Tips for Developing NSF Proposals

This tool is designed for early career STEM education researchers to offer tips for writing grant proposals. The advice largely comes from National Science Foundation-funded awardees who have graciously shared information about their own proposal writing experiences. Their perspectives are a good complement to the official NSF guidelines.

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Developing Your Proposal Idea

Develop a research agenda and trajectory based on your interests. See the proposal as a vehicle for accomplishing your professional goal(s). Ask yourself:

- How does this proposal complement or build on my existing work?
- Will the proposed project help move me closer to my professional goals?
- Will the proposed project make a contribution to the field? How?

Project ideas can arise at any time and in many different ways. In the best of all worlds, your proposal idea emanates from prior research or a very specific area of interest. However, sometimes chance plays a role: a peer poses an informal question during dinner at a conference, or a newspaper article sets in motion the exploration of a new idea. Not every idea will automatically translate into a proposal, but over time, small pieces come together in ways that can inform the direction of your work.

PRELIMINARY RESEARCH

Conceptualize your project and develop an abstract or a preliminary statement. You can revise this as your proposal idea evolves. Approach your project idea by thinking about how you will do the work and present your findings in a way that will most benefit the field.

Conduct research to determine whether similar work already exists. Use this as an opportunity to catch up on all of the literature on the topic. Determine the quality of identified research as well as gaps or limitations in content, methodology, etc.

Identify funding sources. Some people look at funding sources first; others wait until they have a strong proposal idea and then identify sources that align with their proposed topic. Either approach should begin early in your process due to the unique guidelines and timelines for individual funding programs, even within the same agency. For example, NSF has a number of different portfolios within the education directorate. There are also education initiatives supported in the science directorates.

Explore how aspects of your research fit under different funding solicitations. It is likely that no single funding source or program will fund your entire research program over time, but you can focus on obtaining funding to address different parts of your program while always keeping your long-term research goals in mind. Every project can provide an opportunity to investigate a different aspect of your research goals in a way that moves your research program forward.

Start establishing partnerships early—at a minimum, 6 months to a year before the solicitation is due. It takes that long to build your team and build relationships with schools, teachers, and other institutions. Planning your project in advance, with well-established partnerships, can lead to a stronger proposal as well as to a better conceptual and methodological starting point if your work is funded.

NETWORKING

Get feedback from your peers to assess the need for the proposed work. Consultation with others can help you decide whether your proposal idea may be worth pursuing and, if so, how to think about the depth and breadth of the proposed research. Peers may be STEM education researchers within your institution or those from the larger STEM education network. If you are considering a DR K–12 submission, you might want to explore projects and PIs on the CADRE website: cadrek12.org. It is important to think about identifying colleagues from disciplines different from your own. Many NSF proposals include project leaders with diverse backgrounds (e.g., curriculum, assessment, or professional development).

Talk to other successful NSF grant recipients at your institution. Ask about their process for developing proposals. Determine if they would be willing to discuss their funded proposals. Find colleagues you respect and with whom you share interests. You could arrange monthly meetings with colleagues as a way to discuss ideas. In some cases, these relationships might flourish and evolve into future collaborations.

Share your ideas more broadly with people in and outside of your field. When you have a clear description of your proposal, ask others to comment. These interactions can help to clarify your logic model, research questions, and methodological approaches. If you find someone whose work interests you, ask to see their funded (or unfunded) proposal(s). Many researchers are willing to do this; consider asking to see only their project description, because sharing a proposal budget can cause problems in terms of releasing confidential information. Even if the researcher says no, you've made a connection.

Consult with NSF. Once you're in a place where you can clearly articulate your idea, share a one-page concept paper with an NSF program director via email. Check the NSF website to find the program directors responsible for the program to which you are planning to submit. Try to zero in on one program director by identifying the contact for the discipline or focal area that relates to your concept paper. Bouncing your ideas off of a program director can be extremely helpful. Most directors will generously give their time to discuss your proposal ideas and to help you determine whether your concept is appropriate for a specific NSF program and aligns with the priorities of the solicitation. If your project idea is not a good fit, the program director may recommend a different program. NSF program directors are typically interested in coaching early career professionals.

Early Stages of Proposal Development

When developing your research ideas and questions, consider the following:

- What issues am I observing in my own practice and/or research?
- What questions is the field addressing at the moment?
- In what ways does my project idea align with the big questions within the discipline?
- What are some of the unanswered questions from my previous work?
- Do my research questions jive with the request for proposals (RFP)?
- What contribution can I make to NSF?

Consider how you will move from research question to project design:

- What claims do I want to make?
- What evidence will I need in order to make those claims?
- What methods will allow me to gather that evidence?
- What kind of project design is possible? What is useful? What is manageable?
- Is there a beginning logic model?

When beginning to think about choosing partners, advisors, and evaluators, engage in self-evaluation and critical thinking:

- What do I bring to the project?
- What knowledge/perspectives/expertise am I lacking?
- Who can bring that experience to the project?

Use your networks to find individuals who share your interests. Explore the places where your work and others' intersects, and propose opportunities for collaboration. You can decide beforehand where you want this work to take you and invite others to join, or you can decide as a group where you want to go together.

Remember that we as individuals don't know everything. A strong proposal and project require more expertise than any one individual (or even one institution) has. Collaboration will make your proposal more competitive and allow you to better execute the project. Consider how a team of researchers, developers, partners, advisors, and evaluators will bring the expertise needed to properly address the research questions. Look for people with whom you have good relationships and you enjoying working; you will be working together for a while.

Don't be afraid to reach out to new people to serve on your advisory board. Invite people whose work interests you and who you think would add an interesting perspective, even if you don't know them personally. Use the task of assembling an advisory board as a reason to form new relationships. Be clear about expectations for the advisor role as well as the logistics: number of meetings (virtual or in-person), stipends, and required travel. You can certainly revise the role and specifics but have an initial plan when you approach potential advisors. Some prospective advisors may ask to see a proposal abstract; others may ask who else will be serving as advisors. It is important to share why you are asking them to serve.

Use your network to find the most suitable evaluator for your project—someone whose opinion you respect and who can be a critical friend. Experienced PIs might be able to make recommendations for evaluators. Design a role description for the evaluator to serve as a starting point from which you can develop a full plan. Ensure that the evaluator is independent, and involve them in the early stages of the proposal development. An evaluator can help you think through your logic model and may assist with research design. Many evaluators prefer coming on board before the proposal is finalized; having a clear understanding of their role makes their job easier later on.

Proposal Development

A solid proposal should reflect your passion about the work. It's a good sign if the writing process generates excitement.

Writing a proposal is very different from writing for publication. With proposal writing, you are trying to offer a specific rationale for your project and very detailed information about your goals, objectives, research design, and activities, as well as the implementation, dissemination, and evaluation process. Clarity and detail are crucial, and you must ensure coherence between the sections of the proposal. Ultimately, you are selling your work to the reviewers.

Demonstrate how your approach is novel, trusting, and transformative. You must convince the reviewers that there is a need, that the need relates to a problem of national importance, that you know how to solve this problem, and that your team is in the best position to carry out the work.

Use the first two pages to convince the reviewers to fund you; use the remaining pages for elaboration. Introduce everything in the first two to three pages: the problem, your proposed solution, your research questions, and how are you going to go about answering those questions. Use the remaining pages to elaborate on each point. Don't introduce anything new beyond the introduction. You might benefit from writing the introductory pages first in order to think through your project timeline. As you work on additional sections, you can keep returning to the first two pages to tighten your argument. This strategy requires a lot of time upfront but can be beneficial in the long run.

Write for your audience. Don't make assumptions about the reviewers' backgrounds. You are writing for a diverse panel of experts. It's rare for all reviewers on a panel to have expertise in your specific area or even in your field; therefore, you must make your writing as accessible and understandable as possible. Read the solicitation to become familiar with the specific language it includes, and match it to your work. Provide concrete examples for those who might be unfamiliar with the concepts. Consider opening with a scenario or vignette to help engage people outside of your field. Don't simplify your proposal; just make it clear and accessible. Ensure deep intellectual integrity, but write it in a way that everyone can understand. Leave reviewers with the impression that it is important work, even if they don't understand all of the intricacies.

When available, experts will review the sections of your proposal that deal with their particular field. For instance, a methodologist will read your methodology section; a teacher educator will review your plan for professional development. If an expert discovers a weakness in a section that addresses their area of expertise, they can convince the panel not to invest in you. When developing a particular section, write for the highest expert in that field in terms of substance and expertise, but use language and examples that can be understood by everyone.

Remember that you are telling a story. You must include all sections required by the RFP, but arrange them in a way that helps your narrative flow. Determine what story you want to tell, and then, as you're writing, check in periodically to make sure your storytelling is consistent. It is your story that will stand out for reviewers. Make it compelling!

Develop a logic model to describe what you're proposing and how the pieces of the project fit together. There are many ways to illustrate the model. PIs have recommended looking at the format of models that others have used. The logic model should help with the coherence of the proposal.

Be considerate with your reader. Reviewers are reading many proposals. When writing, imagine that yours is the last proposal they are going to read at the end of a long day, and think about ways you can make their job easier. Consider using visuals to break up the narrative and present the information in a new way. This will give the reviewer a bit of a break but also appeal to different types of learners. When used properly, figures and tables can help reinforce the big ideas. Formatting can also help draw attention to specific areas you want to highlight.

Pay attention to NSF's requirements regarding font, page length, necessary letters of collaboration, and supplemental documents.

MANAGE THE WRITING PROCESS

The writing process will vary depending on your style. Some write the summary first and then build out the rest of the proposal; others do the opposite. Everyone starts at a different place depending on how they organize their thoughts. Most people go through a long process of writing and rewriting.

Authorship of the proposal varies. In some cases, the PI writes the proposal, often on the basis of conversations with potential team members, advisors, and evaluators. The best proposals are conceptualized by a team, not only by the PI. The process can occur in-person or virtually. In some cases, a lead writer (usually the PI) drafts an outline and then assigns sections to different members based on their areas of expertise. This creates greater buy-in from the team and strengthens the overall proposal.

Once the sections are complete, one team member should act as the final authority to ensure unified style and voice. Make sure the narrative flows and that everyone understands what teammates are proposing even if they are unfamiliar with the areas of expertise. The proposed PI has final authority for the quality of the proposal.

Ask a friend (or two) to read your draft. Are there missing pieces? Is it coherent? Does it make sense to an outsider? It's better to receive critical feedback from friends when the stakes are low than from blind reviewers when the stakes are high. Consider soliciting targeted feedback at different stages of proposal development. It is best NOT to wait until your final draft. By then, it is usually too late to make substantive changes.

CONVEY YOUR PLAN FOR SUCCESS, BUT ADDRESS POSSIBLE OBSTACLES

Decide first what "success" means to you. Be specific in describing how you will move from the idea to the final stage of the project. Demonstrate that your project team is qualified to do this work.

Rationale and execution are important, but reviewers also understand that projects evolve. Things can change with timeline, budget, partners, etc. Decide how much of a risk you want to take. Be clear about how you plan to measure success and interpret and deal with setbacks. Write the proposal as if everything will go according to plan, but demonstrate that you have thought of possible eventualities and are aware of potential obstacles. Explain the guiding principles you will use to deal with unexpected deviations from the plan. For example, partners might drop out. How will you go about choosing new partners? How would you deal with attrition? Know that any weaknesses in your proposal will be identified. Consider all the possible objections to this work and prove that you're able to think these things through.

ADDRESS INTELLECTUAL MERIT AND BROADER IMPACTS

At a minimum, follow the specific NSF guidelines for intellectual merit and broader impacts. The intellectual merit criterion encompasses the potential to advance knowledge, and the broader impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

Consider what you want your project's legacy to be. What contributions do you hope to make both conceptually and empirically? Put yourself at the end of the project and ask:

- What was accomplished?
- How did it contribute to the field?
- Why should society care?

Position your work within the national conversation around broader impacts. Don't just describe what you're going to do; describe how it will make a difference. Consider the following questions:

- What national issue can this work contribute to?
- How is this work going to make a difference?
- Who is impacted by this work?
- How can I ensure the right voices are at the table to do this work?

Think about broader impacts as extending beyond numbers. It's not just about reaching X number of people or certain populations; it's also about the substance of the work and how it will transform some persistent inequality or problem in the field.

A project's intellectual merit and broader impacts can make or break competitiveness. Convince the review panel that your work is a worthwhile investment.

WORK WITH YOUR INSTITUTION

Understand the funding process for your institution. Most academic institutions require that proposals be reviewed by the grants office to ensure that you're not making promises that have implications for the institution without their permission. Non-academic institutions will likely also want to clarify the institutional obligations required for your project. The process for this varies greatly by institution, so make sure you understand the requirements before pursuing external funding. Sometimes there is a cap on how many proposals can be submitted by the same institution. Check with your institution about this to know whether your proposal will be eligible for submission. Talk to them early and often!

SECURE LETTERS OF COLLABORATION

Prior to submitting your proposal, check to see if you should obtain letters of collaboration. If you are working with specific school districts or states, you should have a letter detailing their role on the project. In addition, it is advisable to obtain letters from your advisory board. Having letters from the people and institutions with whom you will collaborate demonstrates their commitment to the work. Please make sure you do NOT submit testimonials about your organization or letters from legislators or policymakers.

DEVELOP A BUDGET

The budget provides a lot of information about your project design. Your narrative explains the problem and how you plan to solve it, whereas your budget provides additional detail and demonstrates the costs for each component of the project. Make sure your budget reflects all the activities described in your proposal. If your proposed budget is too low, for example, the reviewers will know that certain activities can't be done or done well. Likewise, red flags will be raised if you're requesting too much money for a limited number of activities.

One of the biggest problems, especially with early career professionals, is promising too much with too few resources. Knowing exactly how much it costs to do certain activities becomes easier with experience, but be sure your budget aligns with what you want to do. For example, don't propose collecting more data than you can afford to analyze.

Make sure you understand the budget requirements for NSF and for your institution. See the budget guidelines in the Proposal & Award Policies & Procedures Guide (PAPPG). Some questions to consider include:

- Am I providing adequate stipends for participants? for advisors? Check the allowable and standard rates.
- Have I budgeted enough for travel to do the work, attend PI meetings, present my findings, etc.? Check the GSA per diem rates.
- Have I budgeted for the type of evaluation I want?
- If this is a multiple-year project, have I accounted for raises?
- Have I budgeted appropriately for the preliminary work required to get the project off the ground?
- Do I have enough money allocated for data analysis, writing, and dissemination at the end of the project?
- Is there a budget for advisors?
- Will there be subcontractors and/or consultants for this project?

Work with others to develop the budget. Some proposal leads will identify the parameters but allow those with more experience to generate the numbers. There might be institutional support to help you with this. Still, make sure you are engaged in the process because budget management will be your responsibility.

Even if the overall budget is adequate, there is often a need to shift individual line items over the course of the project. Maybe you won't need as much money for travel. Maybe you'll need to bring in more graduate students. Any significant changes will need approval from NSF. Knowing what constitutes a significant change

will get easier with time, but when in doubt, consult the program guidelines and requirements outlined in the PAPPG or talk to your program director.

Between Submission and Notification

Do not contact NSF while the proposal is under review. It's advisable to consult with program directors when you are developing your idea or to ask for advice to strengthen your proposal, but be hands off once you've submitted.

If the program director gets back to you with questions/feedback from the review panel, answer every question as thoroughly as possible and within the requested timeline. Be clear and specific so it is easy for the program director to advocate on your behalf during the final review.

See the questions as an opportunity. You've had a break and have been able to reflect on the proposal you submitted. There might be new things you want to highlight in your responses to the reviewers' questions. Their questions can help improve your work by reorienting you after the break. If funded, this will make it easier to hit the ground running.

The Successful Proposal: Getting Started

Getting a project off the ground is hard work, but hopefully your excitement about the idea outweighs the burden and responsibility.

Use the proposed timeline to create and implement a work plan. Don't shortchange yourself on the time it will take to get the project started. During this phase, you may need to hire staff and students, develop partnerships with school districts, prepare subcontracts and consultant contracts, set up your budget, or address Institutional Review Board (IRB) issues.

Introduce yourself (virtually or in person) to the program director assigned to your award, and keep them informed as you begin to navigate this work and throughout the process, especially when you encounter issues that require difficult decisions. At the same time, be judicious when asking for their time; program directors are busy!

Note when NSF will require your annual report. It will be an opportunity to share what you have learned and accomplished over the year. Keep notes during the year that can provide input for that report.

Dealing with Rejection: Try Again!

You can't be afraid of failure; you will be rejected at some point in your career. Failure is part of the experience. In particular, don't feel bad if your very first proposal is rejected. Some PIs report having submitted a proposal several times before getting funded. The hurt from rejection gets easier to manage over time, and each rejection brings a new learning experience.

If your proposal is rejected, schedule an in-person or phone meeting with the program director for additional feedback on how it can be improved. Ask yourself what you can learn from this. Many people do not take advantage of this opportunity. NSF staff is accessible as a resource to make your next proposal stronger.

Remember that your proposal is being reviewed by only one panel. If it had been reviewed by a different group of people, feedback might have been completely different. This is why it's important to discuss feedback with the program director who was in the room. It will give you a sense of how to improve your proposal.

You can revise the proposal by incorporating feedback from reviewers and program directors, and then resubmit the proposal. Consider whether another program is a better fit. If you find another program, make sure to revise your proposal so that it matches that program's solicitation. You might also be able to reconceptualize a project, such as resubmitting a design and development proposal as an exploratory research proposal.

You can build on rejected proposals by finding ways to incorporate your ideas into future proposals. Your original ideas can inform later work in many ways, even if you can't recognize those opportunities immediately. One PI was told she'd submitted a great proposal but the field was moving in a different direction. She held onto the rejected proposal for 10 years and was able to recycle some of those ideas once funding trends shifted.

Additional Advice for Early Career Researchers

It can be challenging for young professionals to break into the field. NSF wants to support the next generation, but they also want to see a record of success. It's hard to complete with 20+ year veterans, but there are options that can help you gain traction.

Research postdoctoral opportunities, such as the Spencer Postdoctoral Fellowship Program. This will give you experience writing a proposal and managing your own short-term research project. During this time, you will have an opportunity to further flesh out your research trajectory before you begin applying for faculty positions.

Consider submitting a proposal to NSF's Faculty Early Career Development (CAREER) Program. This program is designed specifically for junior faculty in a tenure track position, and is intended to provide a foundation for continued leadership in education research and development. The CAREER program allows you to integrate a research program with your own educational goals. While CAREER grants are extremely competitive, you're competing against other early career researchers like yourself and not veteran researchers with extensive backgrounds.

Although CAREER grants are great for some people, they are not ideal for all. CAREER grants are designed for solo researchers. If collaboration is an important part of your work at this stage of your career, another funding source would be a better fit. Your funding source should never detract from your long-term research goals.

Explore opportunities for university, state, or foundation funding to gain experience managing grants and developing your portfolio before attempting to compete for NSF funding.

Your first proposal should be relatively modest—something small-scale but interesting to you and in-line with your research agenda and career trajectory. Spend some time flying under the radar. Focus on doing good work and getting good results.

A small grant will help you get your feet wet, establish a track record, and gain experience in different areas of project management on a small scale. Be realistic about project management. There's a steep learning curve around managing people, budgets, and reports. This is distinct from having a really good project idea, and both are critical for a successful proposal and project.

Collaborate with peers who are farther along in the field to develop a larger project, and serve as a co-PI to help build credibility. Collaboration will allow you and your team members to address a more complex problem from a variety of perspectives. However, in a collaborative environment, you will have to work much harder to carve out your identity and establish yourself as an individual. This is an especially important consideration for academics in tenure track positions.

Be a reviewer for NSF. Serving on a review panel is a great way to gain exposure to different styles of proposal writing and approaches to required content, as well as insight into how reviewers respond to those proposals.

Additional Resources

- Berkeley Research Development Office: NSF Faculty Early CAREER Development Program
- NSF Programs: Directorate for Education & Human Resources (EHR)
- Old Advice for New Researchers
- On the Art of Writing Proposals
- Where to Search for Funding
- Writing the Broader Impacts Section of Your Research Proposal