Goldwater Research Essay Q&As

Providing Some Guidance on Writing the Research Essay

Kerry Karukstis, karukstis@g.hmc.edu
Bert Holmes, bholmes@unca.edu

These slides will be posted on the Goldwater web site under the "2026 Open House" tab in the lower left corner of the opening page.

2026 Goldwater Scholarship Competition

In this Open House, we will:

- Review the reasons for requiring a research essay in the application
- Provide some guidance on selecting the research to be described in the essay
- Address some questions on the format of the essay
- Provide examples of how to address the goals of the research essay
- Review excerpts of a research essay for its strengths
- Outline a possible format for a research proposal
- Examine an AI meta-analysis of research essays from several successful applications

Why does the Goldwater application include a research essay?

Reviewers are looking for **evidence of the student's motivation, background, experience, skills, and interest in pursuing a research career**. Reviewers also looks for typical characteristics of successful researchers such as determination, creativity, resilience, etc.

Strong essays describe:

- The importance of the research project to the discipline.
- The student's specific role and intellectual contribution to the work.
- The skills the student brought to the research from prior research or course experiences and applied to the current research.
- The new skills gained from participating in the project.
- Examples of how the student "thinks like a scientist". These might include problem solving during experimentation or computation, data analysis, or interpretation of project results.

https://goldwaterscholarship.gov/developing-the-research-essay/

Let’s start with some questions on selecting the research project to describe in the essay.

Q: If an applicant has conducted more than one research project, should the research essay summarize all of the projects?

A: Focus on one project and focus on the project in which the student (1) demonstrated the greatest **ownership**, (2) achieved the most **significant results**, and (3) clearly showcased his/her **ability to think like a scientist**. The project will likely be the one in which the student spent the most time (but not necessarily). Other projects can be briefly summarized if the students thinks that would be informative.

Be sure that one of the letters of recommendation is from the research mentor for this project.

Q: If an applicant has conducted more than one research project, should the research essay focus on the most recent project?

A: The project does **not** need to be the student's most recent. Use the same criteria noted on the previous slide to select the project to address.

Q: Can the research essay focus on a course project?

A: Yes, but this option is probably best if the applicant has no independent research projects outside of courses. The course project should be ***discovery-based*** (i.e., the results are not known to the student in advance) and ***require substantial individual student participation***.

Again, be sure that one of the letters of recommendation is from the course instructor who assigned the research project.

Q: When should a student submit a research proposal rather than a research essay?

A: This option is probably best if the applicant has no independent research projects and no research projects in courses.

*It would be ideal if one of the letters of recommendation is from a faculty member who can speak to the **originality** of the proposal, the **scientific merit** of the question being addressed, and the **capability** of the student to conduct the proposed research.*

Let’s address some questions on formatting and developing the research essay.

Q: Is it OK to use equations in the essay?

A: **Yes.** Equations are appropriate, even necessary, when they communicate important relationships in a compact manner. Be sure to identify all variables and explain the context carefully.

Q: Is it OK to use figures in the essay?

A: **Yes.** As appropriate, utilize graphs, tables, and figures in the essay to explain or clarify results. Keep the number of such items to a minimum. Use captions to guide the reader in interpreting graphs, tables, and figures.

Q: Should the applicant use headings to demarcate the various sections of the research essay? If so, are there preferred headings to use?

A: Using headings is an ideal way to organize the essay and help the reviewer to follow the student's train of thought. There are no set preferred headings.

Use the terms that provide structure and clarity for the student's writing. Only a few headings should be necessary in a short essay.

Q: Can you suggest some preferred ways for the student to introduce and conclude the research essay?

A: A short opening paragraph can present the broader picture to the reviewer, specifically the ***importance of the research and the motivation for doing the work***.

A final paragraph might discuss either (1) ***next steps*** for the project if the work is not yet complete or (2) ***possible new projects*** that the current research has inspired.

Q: Can you give some examples of how a student can describe their own contributions to a research project?

A: Use the word "I" and provide examples of activities like:

- Taking initiative and working independently
- Proposing solutions and strategies to roadblocks or unexpected results
- Actively contributing ideas
- Making decisions and being responsible for the outcome
- Remaining committed to the project despite setbacks

Reviewers understand that research is collaborative and that students will need to gain expertise in new areas and techniques. Avoid language such as "Working with a graduate student, I…" and "My lab partner and I…" and use phrases such as "I became proficient in …." and "I contributed …"

Q: The Goldwater instructions on the research essay mention discussing "the skills you brought to the work from prior research or course experiences" and "the skills you have or expect to obtain from participation in the project." Can you give some examples of what is meant by "skills"?

A: The skills that reviewers are looking for might be categorized as follows:

Technical skills - scientific techniques associated with conducting the research involving instrumentation, software, writing, presentation

Research skills - critical thinking, hypothesis formulation, data collection and analysis, evaluation of sources, communication, time management, attention to detail, problem-solving, project management, collaboration, leadership of a team, adaptability, and the ability to plan and organize research effectively *continued*

A: The skills that reviewers are looking for might be categorized as follows:

3. Understanding the Research Process - generate the research question (idea), design experiments/computations to address the question, carry out the work, analyze the results, and communicate outcomes to the STEM community

- The applicant should indicate which of these steps were personally addressed.
- Reviewers recognize that few students generate the research question.
- But, stronger applicants have generally participated in several stages of the research process and can describe their contribution to each step.

Q: How can a CR assist applicants in developing their research essays?

A: Feel free to share the advice presented here with applicants. Also encourage the applicant to:

- Start drafting the essay well before the deadline and write multiple drafts.
- Share drafts with the research mentor.
- Seek additional feedback from others such as a STEM faculty recommender, a STEM writing consultant in the campus' Writing Center, the Campus Representative, the Goldwater selection committee, etc.
- Pay close attention to spelling and grammar.
- Ensure that the final essay maintains one's individual voice.

A Campus Representative recently posted an example research essay on the National Association of Fellowships Advisors (NAFA) listserv.

Let's just focus on the organization of the essay and how the student demonstrated his contributions to the project.

As we have noted numerous times at our Goldwater Open Houses, reviewers evaluate applications ***holistically****, giving balanced consideration to all elements of the application. Applicants should write their research essay to reflect their own voice.*

Informative title

Simple heading

Opening paragraph to describe:

- the importance of the research
- the motivation for doing the work

Learning Deep Goal-Parameterized Robotic Skills from Demonstration

Introduction

[redacted] is a promising direction of research for [redacted] However, many contemporary LfD approaches [redacted] are unable to target [redacted] This requires a lot of data [redacted] that is usually infeasible for real-world situations.

* Multiple uses of the word "helped" suggest a collaborative endeavor. If this is not the case, the student should reword. The student might consider some stronger language, such as "along with others I proposed a method…".

To combat this issue, I helped propose a method that [redacted] *

This work directly builds on recent successful approaches to LfD. [redacted]

[redacted] I proposed and helped implement a novel DNN architecture that builds directly on this success [redacted] I then designed and helped run experiments [redacted] *

*

Description of how the research contributes to and advances the discipline

Example of student's creativity and contribution to the project

* Multiple uses of the word “helped” continue to suggest a collaborative endeavor. Research mentor should clarify the student’s exact contributions.

Another helpful heading

Actively designed experiments

Methodology

In an effort to evaluate our algorithm, I designed several experiments in three separate domains: [redacted]

Figures give the reader a concrete illustration of the three experimental set-ups

Figure 1: Views from our experimental setups

[redacted] To answer these questions, I designed [redacted]

[redacted] I then collected [redacted] I helped train [redacted] *

[redacted] we evaluated [redacted]

I helped perform the above experiment *

[redacted] Finally, I tested [redacted]

Conducted tests of proposed model

Concluding paragraph detailing next steps to continue the project.

(potentially weakened a bit by using the term "our idea…")

Key references

Example of student interpreting research findings.

[redacted] I hypothesize that [redacted]

Future Work

I hope to deepen this line of work in the future. Specifically, I hope to extend our idea of [redacted]

References

Yiming [redacted]

Sergey [redacted]

Tianhao [redacted]

Suggested Elements of a Research Proposal

Title

- Succinct but technical and informative

Proposed Scientific Question

- Provide a brief context for the question to be addressed and why the proposed research is essential for advancing the field.

Methods and Experimental Design

- Present a feasible experimental plan that specifies
  - Necessary materials, instrumentation, equipment, computational resources
  - Procedures - Key experimental steps, protocols, or measurement techniques
  - Data to be collected and how that data will be analyzed
  - Potential limitations of the approach

Expected Outcomes

- Describe expected results and their significance
- Discuss potential responses to unexpected findings

Key References

A post on the National Association of Fellowships Advisors (NAFA) listserv provided a Generative AI meta-analysis of a number of examples of research essays from the institution's successful Goldwater applications. The following slides detail the resulting guidance for preparing the essay.

These suggestions are consistent with the recommendations given on the Goldwater Scholarship website. See https://goldwaterscholarship.gov/developing-the-research-essay/

A Goldwater Scholarship research essay should showcase the applicant's understanding of their research experience, their ability to communicate complex scientific ideas clearly, and their intellectual curiosity. Based on examples and best practices, the following key points should be covered:

1. Clear Description of the Research Project Purpose and Significance: Begin with a concise explanation of the research question or hypothesis and why it is important. Highlight its relevance to the field and potential real-world applications.

Context: Provide background information to establish the scientific foundation and situate the research within broader scientific trends or challenges.
Specific Role: Clearly state your role in the research, distinguishing your contributions from those of collaborators or advisors.

2. Explanation of Methods and Approaches Methodological Clarity: Describe the methods and approaches used in the research, ensuring they are detailed enough to demonstrate your understanding but clear enough for a scientifically literate audience.

Tools and Techniques: Mention specific tools, technologies, or techniques you employed and how they were critical to the project.

3. Results and Outcomes

Summary of Findings: Clearly explain what the research uncovered or achieved, whether it produced conclusive results, was exploratory, or remains ongoing.
Analysis: Demonstrate an understanding of how the results were analyzed and their implications.

4. Impact and Broader Implications

Relevance: Discuss how the research contributes to the field and its potential implications for future research or applications.
Connection to Goals: Highlight how this research aligns with your academic and professional goals as a future researcher.

5. Intellectual Engagement

Challenges and Solutions: Reflect on the challenges encountered during the research and how you addressed them, demonstrating problem-solving skills.
Insight and Growth: Share what you learned through the research process and how it has shaped your perspective as a scientist.

6. Concise and Accessible Writing

Technical Accuracy: Use precise scientific terminology, but balance it with accessibility for readers who may not specialize in your field.
Logical Structure: Ensure the essay is well-organized, with a logical progression from research description to broader significance.
Engaging and Clear Language: Avoid jargon-heavy explanations. Strive for clarity, concision, and elegance in writing.

7. Future Directions

Next Steps: Briefly outline future research directions for the project or related questions that the research has inspired.
Integration with Career Goals: Tie the research to your aspirations, emphasizing how the scholarship will help you continue to contribute to the field.

Focusing on these elements ensures the essay effectively communicates both your technical expertise and your potential as a future leader in STEM fields.