even the question asked. Alignment should be checked regularly and should be considered at every step of the research process. Teachers should consider reviewing example papers with students, highlighting alignment or problems with alignment in those examples.

- *Unfamiliar Approaches:* If students are using a methodology with which the teacher is unfamiliar, the teacher can recommend that the student find an outside expert who can review and comment on that approach. Teachers might also invite other instructors or bring instructional materials into the classroom. For instance, teachers who do not feel comfortable with data might think about inviting an AP Statistics teacher to work with students or could assign statistics videos for students to watch and later apply to their papers. Finally, finding exemplars of the type of method in published work or in previous student papers would be helpful to students.

- *Peer Methods Communities:* Encourage students to engage in peer-reviewing even while developing their methodologies. This might be made easier if students create "method communities" in the classroom, where students with similar research methods can give each other feedback on their approach while communicating ideas and conclusions.

- *Ethical Issues:* Teachers need to spend more time prior to the research proposal discussing ethical issues and helping students think through the effects of their choices on their research subjects. A significant and growing number of papers are collecting sensitive information or asking clearly disturbing or triggering questions without evidence of an IRB or some way to gain legitimate consent. Message the need to address ethical issues proactively, fully, and appropriately, particularly when dealing with human or animal subjects. Remind students that it is their responsibility to act in an ethical manner while carrying out their study responsibly and in presenting the data honestly and accurately. Even if students will not go through an IRB/human subjects review process, encourage them to reflect on ethical issues of their projects' methodology or implications, as it is expected that they do so.

- *Plagiarism:* Emphasize to students that it is their responsibility to act in an ethical manner with regard to appropriate citation and attribution. Use Turnitin.com to ensure that students are complying with AP Research course guidelines regarding plagiarism.

- *Start Early, Plan Ahead:* Consider creating a timeline for student success in the yearlong research process. Emphasize the importance of starting to collect the evidence or data as early as possible in the year, to leave enough time to carry out the study, complete the analysis, and leave time to write up and revise the paper. Students appear to be spending a great deal of time on their reviews of the literature and the development of their methodology, but not on analyzing the information that they collect or drawing conclusions from that information. These sections tend to appear more rushed and less complete than the earlier sections of the paper.

- *Analyzing Data:* Teachers should construct more activities on how to analyze data (for instance: how to use primary documents in historical analysis, or how to do content analysis, or descriptive statistics calculation).

- *Conclusions:* Teachers should encourage students to conclude with an analysis on how the paper's conclusion (drawn from evidence generated by the research method) contributes to the conversation. Summary is an important first step, but conclusions need to also contain reflection and analysis. In the conclusion, papers that referred back and compared the new findings to previous findings demonstrated an ability to show how their results had meaning beyond their own study. That also helped to show the new understanding and its relevance. New understandings discussed should be evidence-based (a result from their study's analysis, findings, or data), rather than simply a new awareness based on the reading they have done or the process that they have undergone. They should also be discussed and elaborated upon rather than simply asserted.

- *Limitations:* Teachers should remind students that they should discuss the limitations of their study's design (question, method), evidence, and conclusions, not on student circumstance or access to resources or time. Limitations should be tied to the conclusions in that they explain how certain the conclusions are, or to what degree they are generalizable, reliable, or valid.

- *Implications:* Encourage students to see the implications and conclusions sections of their papers as critical components that allow them to situate their study's findings and help the findings to have meaning beyond the study. The implication sections in weaker papers suggested that this step was an afterthought or an attempt to simply catalog possible sources of error, rather than an opportunity to address the "so what?" implications of their research or the opportunity to speak back to the professional discussion. Encourage students to reflect on and write about why their results are what they are; have them point out where their results matched previous research (and explain why this could have happened) and where it did not (and explain why this could have happened). Remind students to situate their findings in the literature.

- *Appendices:* If students wish to use an Appendix, remind them to discuss the most pertinent material or evidence in the body of the paper and to explicitly reference (and direct the reader to) the Appendix in the main text of the paper.

- *Writing and Citation Style:* Make sure students know the writing style and citation style expected in their discipline. Spend time emphasizing proper and consistent citation techniques, including the need to cite works of art, images, tables, or figures throughout the entire body of the paper, and the need to fully cite all online sources (not just the URL/web address). Teach, model, discuss, and work with students throughout the year regarding the mechanics of citations. Remind them to proofread to avoid incomplete or error-filled "works cited" sections.

- *Proofreading:* Remind students that prior to their final submission, they should proofread their work carefully. At this time, they should remove their names, school information, teacher and expert advisor names, and other identifying information from works to be submitted. Consider giving teachers the ability to redact that sensitive information before upload.

- *Uploading:* Sometimes conversions from Google Docs or other formats to PDF result in some content being lost. Remind students to make certain that the PDF they are about to submit is absolutely their final paper, contains all the desired text and elements, and is the version that they intend to be scored.

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

- Use the rubric as a teaching tool and a guide for the students throughout the course. Periodically have students review the rubric and ask (perhaps in the PReP – Process and Reflection Portfolio) whether the elements of their academic paper have met the criteria in the rubric.

- Use the AP Daily videos via the AP Classroom platform to help strengthen student understanding and development of the transferable skills for the course.

- Use the Student Workbook and associated PowerPoint presentations from the AP Research Teacher Community (https://apcommunity.collegeboard.org/web/apresearch) to help students focus their research questions, align their chosen method to the purpose of their inquiry, and ensure they are addressing ethical research practices in writing and in the implementation of their method.

- Teachers should attempt to troubleshoot their curricula on the AP Research Teacher Community, encouraging and engaging in dialogue that supports their own development of the course and course expectations, particularly after they receive their score report data.

- Teachers should also consider applying to be readers during the AP Research Reading, as this professional development not only allows teachers to understand the rubric but it provides access to student work that creates more context for the course and the various disciplines of scholarly research.

- Citations in many student papers were disorganized, missing sources, or formatted incorrectly. Effective use of free plug-ins or apps such as Zotero (https://www.zotero.org/) can help students organize their cited sources and cite them consistently and in the correct format.

- Purdue Owl (http://owl.english.purdue.edu/owl) is a great, free online source on citation and reference formatting. It contains information on many widely-used citation styles and guidelines regarding best practices in source citation and attribution.

- Human Subjects/IRB training would be useful professional development for AP Research teachers but would also benefit AP Research students who will be engaging with people for their projects. While there is an IRB education exemption for most high school students' projects (based on U.S. Department of Health and Human Services guidelines), such training would help students to at least talk about the ethical issues involved in their study, which is still required. It also models better research practice, which would be required at the college or university level. One option is the online Protecting Human Research Participants module from the National Institutes of Health's (NIH) Office of Extramural Research at https://phrp.nihtraining.com.

- Teachers should look into alternative journal collections such as JSTOR, search engines such as Google Scholar, or consider a field trip to the local university library to use those resources. This way, students have a wealth of information outside of EBSCO. Teachers might consider building partnerships with local colleges or universities and their libraries to provide more resources to students and to introduce local institutions of higher education to the great work AP Research students are doing.

- Encourage students interested in historical research to look into digital archives and data sets. There is a wealth of letters, diaries, and artifacts from under-represented groups that have been digitized and made widely available. Students looking for an innovative topic should look to the work of digital historians and digital history projects to find data that has only been lightly explored. There are various quantitative database websites with

online analysis built into the platform (especially in the social sciences), such as Gapminder, Google Trends, Kaggle, the European Social Survey, GESIS, World Values Survey, or the General Social Survey. There are also numerous sources for aggregate public opinion data, such as the Pew Research Center, Roper iPoll, Gallup, and PollingReport.com. Free open source government and international organization data also exist at websites such as http://www.data.gov, http://www.census.gov, https://data.worldbank.org, http://data.un.org.

- Students who want to conduct statistical analyses can use a free online tool called PSPP, which can be accessed at http://www.gnu.org/software/pspp. It is designed to be similar to SPSS, a commonly-used statistics software package, and is generally user-friendly.

- Professors at nearby colleges or universities could become resources: as expert advisors, oral defense panelists, or as guest lecturers who might, for instance, come and talk about good qualitative methodology or about ethical issues in working with human subjects.

- If your local college or university holds an honors day or research symposium event where undergraduate students are presenting their research, consider finding out whether your class can attend (or even present their work). They could see different kinds of research and, hopefully, observe good presentations. For students who perhaps were not thinking about going to college, seeing where their research could take them could be meaningful and encouraging.