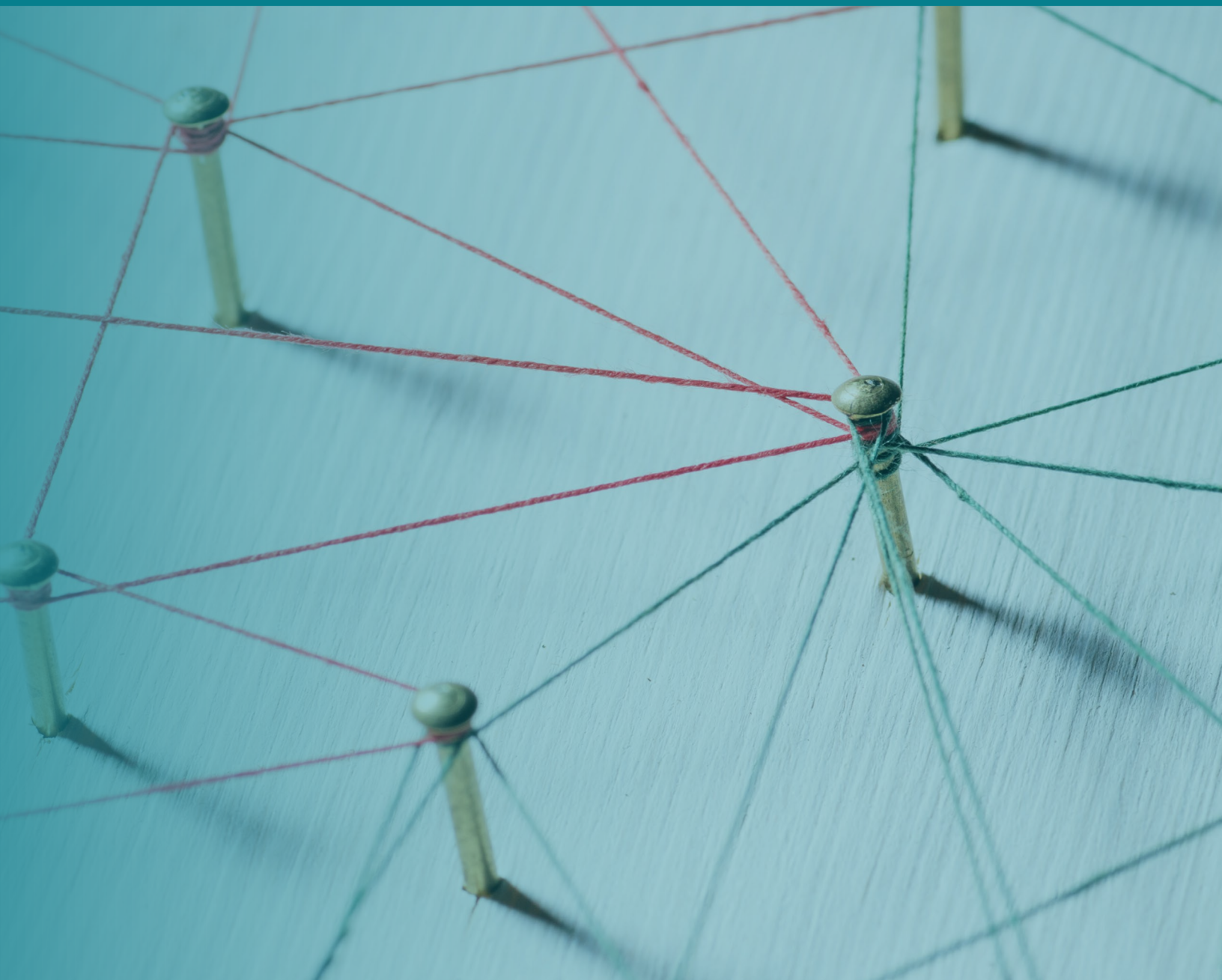


# CADRE

## Early Career Guide: Tips for Early Career STEM Education Researchers



**CADRE Early Career**

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# Introduction

## ABOUT THIS GUIDE

The CADRE Early Career Guide offers advice on becoming a successful researcher in the field of STEM education and a portrait of an early career researcher support program. The advice offered throughout the guide comes from experienced researchers who are part of the National Science Foundation's Discovery Research PreK-12 (NSF DRK-12) community. Over the past eight years, they have graciously shared their experiences with small groups of doctoral students and other early career researchers through the CADRE Fellows program. Those experiences and insights have been compiled to provide guidance on navigating the STEM education field as an early career professional.

The guide is divided into two parts. Part I offers tips and resources to address the needs of STEM education researchers who are early in their careers, primarily doctoral students and research associates. These materials are organized around four focal themes: (1) pursuing academic and non-academic career pathways, (2) writing for publication, (3) building professional networks, and (4) developing NSF proposals. Early career researchers may choose to independently access the resources on an as-needed basis or pick from the resources and other elements of the Fellows program (described in Part II) to share with, for example, a study group with other graduate students and professional peers.

Building on Part I, Part II describes a model for supporting early career STEM education researchers based on the CADRE Fellows program, and provides strategies and resources to guide those who supervise, advise, or mentor groups of early career STEM education professionals. Part II offers a detailed description of the structure and objectives of the CADRE Fellows program and the design of the activities within the focal themes. It also provides insights into the impact of the program. The guide is organized in such a way that advisors, supervisors, mentors, and program leads who work with early career researchers can choose those elements from Parts I and II that are most appropriate and use them to develop customized supports on an ad hoc basis or to form a more formal early career researcher program. Early career researchers might also choose to use several of the guiding questions associated with each strand in Part II when talking with more experienced researchers, or work on one of the assignments independently or with another colleague.

## ABOUT CADRE AND THE CADRE FELLOWS PROGRAM

The Community for Advancing Discovery Research in Education (CADRE) is a network for STEM education researchers who have been awarded grants by NSF's DRK-12 program. CADRE connects these researchers who are endeavoring to improve STEM education in and outside of schools. CADRE helps the grantees share their methods, findings, results, and products inside the research and development community and with the greater public. CADRE also helps to build the capacity of researchers, including through the CADRE Fellows program.

The CADRE Fellows program is designed to build the capacities of and provide opportunities for early career STEM education researchers. Fellows are primarily doctoral students, research associates, or postdoctoral researchers who have been identified by a DRK-12 principal investigator (PI) or co-PI as a future leader in STEM education. They represent a variety of institutions, disciplines, backgrounds, and geographic regions.

Each year, CADRE selects 10 nominees to become Fellows. During the half-year program, Fellows engage in capacity-building activities to learn more about what it takes to be successful and effective in the field of STEM education research; network with researchers from a variety of institutions, at various stages in their careers, and with diverse expertise; gain insight into NSF and its funding practices; receive advice for those pursuing careers in academia and beyond; and learn about the work of other STEM education researchers. More information about the structure of the CADRE Fellows program is available in Part II of this guide.

# Part I

## Tips for Early Career Researchers

### Contents

#### **PURSUING ACADEMIC CAREER PATHWAYS**

These tips offer guidance on deciding if the academic path is right for you; searching for positions in academia; developing an application; preparing for the interview; and getting started in a new job.

#### **PURSUING NON-ACADEMIC CAREER PATHWAYS**

These tips offer guidance on deciding if the non-academic path is right for you; searching for positions in industry or the nonprofit sector; developing an application; preparing for the interview; and getting started in a new job.

#### **WRITING FOR PUBLICATION**

These tips offer insight into developing ideas for a manuscript, the writing process, navigating authorship, choosing the right journal, and the journal review process.

#### **BUILDING PROFESSIONAL NETWORKS**

These tips provide guidance on networking strategies, how and where to make connections, and how to sustain professional relationships.

#### **DEVELOPING NSF PROPOSALS**

These tips guide the reader through the proposal development process, from the earliest stages of developing a proposal idea to the NSF review process and beyond.



# Tips for Pursuing Academic Careers



*“The more insight you have into what being a faculty member entails, the easier it will be to decide whether academia is the right path for you.”*

## Paths into Academia **A**

Scholars traverse a variety of paths into academia. Some take a direct route from being a student in higher education to holding a faculty position; others come into positions later in their careers after working as educators at the district or state level, or in the private sector or the nonprofit world of research and development. Still others enter the profession of STEM education after a career in one of the STEM disciplines. All agree that it is hard to know early in your career exactly what you want to do, and it is challenging to plan very specifically in advance. Often it is a matter of being in the right place at the right time and having different experiences to determine what fits with your knowledge base, skill set, and personality. Education is a large and diverse field with many possibilities. For most scholars, it is about defining your goals and (if appropriate) your research agenda, deciding how best to develop yourself professionally, and pursuing different opportunities that align with your goals. While academics acknowledge frustrations, such as heavy service load, institutional politics, and the pressure of the tenure clock, many value the independence, autonomy, and flexibility that they have in the academy. They like balancing research and teaching and appreciate having the freedom to define their own research agendas. Early career researchers need to understand what type of professional environment they need to thrive and whether the culture of academia is right for them.

## Preparing for a Career in Academia

There are numerous things doctoral students can do to prepare for a career in academia. The more insight you have into what being a faculty member entails, the easier it will be to decide whether academia is the right path for you.

**Start doing research as early as possible so that you know whether it is something you want to do in the future.**

By joining a research team early, you can experience the process of developing research questions, collecting and analyzing data, writing, presenting, and publishing. You will have support with this while you work on your dissertation, but once you begin your first job, you will be replicating this on your own. The more practice you have, the easier the transition to independent research will be.

**More and more, it is becoming critical for you to have publications on your CV before you begin applying for jobs.** In addition to collaborating with your advisor or PI, ask colleagues if they have projects or publications that they need help with. They might find ways for you to make a contribution, which will give you relevant experience and help strengthen your applications when you go on the job market.

**Try to gain experience with grant writing and project management.** It will benefit you to know about the administrative and management side of funded research.

**If possible, serve on a hiring committee.** You will read applications, participate in phone and in-person interviews, and observe job talks and teaching demonstrations. Through this experience, you will get a sense for the application process, what committees like and do not like to see in the materials, what types of questions are asked, etc. This insight will give you an advantage when you begin the process yourself. If you do not have this opportunity available to you, try finding other students who do and learn from their experience.

**Start developing good professional habits.** Develop a system for managing your time and prioritizing tasks. For example, work on your dissertation for at least 15 minutes every day. Read at least one article a day. Build this time into your schedule. Producing work becomes more natural if you have routines in place.

## Postdoctoral Fellowships

After you earn your doctorate, consider a postdoctoral fellowship. A postdoctoral fellowship is

not essential, but it is valuable. You can use your time as a postdoctoral researcher to begin publishing from your dissertation and gain additional research, proposal development, and project management experience, which can position you to be very strong on the job market. If your research agenda is not as well-defined as you would like, or if you want to explore other areas or broaden the scope of your research, a postdoctoral position can be a good opportunity for further exploration and professional growth. Also, the first year at an institution is often challenging, and postdoctoral fellowships can help ease the transition. NSF awardees who completed postdoctoral work reported being better prepared to hit the ground running in their first faculty positions than had they gone directly into those positions after graduation.

**There are a variety of ways to find postdoctoral positions.** Many are advertised through popular e-lists such as [AERA](#), [SIG](#), [ISLS](#), or e-lists that intersect with a particular area of research. Doctoral students often learn about postdoctoral opportunities through people in their professional network.

Other resources include:

- [Postdocjobs](#)
- [Findapostdoc](#)

**There are important things to consider before accepting a postdoc position.** Make sure the position will allow you to maintain a balance between teaching, publishing, and project work. It is important to remain productive on the scholarship side while further developing your own research agenda and setting yourself up for future work.

**It is possible that some institutions will value postdoctoral fellowships more than others.** For example, a fellowship can be especially valuable if you plan to pursue a career at a research 1 university. Be sure your experience as a postdoctoral researcher is setting you up for the work you want to do at the type of institution you want to be a part of.

# Finding a Faculty Position

## STARTING THE JOB SEARCH

Use the job search as an opportunity to think about who you are as a scholar, your future plans, and what contributions you want to make in your field. If you have not already, engage in self-reflection to begin to identify a long-term research agenda. Ask advisors, mentors, fellow students, and colleagues for advice. Take time to connect the dots on your educational and/or professional path. Figure out how your varied experiences connect with one another. Figuring this out early will help with your professional decision-making.

**You can begin the job search and application process before defending your dissertation, but make sure to strike a balance between the two.** It is recommended that you begin searching for positions and developing your application materials the summer before you graduate and start applying in the fall. If you apply for jobs while you are still a student, make sure that you are prepared to finish your dissertation if you are offered a position. Most institutions will not allow you to start until your dissertation is complete.

**Check for faculty positions on the websites of the institutions you are interested in.** Smaller institutions in particular might not always advertise jobs nationally. You can also find job listings through scholarly associations, through discipline-specific e-lists, or on other sites such as:

- [Higher Ed Jobs](#)
- [Academic 360](#)
- [The PhD Project: Academic Jobs Sites](#)
- [Vitae](#)
- [Academic Keys](#)

**Leverage your professional network to learn about job opportunities.** Let your contacts know that you are on the job market and what types of positions you are looking for; they might know of open positions or be able to make recommendations. Conferences, particularly smaller conferences, can be a great place to network and learn about job opportunities.

Once you identify institutions or positions of interest, consider contacting faculty for informational interviews to learn more about the institutions and their experiences there. The goal is not to sell yourself to a potential employer, but you can be honest about being on the job market.

**If you are truly interested in a position, submit an application even if you do not have all of the required qualifications.** In your cover letter, highlight all of the preferred qualifications you have and indicate that you are willing to grow into the position. You may have experience in your background that makes you an even more desirable candidate than someone who meets all of the required criteria.

## DEVELOPING YOUR APPLICATION

**Know your audience.** Do your homework. Look at course listings. Demonstrate knowledge about the institution, the department, and the program. Know what the institution values. To the extent possible, learn about the people on the search committee and what they care about. Be clear about how your identity and goals fit with the job you are applying for, what you will need to be successful, and where you can be most successful.

**What search committees look for varies by institution.** Some want to see publications in top-tier journals, whereas others prefer publications in journals with high-volume readership. It is assumed that you are a good teacher, but some institutions focus more heavily on teaching experience than others. Experience with funded projects is also a plus. Have a clear understanding of these expectations before you apply. Networking can help you gain this information. You can also look at the profiles and portfolios of recent hires. What does their work look like? This can provide insight into what is expected at a particular institution. *Note: Be cautious of institutions whose expectations are shifting rapidly. Expectations might be shifting faster than the infrastructure to support them.* Understand what supports are in place to help you meet those expectations, particularly in terms of grant writing and publishing.



Search committees examine your career trajectory to understand who you are, what you have accomplished to date, and what goals you have set. Use the application process as an opportunity to tell your story. Committees also want to see evidence that you are well connected to and engaged with your field of study through publications, conferences, and membership in professional associations. As much as they are thinking about what you can offer the institution, they are also thinking about how well they can support you as a scholar. They are considering whether they have the resources necessary to help you succeed or whether another institution would be better able to support you. In addition, there are considerations related to balancing the experiences, backgrounds, and research interests of their department's faculty.

**Devote time to carefully developing your application materials in advance.** Having a CV, cover letter, and adaptable research/teaching/diversity statement will make it easier to tailor each for specific applications and speed up your process.

## CURRICULUM VITAE (CV)

**Include as much relevant detail as possible on your CV.** A CV is not the same as a resume; there is no need to keep it brief. A five-to-seven-page CV is reasonable for someone early in their career. Key information includes:

- ✓ **Education**
- ✓ **Publications**

Include manuscript submissions, articles “in review,” and accepted publications. Do not list all publications together in one section; separate them by peer-reviewed journals, top-tier journals, conference papers, practitioner journals, etc.
- ✓ **Research experience and productivity**
- ✓ **Methodological skill sets**
- ✓ **Proposal writing and/or grant management experience**

Search committees will want to see that you can bring money into the institution.
- ✓ **Teaching experience**

Provide evidence of strong teaching, even if it

is not asked for explicitly. Include courses taught or developed.

- ✓ **Conference presentations and papers**
- ✓ **Administrative experience**

Administrative work is relevant for managing projects.
- ✓ **Technical skills**

Having certain skill sets such as software experience can set you apart from other applicants.
- ✓ **Languages spoken**
- ✗ **Do not include personal information on your CV, such as marital status, children, or activities in nonprofessional organizations.**

Make sure that everything you include is relevant to your professional life.

**Research how best to structure your CV.** Ask yourself, “What do I want the search committee to see first? How do I want to communicate my priorities to them? How do my priorities align with those of the institution?” Think about listing information on your CV so that it aligns with the priorities of the institution. For instance, if an institution prioritizes publications, consider listing your publications first; if it prioritizes teaching, consider listing that experience first.

**Have multiple readers review your CV.** Choose reviewers who are in different positions and at different levels in their career trajectories; their input will offer you diverse perspectives.

## COVER LETTER

**Use your cover letter to communicate everything you want the search committee to know about you.** Highlight your strengths, and let them use your CV and statements to learn more. Your cover letter is arguably the most important part of your application. If you do not capture their attention in the letter, committee members are not likely to read further.

**In your cover letter, directly address the position for which you are applying.** Do not just recycle the same cover letter for every application. Convey your interest in

the institution, and align your letter with the missions of both the institution and the department. Let them know why you are interested in them, what **you can** contribute, and what you can learn. Speak to all qualifications (minimum and preferred) listed in the job posting. Be specific and targeted; do not use generic language. It is obvious to search committees when applicants have recycled application materials and have not taken the time to tailor the application to each position.

**Use your cover letter to connect the dots.** If you have worked in a variety of fields, your CV might not easily convey that you are a good fit. Use your cover letter to complete the story, fill in any gaps, and demonstrate how your past experiences build on one another. This will make it easier for committee members to advocate for you.

## RESEARCH, TEACHING, AND DIVERSITY STATEMENTS

**Start developing these statements early. Consider working on them iteratively.** Write early drafts, set them aside for a few days, and keep returning to them until they are polished. Ask colleagues and others in your network to review them and offer feedback. Consider developing your statements simultaneously to help you communicate how your research, teaching, and commitment to equity inform and build off of each other.

**Many institutions require a diversity or equity statement.** Take time to think about how your work addresses issues of access, diversity, or equity in education. If you do not address issues of equity in your research, you might use this opportunity to think about how you can.

## LETTERS OF REFERENCE

**Part of applying for jobs is managing the people who are writing your reference letters.** One technique is to provide them with your CV and your statements in advance and alert them to job postings as you come across them. Keep a shared, up-to-date list of the positions you are applying for that includes the name of the institution, department, and program; name and address of the contact at the institution; a brief description of the job; a link to the posting; and the application deadline. Your references may be writing letters for multiple students, so be organized and thorough in the information you provide; help them help you.

## PREPARING FOR A CAMPUS VISIT AND IN-PERSON INTERVIEW

**The interview process generally begins with a phone or virtual interview to narrow the applicant pool.** These interviews are brief, about 30 minutes on average, so you need to be able to respond to questions succinctly. Research common phone interview questions, develop concise answers in advance, and practice, practice, practice.

**If the search committee invites you for an in-person interview and campus visit, this generally means that you meet the basic qualifications for the position.** Now, they are looking for the best fit.

**If accepting a position will require relocation, now is the time to explore the possibility of your spouse or partner working at the same institution.** A good time to introduce the idea of a dual hire to the search committee chair is between the phone interview and the in-person interview. Share your spouse or partner's CV information with the chair so the committee can begin a conversation with other departments to see what opportunities might exist for them. Do not wait until you are offered the job to mention this; it won't be impossible, but may be more difficult, to accommodate your spouse or partner later in the process.

**When you arrive on campus, recognize that you are always being interviewed, not just during the formal interview but also during other meetings, group meals, and informal social time.** In addition to assessing your scholarship, research agenda, eligibility for promotion and tenure, and potential to become a leader in your field, the search committee is also determining how well you would fit in with existing faculty and staff. They want to get a well-rounded picture of who you are.

**Be prepared for long days.** The campus visit and interview is a grueling process. In addition to the formal interview, you will be expected to give a job talk, meet with other faculty, tour the campus, and possibly teach all or part of a class. Ask the search committee about these expectations before your visit. While the days are likely to feel overwhelming, if these activities excite and energize you, it might be a sign that the institution is a good fit.

**Before your formal interview, consider developing a list of common interview questions and writing out your**

**responses to them.** Review this list again and again in preparation. You know the answers, and you know how to talk about your research, but it can be easy to forget important details in the moment.

**Come with questions. Not asking questions is a red flag.** Questions will likely arise naturally during the visit, but prepare a few in advance as well. You should know who you will be meeting with during your visit before you arrive; research those people—read their bios and some of their articles and mentally prepare for your conversations with them, especially if your personality is more introverted. Consider asking several faculty members similar questions about the department or program so you can gain multiple perspectives.

**If your research involves work in schools, examine the relationships between local schools, nonprofits, community organizations, and the university.** Check out their respective websites for lists of community partners. Ask to visit schools and organizations and talk with university partners as part of your campus visit. Communicate to the search committee the importance of these relationships to your work. This will help both you and the search committee better understand what you need in order to be successful and whether your scholarship is a good fit with the institution.

**Remember that you are interviewing them, too.** If it has not already been communicated, ask explicitly for a breakdown of responsibilities, the department's expectations for scholarship in the first year, and criteria for tenure (number and types of publications, grant funding, etc.). If you feel comfortable, state your mission as an early career researcher, and ask how they're going to help you grow as a scholar. Ask about what supports they have in place to help junior faculty be successful researchers (e.g., pre-tenure sabbatical, early course release, good start-up package to support your research, mentorship). Having answers to these questions lets you know that even if expectations are high, they are trying to help you succeed.

## JOB TALK

The job talk, or research talk, is your main research presentation during the interview. For early career scholars, the substance of your job talk often comes from your dissertation work. If during graduate school you

worked on projects that do not align closely with your research interests, identify experience or knowledge gain that is transferrable and how it contributes to your future research agenda. The main goal of the job talk is to communicate your research agenda and describe how it builds on the work you have done previously, how it relates to your professional goals, and how it contributes to broader themes in your field.

**Practice your job talk ahead of your campus visit.** Practice, whether virtually or in person, with a range of people in your network (peers, advisors/mentors, people at different institutions, and people with varying levels of familiarity with your work). Use their feedback to inform your final presentation.

**Demonstrate how your research agenda connects to the position for which you are applying.** The search committee is trying to hire a particular type of scholar for the position and wants to learn more about you, your work, and the kinds of theoretical and conceptual frameworks that ground your research.

**Think of the job talk as a conference presentation.** Job talks vary by institution, so ask the search committee about the format for the job talk before your campus visit. Expect to be presenting to faculty from various departments, and be prepared for tough questions. Use your time wisely. Speak passionately about your research interests. Explain why you want to study these particular research questions, what impact you think this work will have, and how it fits into broader themes you care about. Be succinct and focused, but not too narrow. Do not focus on just one aspect of your work; rather, speak to the broader parameters of your work. Give general descriptions of your methodology, the types of studies you want to propose, and the kinds of participants with whom you want to work. Keep the language general and invite follow-up questions.

**You will likely be required to give a teaching talk or demonstration in addition to your research talk.** Get as much information as you can from the committee so that you can design your presentation to meet their specifications. If it is a teaching demonstration, ask about the audience (undergraduate, graduate), the content area, specifics about what they need to do or learn, and

how many people will attend. Make your talk or demonstration interactive; if you plan to use technology, have a plan B in case something goes wrong. If you are required to teach a course you are not as experienced with, ask colleagues or others in your network to help you with the content and design.

**Overall, highlight your accomplishments and show that your research program has promise during your campus visit.** Although your scholarly accomplishments are likely comparatively small, that is okay and expected at this stage of your career. Demonstrate what your research program offers and how you are going to work with others; mention publication or proposal ideas, even if they're in the early stages; and describe your potential to be a leader in your field. Paint them a picture of what you would be like working in their department.

## WAITING TO HEAR FROM THE COMMITTEE

**Following your campus visit, follow up with everyone you met and thank them for their time.**

**Know that hiring is a slow and bureaucratic process.** Stay in contact with the search committee, and try not to get discouraged. If after the campus visit and in-person interview the institution does not offer you a position, try not to take it personally. There are many variables in terms of what committees are looking for in a new hire. Someplace else is a better fit for you. It is hard to know exactly why an institution did not hire you, but try to get as much information as possible so you can use that information to strengthen your candidacy.

# Considering a Job Offer

**If the university offers you a position, negotiate for the things that matter to you.** Be serious about your interests; you are the only one who is representing them.

**Negotiation is an expected part of the process.** While the process is unique to each institution, it is likely you will be contacted via phone or email with an offer. Thank them, and let them know you will get back to them. Consult with colleagues to find out what you can ask for

and how to do so successfully. (This is something you can ask faculty about during your campus visit.) Make a list of all the things you need/want and then prioritize them. Know what you are willing to compromise on and what is non-negotiable. When an institution cannot meet every ask, sometimes they will counter with things they can offer you instead.

**Know ahead of time whether the offered salary is appropriate for your level of experience.** Salary information for public universities is usually available online. It might not always be easy to find, but it is publicly available. Do research to see what others at your level are earning. If you will be relocating for the job, factor in differences in cost of living, including differences in income tax by state. Ask for what you need and what you think you deserve, but understand that when it comes to salary, not everything is within the search committee's control.

**Negotiate for non-salary benefits.** Salary is important, but it is not the only factor. Determine beforehand what you need to be successful. Will you need graduate students or other research assistance? course release? start-up money or discretionary funds? equipment? professional organization dues? travel funds? Your arguments are stronger if you present these requests in the context of the work you want to do in the first few years. Make a case for needing those things for you to be productive. Do not forget to compare other benefits such as healthcare or retirement/pension plans among different institutions. If you have to relocate, ask whether the institution is able to cover the associated costs.

**Be strategic in your negotiations.** Think about what you need in the short and long terms. When might you benefit most from having a graduate teaching or research assistant? Does it make sense to have one in the first year when you are just getting settled or will you have a more productive relationship in year two or three? When might you need a reduced course load to do your research? Make sure you are meeting your immediate needs and setting yourself up for future work.

**Think about how important work-life balance is to you when choosing an institution.** During your campus visit, ask about your colleagues' work-life balance. Know that balance is easier to achieve at some institutions than others.



**Consider the broader community beyond the institution.** Does the location offer what you need to be personally as well as professionally fulfilled?

## After You Are Hired

**Work to build relationships with people inside and outside of your department.** Faculty in your department have been where you are and can share their experiences. You can also learn about how they are conducting research. Administrative staff know the ins and outs of your department and can help you learn the ropes. Gaining perspectives from other disciplines can help strengthen your research. For instance, STEM education researchers can benefit from establishing partnerships with content area experts. Building relationships with colleagues in the research office and communications office at your institution will help you when it comes time to apply for grant funding and disseminate your work.

**Develop a detailed timeline for getting started.** Plan what you want to accomplish in your first five years, and then begin to break it down by year, month, and week to identify concrete tasks and realistic benchmarks. This will help you monitor your progress. Get advice from trusted colleagues about how to manage your time during your first few years.

**Know that it will take time to get into a routine, and be patient with yourself.** You will spend a lot of time developing your courses and teaching, which may take focus away from your research. Once you become more comfortable in the classroom and know what to expect from students, eventually you will be able to plan ahead and find a rhythm in your teaching. This will make balancing teaching with your research and other responsibilities easier.

### TENURE

**Make a conscious decision to choose the tenure track or not.** Understand what it entails and make sure it aligns with your goals. Know that with or without tenure, you will land on your feet. There are always other options—in industry, at nonprofits, or at other institutions with different foci.

**Ask about tenure expectations upfront.** They hired you because they thought you could be successful, so make sure you understand the tenure promotion process. Talk about tenure requirements because they can change. Ask people, especially newer faculty, how the process worked for them. Some of them might even be willing to share their tenure materials with you to help demystify the process.

**Continue ongoing conversations about tenure with those in your department and beyond.** If you remain engaged with the process, you will know in advance how likely it is that you will get tenure. If it looks unlikely or questionable, you will have time to plan. But you have to know whether you are on track; feedback from formal and informal mentors can help with this. If you are not on track for tenure, it is likely you are not at the right place to be able to do your work successfully.

**Consider creating a document or electronic file to record everything you do that can count toward tenure.** This is especially useful for items that are difficult to document on your CV.

### WORK-LIFE BALANCE

**Achieving balance between your professional and personal lives involves continuous attention, negotiation, and creativity.** Figure out your processes. Find ways to remain organized; it will save you time in the long run. For example, update your CV on a regular basis or keep track of references using a system that works for you.

### CHANGING JOBS

**New opportunities may arise at other institutions.** You can learn something valuable at each institution you work and make connections with new colleagues. Moving around to different institutions can give you a sense of how different universities operate, expose you to new people and new ideas, and offer insights into how ideas play out in different contexts. Do not overlook opportunities for growth within the same institution. You can work with new colleagues, begin new projects, take classes, develop new research interests, and teach new courses.

**Know that institutions take notice if a potential hire has moved around a lot.** Search committees are looking for long-term investments in faculty, so they may wonder how



long you will stay with them and whether you are too risky an investment. Make sure you can explain your decisions, and be upfront about the changes that led to those decisions.

**Remember that you are part of a larger research community.** When considering future opportunities, think about how you can contribute to those broader networks. Figure out what you need in order to make the impact you want to have.

**It is possible to balance your academic work with consultancy work.** These opportunities often arise through your connections in the field (professional development opportunities, speaking engagements, etc.). If you are able to carve out a niche for yourself by having a unique set of skills or expertise, it can open doors for consultancy work or even future research collaborations.

**If you decide to leave academia for another opportunity but think you might want to return someday, make sure you continue publishing and presenting at conferences.** It is important to keep your name and work present in the field.

## Additional Resources

- [Academic Job Search—The Hiring Process from the Other Side](#)
- [Becoming a Job Candidate: The Timetable for Your Search](#)
- [From PhD to Professor: Advice for Landing Your First Academic Position](#)
- [Graduate Student Resource for Choosing a Postdoc](#)
- [Maximize Your Chances of Landing a Faculty Job](#)
- [Preparing for Academic Interviews: Screening, Conference, and On-Campus](#)
- [You are Not Prepared: Some Advice I've Received on How to be a Professor](#)

[Additional resources](#) available at [cadrek12.org](http://cadrek12.org).

# Tips for Pursuing Non-Academic Careers

*“It is important to be driven by the excitement of the work, wherever that takes you.”*

## Paths to Non-Academic Careers



The large and diverse field of education offers many career possibilities. While many early career education researchers choose to pursue careers in academia, others prefer to establish careers outside of a university setting. The possibilities include public sector departments (federal and state departments of education, county and local school districts, or policymaking organizations), research and development groups and think tanks (nonprofit organizations or for-profit companies), cultural organizations and out-of-school programs, and a variety of start-up companies. Some professionals cite collaborative work environments and flexibility as reasons for pursuing careers outside of academia. Ultimately, you have to decide which path is right for you. You want to be in a place where there are good ideas and you can make a difference in implementing those good ideas. Sometimes it is hard to know early in your career exactly what you want to do, and it can be challenging to plan in advance when there are so many options. Often it is a matter of being in the right place at the right time and having different experiences so you can assess your interests, performance, and career satisfaction. For most people, it is about defining your professional agenda (e.g., research, professional development, curriculum development, assessment, evaluation, instructional design, specific grades levels, or school-to-work), deciding how best to develop yourself professionally, and taking advantage of different opportunities to pursue that work. It is important to be driven by the excitement of the work, wherever that takes you.

# Finding a Position

## PREPARING FOR THE JOB SEARCH

Engage in reflection and self-assessment. Ask yourself:

- What kind of work do I want to do? Am I interested in foundational research, policymaking and advocacy, professional development, and/or curriculum development?
- Why do I want to do this work?
- What do I need to be able to do this work?
- Who is doing related work I think is important?

**Graduate students are socialized for an academic position.** If you get the sense that academia might not be right for you, think about the parts of your work that make you feel the most energized and excited and what that work could look like in a non-academic setting. Consider what you would be giving up by not going the academic route, and ask yourself whether you are okay with that.

## IDENTIFY ORGANIZATIONS THAT ARE A GOOD FIT FOR YOU

**Research the types of organizations and groups that do the kind of work that most interests you.** Unfortunately, there is not one particular clearinghouse to help you zero in on specific organizations; searching may require a lot of time and effort. You can start with internet searches, exploring websites of organizations you have identified, searching sites such as LinkedIn, or going directly to HR departments of particular organizations. You might think about accessing social media sites to find colleagues who work at or know of organizations that may interest you.

**Think about your identity as a STEM education professional and whether an organization will allow you to work in an area that aligns with your knowledge, skills, interests, and goals.** Compare your career goals and, if appropriate, research goals with the mission and strategic goals of the organization. Know what supports are in place to help you develop the skills necessary to do this work. Understand how the organization staffs projects. What is the process for continuing a strand of work? How likely is it you could be focusing on work that does not align with your professional goals?

**Network.** Networking is one of the best ways to figure out if a career path, organization, or job is right for you. Identify individuals who are doing work that interests you and get in touch with them through email or at conferences. As you identify organizations and specific STEM education leaders, set up informational interviews to learn more about the work of the organization, and gauge whether it might be a good fit for your professional pathway. However, only reach out to people if you are truly interested in their work and/or the work of the organization.

**Keep informational interviews short.** Aim for about 20-25 minutes. If you find you have a lot to discuss, it is okay to let the conversation run longer, but be respectful of the other person's time. Set a goal for the conversation, and develop a list of clear, targeted questions to help you get the information you need.

**The best time to reach out and make connections is before you are on the job market.** Getting your name out there early can be advantageous when your job search begins. People will be more likely to speak with you if they do not feel pressured to offer you a position.

**Ask your contacts at organizations that interest you if you can submit your resume to them.** If they think you are a good fit with an organization, those contacts will often pass around your resume to other colleagues even if they do not have an open position at that time. Keep in touch with your contacts to learn about upcoming job opportunities. In the meantime, and if you have some time to spare, ask your contacts about volunteer opportunities. Volunteering can help you get a sense of whether an organization is right for you.

## JOB POSTINGS

**Most organizations include job listings on their websites and other job boards.** Professional associations sometime promote job postings through databases and e-lists. Public sector jobs in education are listed on state department of education websites. Some organizations will allow you to submit a resume or CV online and will contact you if positions become available that align with your skills.

The job outlook varies, particularly in the nonprofit sector. At organizations funded through “soft money” (i.e., grants, contracts, etc.), employment opportunities are dependent on the needs of individual projects, and hiring often occurs on a rolling basis. For some organizations, new projects are often announced in the fall. For school district positions, the goal is to hire before school begins; for policy positions, before the legislative session starts. Overall, the hiring process tends to be quicker for non-academic positions.

## DEVELOPING YOUR APPLICATION

Hiring is usually done by project staff rather than the human resources department, so knowing someone at an organization is beneficial. Hiring is typically a group decision, and committees can include representatives from the different areas within the organization with whom you will interact on the job.

Hiring committees are interested in well-rounded applicants whose expertise can be broadly applied across a variety of projects and roles. Think about how to present yourself in the best light, which may mean demonstrating deep knowledge in one area but also experience in, understanding of, and interest for other areas. Having a diverse background can make you a competitive candidate. Hiring committees want to understand an applicant’s vision. They want to see a commitment to professional growth and have a clear sense of what you hope to accomplish in your profession. This will help them assess whether the position or organization is a good match.

Organizations are interested in hiring people at different stages of their career trajectory. If a position calls for a doctorate degree, employers will sometimes consider an applicant who will soon graduate. Depending on the position, there may be organizations specifically looking for recent graduates. It is also possible to begin the interview process while you are still a student with the expectation that you will begin working after graduation. It is worth it to begin making connections early rather than waiting until you are on the job market.

## RESUMES AND CVS

Depending on the job description and the type of organization you are applying to, some things to highlight on your resume/CV might include:

- ✓ Relevant degrees
- ✓ Professional training
- ✓ Research experience
- ✓ Content knowledge
- ✓ Relevant skill sets
- ✓ Evidence of experience applying knowledge and skills in a similar setting
- ✓ Publication record (experience with writing, publishing, and dissemination)
- ✓ Teaching experience
- ✓ Methodological skills
- ✓ Evidence of leadership
- ✓ Technical skills
- ✓ Fundraising experience
- ✓ Evidence that your work is contributing to an area of STEM education research, development, practice, and/or policy.

This list is tailored primarily to early career individuals looking for research positions, so adjust accordingly. For instance, if you are applying for a position to lead professional development, include information on sessions you have led or instructional guides you may have created. If you are looking for a position in policymaking, emphasize your knowledge of state and federal STEM education legislation.

## COVER LETTER

Compose a strong cover letter to make your application stand out. Be sure to highlight the skills and experience they are looking for; you can tailor your letter to the position using language from the job posting. With the advent of electronic applications, it can be tempting to get lazy with your letter. Do not let this happen. Be creative. Your cover letter is often what sets you apart from other applicants and conveys your personality. The goal is to get an interview.

**If you are truly interested in a position, submit an application even if you do not have all of the required qualifications.** Sometimes organizations need to hire a specific person with a specific skill set; other times they are looking for a well-rounded candidate to join a research team. You won't necessarily know which type of candidate they are looking for from the job description. In your cover letter, highlight all of the preferred qualifications you have and indicate that you are working toward the required qualifications that are missing. Show that you are willing to grow into the position. It may also help to note any unique skills or experiences you have that may set you apart from other applicants.

## PREPARING FOR AN INTERVIEW AND/OR JOB TALK

**Be willing to travel for an interview if you can.** Most organizations will conduct at least one phone or virtual interview first and then follow up with an in-person interview if they are interested in you as a candidate. Virtual interviews are limiting, and your willingness to travel shows dedication and commitment. However, there are many examples of excellent candidates, with positive results, who interviewed online. Therefore, if you do not have travel funds, do not let it stop you from pursuing an interview.

**Ask the hiring committee about the format for the interview beforehand.** The expectations for interviews and job talks vary by organization and position, so understanding those expectations will help you prepare.

**For research positions, a job talk is often part of the interview process.** This will be an opportunity to showcase your main research thus far and how it fits into a larger research agenda. For early career professionals, the substance of your job talk often comes from your dissertation work. Be prepared to discuss what motivates your research, describe your methodology, and communicate your findings. Hiring committees are looking to assess the quality of the work you have done, understand whether your empirical skills align with the work of the organization, and find out how well you understand the policy or other contextual implications of your work.

**Be prepared to speak about how you can contribute to the culture of the organization.** In addition to

assessing your scholarly qualifications for the position, hiring committees also want to assess whether you are a good fit for the organizational culture. They may be looking for people who can work independently as well as in teams, who are good communicators, and who have experience in diverse workplaces. A history of building strong relationships with colleagues and external partners is a plus for many positions.

**In both the interview and the job talk, describe what you can offer the organization as well as what you can learn from it.** Convey why hiring you will be mutually beneficial.

**Hiring committees will sometimes request a writing sample in addition to a job talk.** This allows them to assess how well you present your work both orally and in writing.

**Always follow up after the interview.** Take the time to thank the members of the hiring committee for meeting with you. Remain in communication with your contact on the committee. Remember that while this job might be highest on your list of priorities, members of the hiring committee are juggling the hiring process with many other professional responsibilities. Do not be pushy, but remaining in contact will help the committee remember you and will show your continued interest in the position.

## Considering a Job Offer

**Explore whether there is likely to be a fundraising aspect to the position.** If so, you will need to think strategically about how to obtain and sustain funding for your work, particularly if the organization operates primarily on external funding, or soft money. You have to enjoy that aspect of the work and be confident that you can do it well.

**Learn if there are ups and downs in terms of funding cycles.** Some positions require paying attention to funding trends and ensuring that your organization is positioned to be competitive. You must be prepared to deal with funding uncertainties; only you can decide if you are comfortable with this situation. Organizations that depend



on external funding are not able to make a long-term commitment to you (e.g., public-sector positions that may require the passage of legislative or school committee budgets).

**Do research to learn the typical salary range of someone in your position.** Talk to people in your network. Ask about starting base salary ranges as they relate to position, education level, professional experience, and geographic location. Advocate for yourself. Do not be afraid to ask for what you think you are worth, but be informed about what is common. Make sure you also understand the opportunities and expectations for advancement within the organization.

**Make sure you understand the benefits package.** Benefits, such as vacation or sick time, are typically non-negotiable. There is no harm in asking the human resources department specific questions about benefit flexibility, but be careful not to seem too pushy with the hiring committee.

**During the negotiation process, explain what is important to you and what you need to be successful.** Be open about your needs, but approach the negotiation as a flexible discussion rather than a demand or deal breaker. Sometimes non-academic organizations do not have as much flexibility when it comes to negotiations, but they might be able to offer help with moving expenses, attending conferences, or professional association memberships. Make sure you understand the organization's policies regarding flex time, working remotely, or part-time work and how those policies apply to you.

**If you interview for a job at an organization you like but are not hired the first time, do not give up.** There are new projects beginning all the time, and it helps to have already made a connection with that organization. Your persistence demonstrates that you are genuinely interested in the work of that organization.

## After You Are Hired

**Always think about what comes next and how to position yourself well to continue doing the work you care about.** Once you are hired at an organization, there will likely be opportunities to move around within the organization.

Organizations often post jobs internally first and try to match people based on their research interests. Still, do not give the impression that you are accepting a position that you are not really interested in just to get your foot in the door. When considering future opportunities, make sure you are continuing to build your portfolio in a way that is consistent with your career goals.

**Maintain and expand your networks.** Creating and sustaining partnerships is an essential part of much of the work in STEM education; make sure to keep in touch with colleagues from different types of institutions (e.g., academic, nonprofit, private sector) and continue to build new relationships.

**If you think you might be interested in eventually pursuing an academic career, stay informed about what is expected in order to enter academia and work to remain eligible.** It is challenging, but not impossible, to transition from a non-academic to an academic position. Keeping up with publishing in the non-academic world is difficult, but it is easier at some organizations than others. Ask about institutional support for this. For example, is publishing a requirement for promotion? If you write grants, include funding for manuscript preparation, publishing, and dissemination in your proposals. Presenting at conferences and writing conference papers can help you keep your name and work in the field. Collaborating with partners at academic institutions is another way to keep a foot in both worlds. Knowing what is expected in both non-academic and academic fields can help you make professional decisions that won't limit your options later on.

**Understand that workloads can ebb and flow. Very few professional careers allow you to keep a 9-to-5 schedule.** Try to figure out the work schedules of people with whom you will be collaborating most closely. Do they have busy periods and lighter periods? During the busy periods, do they stay late at the office? Do they work at home in the evenings or weekends? Are there times that are more and less busy? Decide whether this aligns with the level of work-life balance that you want to maintain. Realize that you may need to say "no" to some opportunities in order to maintain that balance. Most likely, there will be other opportunities. With time and experience, you will have a better sense of your capacity to take on additional tasks, but do not stretch yourself too thin early on.

# Additional Resources

- [20 Transferable Skills for PhDs](#)
- [An Academic's Guide to Getting a Non-Academic Job](#)
- [Converting a Curriculum Vitae to Resume](#)
- [Top 10 Nonprofit Job Hunting Tips](#)
- [Why it's Not a 'Failure' to Leave Academia](#)
- [Working in Industry vs Academia: Which is Right for You?](#)

[Additional resources](#) available at [cadrek12.org](http://cadrek12.org).

# Tips for Writing for Publication



*“How does publishing fit into your current career path and your overall research agenda?”*

## Developing an Idea for Your Manuscript



Deciding what to publish requires a lot of self-reflection; think about where you are now and consider possible professional trajectories. How does publishing fit into your current career path and your overall research agenda? If you are new to the publishing world, do research and connect with others to help examine the terrain. Understand the assets and limitations of various types of publishing venues (specifically practitioner journals and research journals), and decide the role each kind of publication will play in your professional path.

Think about what is missing from the current body of knowledge in your field and what could make a good contribution. It is critical to determine what you can add to the existing literature on the topic. When looking at your data, consider what new conclusions you can contribute and what new questions have arisen.

If your institutional access to journals is limited, consider alternative ways to access current literature in your field. Keep an eye out for open-access days for particular journals or open-access articles. You can access articles through [ResearchGate](#) or [Academia](#), and use the platforms to find authors to reach out to about their work. If you find an abstract that appeals to you, contact the author (their email addresses are included). Authors are usually able to share copies of their articles privately.

If you are curious about a phenomenon you observed in your research or practice, do not let it pass. Explore the literature to learn what has already been studied and published about that phenomenon. This may be a starting point for a research topic.

For doctoral students, you do not have to wait until your dissertation is complete before you begin publishing. While you are collecting and analyzing your data, consider submitting a manuscript based on your literature review or conceptual framework. This is good preparation for your future work on projects, when you should also engage in dissemination before the research is complete.

You can recycle old ideas, but they might need to be updated. Ask yourself, “Is my argument still relevant? Does it need to be reframed?” Find out what new literature exists and how you can contribute to the current conversation.

Get organized around your research question. Ask yourself:

- What do I need to do to start to make sense of this question?
- What audience would be interested in this question?
- Who on my research team might want to collaborate?

In addition, consider the following questions:

- Whose ideas and writing style do I like?
- What do I like to read? Why?
- What kind of writer do I want to be?

Make your idea public. Share your research question(s) with your advisor, mentor, or research team even if you think they are underdeveloped. In this way, you will get useful feedback to help you move forward, but you are also taking ownership over the idea. Continue to consult with these individuals as you progress.

A conference presentation/paper can produce a pre-publication. Presenting an idea that you want to write about at a conference is an opportunity to get feedback from peers before beginning your manuscript. Attendees may even have suggestions for appropriate journals. And even if your conference proposal is rejected, you still receive useful feedback that can help shape your manuscript.

As an early career researcher, focus on publishing first (from your dissertation or other data you collected

during graduate school) and then begin thinking about writing grants. Projects require a lot of work before you have results to publish. Make sure you are in a position to be publishing.

## The Writing Process

Focus on the process of writing; do not fixate on the finished product. Liken the writing process to something else in your life—something challenging but manageable, for example, running a marathon. You can make the process less daunting if you connect it with something you already know how to navigate. Think about intentionality, time commitment, and potential obstacles in both undertakings. Know that writing is hard, iterative work and that going through multiple drafts is normal. When you read an article by more experienced colleagues, remember that you are seeing their final product, not the messy process that led to the publication.

Structure your writing time. Create a timeline with daily, weekly, and monthly goals for your writing projects with strict deadlines. Developing a writing management system will help you track your progress and manage multiple writing projects. Use tools like Excel or Google Docs to create a timeline document that can easily be shared. Remember that identifying a realistic timeline gets easier with practice.

Set aside large blocks of time early in the process to get your head around your data, the message you want to communicate, and how you are going to situate it in existing literature. Having a firm grasp on this in the beginning will make it easier to devote smaller amounts of time to filling in the details, which will help with productivity.

Write regularly. Publishing is particularly important for early career professionals. Do not stretch yourself so thin with other professional commitments that you cannot make time for publishing. Figure out a system that works best with your schedule and for your writing style, and stick to it. Consider scheduling time to write every day, even if it is for only 30 minutes. Or, set aside several large blocks of time during the week. Mark it on your calendar.

**Do not treat it as flexible time; it is easy to put off if you do not make it a habit.** Schedule your writing during the time of day in which you are most productive, and then write. It does not have to be perfect; it is only a draft. Just get the ideas on paper, and you can polish them later.

**Consider finding a writing partner or forming a writing group, and meet consistently.** This could include members of your research team, mentors, or even peers outside of your department/field. We do our best work in collaboration with others. Together you can share ideas or review each other's drafts. Find people you trust who will be accountable to your writing commitments and who will provide valuable feedback to make your work stronger. Writing partnerships and groups may or may not result in co-authorship.

**You may find it helpful to keep a writing manual on hand (e.g., APA 6th edition).** If possible, develop your initial manuscript following the basic guidelines for writing. This will save time in the end and help you develop good writing habits.

**It is common to face challenges when analyzing your data, and it is normal to feel overwhelmed.** Hold on and be patient! With persistence, you will eventually start to see the pattern.

**The author(s) that you heavily cited in your study may be a source of help.** Do not hesitate to contact them for advice. Some researchers may even provide further suggestions for your study.

**Be creative in framing your data to appeal to different audiences.** It is possible to use the same data set for multiple publications aimed at different audiences. This is especially true if you have several research questions addressing different aspects of your project. Think about how to write papers with different foci or perspectives. As an example, you can write one article about the results of your study and another on your professional development model. As you conceptualize your ideas, figure out how to connect your work with different topics both in and outside of your field. This will require drawing on different literature, assessing the gaps in a particular field, and determining how your research will build on the literature and address existing gaps.

**When writing, pay attention to the following:**

- Make sure the wording of your **title** clearly conveys what the article is about.
- Choose **keywords** that accurately capture the main focus of the article and function as search terms.
- Develop the **abstract** by providing highlighting key findings and summarizing the article.
- Use **headings and subheadings** as tools for organizing the paper, clearly outlining the logic underlying the paper, and providing a flow to the narrative.

**Give consideration to ethical issues such as:**

- **Plagiarism:** Be aware of the guidelines for including figures, tables, data, or wording from other published or unpublished papers without citation.
- **Duplicate publication:** Do not submit the same paper or parts of the paper to more than one place.
- **Falsification or fabrication:** Do not alter data or use false data to strengthen the study's findings.
- **Human welfare issues:** You must always treat human subjects in a way that aligns with research and journal policy.
- **Conflict of interest:** Be aware of situations in which you are in a position to derive personal benefit from actions made in your professional position.
- **Authorship:** Be sensitive to issues related to the addition, deletion, or changing of the order of authors on a manuscript.
- **Critique:** If you are critiquing the work of others, do so in an appropriate and scholarly way.
- **Self-citation:** Be mindful of too much self-citation. You are one voice attempting to join a bigger conversation that has been going on for some time. Make sure your work builds on those you are citing and that you do justice to the conversation occurring in the field.

## Navigating Authorship

If you choose to write a paper with others, have an explicit conversation with co-authors about responsibilities before you begin, especially if it is the first time you are working together. Discuss and document the agreements. Consider defining levels of co-authorship:



What level of contribution is expected for first author, second, third, and so on? At the same time, understand that setting concrete, universally applicable guidelines is difficult since circumstances can change during the course of the writing process. Revisit your co-authorship agreement at the end to make sure the contributions and levels of effort match with what was initially agreed.

**There are many ways to determine authorship, so it is important to establish early on what method you intend to use.** Sometimes project leads are the first or last author. Other times the team member who initiated the idea is the first author. Some teams choose to rotate first authorship. Sometimes authorship depends on the level of contribution of each author and is determined after the writing is complete. If all authors have the same level of contribution, names can be listed alphabetically or randomly with a footnote to indicate equal contributions.

**Find out whether there are policies in place for determining authorship at your institution.** In addition, know what your institution values in terms of authorship. What are the cultural norms—the unspoken rules? For example, does your department or institution favor solo or group authorship? How important is first authorship? If you are in a non-academic setting, what priority is there for publishing? How is time for writing compensated?

**If you decide to do a postdoctoral fellowship, be sure to carve out a body of work within your PI's larger project to make a unique contribution with your name on it.** Some institutions do not consider single-author articles you publish during graduate school or from your dissertation to be truly solo papers since you are under the direction of your advisor or PI. You may not improve your career prospects greatly if you publish only with the project team. When listing co-authored papers on your CV, note your specific contribution.

**There are a variety of ways to structure collaborative writing.** One person can take on the bulk of the writing with other authors responsible for feedback and revisions. You can delegate sections to different authors and then have one person prepare the final manuscript to ensure coherency and flow. You can all write together, physically in the same room or virtually in a collaborative online space. Writing tasks are often negotiated based on availability, so figure out what works best for you and your team.

**Being first author often means more than just leading the writing process.** It also entails attending to the administrative tasks required for revising and/or resubmitting. First authors should be charged with structuring reviewers' comments and leading discussions about revisions with your team.

## Deciding Where to Submit

**When deciding where to submit your work, ask yourself:**

- Who is my audience? What are those people reading?
- Where are other articles like this published?
- What journals am I citing in my own work?

**Research the journals in your field.** Every journal has a different style. Read the requirements for submission and the journal's mission statement. Determine the journal's standard of rigor, scope of topics, and breadth of the literature that should be included in references. Review several issues of a journal, and pay attention to the methods that make it through the review process. Ask yourself questions like:

- Is the main point I want to make consistent with the topics covered by the journal?
- Do I need to modify the way I am writing the article to match the style of the journal?

**Do some investigative work to determine which journals are credible.** Know that weight given to impact factor varies by field. Review the articles and assess their quality. Check the citation rate; heavily cited articles are a good indicator that the journal is legitimate. Your advisors, mentors, or colleagues can offer insight as well.

**Review your reference list to see where the people you are citing have published and read those journals.**

**Research the editorial boards of journals that interest you.** A quick search on Google Scholar can offer insight into an editor's work. This is important because editors are responsible for selecting reviewers. The more

an editor knows about your area of work, the more likely they will choose appropriate reviewers.

**Make sure your work fits but also offers something new.**

Pay close attention to the publishing trends over the past couple of years. Read relevant articles in a journal you want to publish in, and cite those works in an authentic way. Connect your work with the work these journals are publishing so you know you are reaching your intended audience. Add your voice to the conversation they are already having.

**Keep an eye out for special journal issues that relate to your area of interest.** Special issues typically have quicker review processes and less competition. Editors will likely be more willing to work with you to make your article fit.

**Research the review processes and timelines for different journals.** The average length of the review process varies depending on the journal. Figure out the journals' timelines. Do they review monthly? Every six months? How often do they publish issues? Decide how quickly you need to publish and how long you can wait for a response. Journals with the highest impact have a greater number of submissions; therefore, the review process is much longer. Junior scholars typically cannot wait two plus years for their first publication. Understanding the review processes for different journals will help you find one that fits your timeline.

**Reach out to lead editors with pre-submission inquiries.**

This is especially useful if you are unfamiliar with the journal. Keep in mind, however, that editors are committed to reviewing full manuscripts rather than preliminary ideas. Send a concise message and brief abstract to gauge whether your idea is a good fit for a particular publication. Rely on advisors or mentors for more substantive feedback on the quality of your idea. Understand that editorship changes, which can affect what a journal is looking for. Decide how committed you are to making your work fit that particular outlet.

**If you are just starting out in a line of research or as first author, begin with modest aspirations.** Pay attention to the credentials of the authors in various journals. Be realistic and consider options beyond just the top-tier journals. Ask colleagues/peers to help you identify an appropriate starting point. This does not mean you should not submit to top-tier journals, but that you should explore

other options as well. Even if your manuscript is rejected by a top-tier journal, these publications usually have great reviewers who provide high-quality feedback that can help strengthen your manuscript or even influence the overall direction of your research.

**Diversity in publication matters, especially in academia.**

You want to be publishing in a variety of journals. Figure out what is common practice based on your career goals. Publishing is always good—no matter what—but do your research and connect with people who are doing the type of work you want to be doing.

**Where are they publishing?** Find commonalities between their trajectories and your own. This is an area where networking/mentoring can really help. It is also becoming increasingly important to have international experience and collaborations; American and European journals have many similarities, and many scholarly topics are universal.

**While collaboration and diversity in publication are important, it is also crucial that you continue to develop your own area of research.** This is especially important for early career scholars who might not yet have a clearly established research direction when they begin publishing. Your list of publications should have a central focus, and your articles should build on previous studies and contribute to the development of your research trajectory.

**In higher education, know what is expected for tenure at your institution.** Once you have tenure, you will have more freedom in terms of publishing. Until then, it is important to think about what academic departments and institutions prefer or require, and how that aligns with your career goals. What types of publications count toward tenure? Are there specific journals you must publish in to be eligible for tenure? Is there a preference for research journals over practitioner journals? How important are journals' acceptance rates, citation rates, or impact factors? There can be different expectations for publications at every level of the tenure process, so having mentors both within and outside of your department can help you navigate this.

**With every research article you write, consider writing a parallel practitioner piece.** This is good practice for communicating with different audiences as it requires you to frame your research using plain language that is clear and concise. This also makes your work more visible and

accessible. In addition, periodically taking off your researcher hat can help keep you grounded in the broader communities within your discipline.

**If your research interests are interdisciplinary, think about which journals will provide a better entry point to each disciplinary field, as well as which journals may align with the area of convergence that your interdisciplinary work features.** If your work involves science education and English Learners (EL), for example, ask yourself what is needed in those fields. Do science journals need an EL perspective, or do EL journals need a science education perspective?

**You can find a home for almost anything you write if you do your research on various outlets and present your work appropriately.** When conducting a study, your main focus is often on publishing your findings in a peer-reviewed research journal, but there are many other avenues for getting your work out there, such as blogs, project websites, conference papers, or online publications. Websites like [ResearchGate](#) and [Academia](#) allow for self-distribution. The world of publishing is much bigger than peer-reviewed journals! This is even true for once-rejected manuscripts. Rework, reframe, and figure out some way to get your work out there.

**Think creatively about ways to broaden your dissemination outside of your particular field or subfield.** How could your work appeal to parents or your broader community? Consult with your institution's communications department about op-eds, interviews, or other ways of communicating with the general public.

## Submission and Review

**Follow all formatting requirements, and submit your manuscript along with a convincing cover letter.**

**The review process is complex.** Papers are evaluated on at least four factors: competitiveness, topic centrality, methodological alignment, and harmony between manuscript and journal. Upon receipt, a manuscript is first assigned to reviewers. Reviewers read the paper and submit a written review to the editor. (Reviewers only

make recommendations; the editor makes the final decision on the paper.) Once a decision is reached, the editor can accept the paper, accept the paper with minor revisions, ask the author to revise and resubmit (to be reviewed by the editor, the same reviewer, or different reviewers), or reject the paper. Remember that it is very rare for an article to be accepted without at least some revisions.

**After dedicating so much time and energy to preparing your manuscript, receiving critical feedback from reviewers can be an emotional experience.** Read the letter, take a break, and return to it later. Then reread your manuscript in light of the feedback you have received. Give yourself time to process your emotions before jumping into the revisions. Keep in mind that feedback is meant to make your writing stronger and more meaningful, even if you do not yet see the potential. Reviewers can be very insightful and help you take your paper to the next level. Do not be disappointed by critical feedback; be delighted that you have an opportunity to write an even better paper!

**You can disagree with feedback from reviewers and discuss your concerns with the editor who shared the comments with you.** Likewise, if you receive contradictory feedback from reviewers, you can consult with the editor for advice about which revisions to focus on. Pay attention to the editor's comments for clues about what is most important to address.

**The time needed for revisions depends on the feedback given.** Reframing or reorganizing takes less time than reanalyzing data, for instance. You will receive a timeframe for resubmission in your letter and can negotiate, if necessary.

**Address every comment in the revision, and submit a response letter.** This may seem daunting, but bear in mind that it will ultimately make your manuscript stronger. Be very pointed in your responses. Explain how you addressed the feedback, where you addressed it, and why you think it strengthened the manuscript. Rather than responding by reviewer, consider categorizing your feedback into comments about methods, analysis, interpretation of results, etc. Responding to comments by theme may be easier. Acknowledge the comments you disagree with, and provide a rationale if you did not

address them in the revision. Compose a solid response letter, as it reframes the manuscript and will influence the review of the revised version.

**Revisions are usually submitted to the same reviewers, but not always.** It is different for every journal. You can request that the same reviewers read your revised version. If you do not, you could end up with completely different feedback.

**It can be challenging to revisit your manuscript since you have likely shifted your attention to something new.** Conserve the energy you need to get back into that mindset. Prioritize other tasks accordingly. Do not allow yourself to lose steam at the end.

**Once you have taken care of revisions, reflect on the feedback you received to determine which areas of your writing you need to improve (e.g., connecting your theoretical framework to your results).** Next time you will know to pay particular attention to those areas as you write so you do not repeat the same mistakes.

**Prepare for the long haul.** Getting published will take a long time. While your writing timeline depends on your own schedule, it can take more than a year from the time you submit until your article is finally published. Plan for at least 2 to 3 years before you see your initial idea in print.

**Because the writing/review/publication process is so time consuming, plan ahead and try to always keep different manuscripts at various places in the writing and publication cycle.**

## Dealing with Rejection

**If your article is not accepted by one journal, look at an alternative journal.** One of the most common reasons for rejection of a manuscript is that it is not a good fit for that particular journal. If your submission was rejected or you are unhappy with the feedback from a journal, rewrite and submit elsewhere. Take the reviewers' comments seriously, though, even if you plan on submitting to another journal. The feedback will make your next submission stronger.

**People generally want you to succeed in your career; take advantage of that.** Even when you receive bad news, contact the editor to discuss feedback. See it as a learning opportunity. This is particularly important for young scholars.

## Additional Resources

- [Edanz Journal Selector](#)
- [Eight \(8\) Reasons I Accepted Your Article](#)
- [Eight \(8\) Reasons I Rejected Your Article](#)
- [How to Get Published in an Academic Journal: Top Tips from Editors](#)
- [How to Publish in Scholarly Journals](#)
- [How to Write a Good Title for Journal Articles](#)
- [How to Write the Best Journal Submission Cover Letter](#)
- [Publications for STEM Educators, Policymakers, and Researchers](#)
- [My Writing Productivity Pipeline](#)
- [Writing a Journal Cover Letter](#)
- [Writing Group Starter Kit](#)

[Additional resources](#) available at [cadrek12.org](http://cadrek12.org).

# Tips for Building Professional Networks

*“Building professional networks is one of the best ways for early career professionals to set themselves up for success.”*

## Why Network?

Networking is about building and sustaining relationships with people—those who contribute to your professional growth and those with whom you can work to contribute to the profession and field. Networking often occurs naturally in the course of your professional life, even when you do not realize it is happening. Building professional networks is one of the best ways for early career professionals to set themselves up for success. Learning more about others in the field ultimately makes you a better researcher. The perspectives of others can strengthen your work, and your professional relationships have the potential to create partnerships for the future. At the same time, your work, background, and perspective have much to offer your colleagues and the field.

Some reasons to form networking relationships include:

- Learning about an institution or organization
- Learning more about a person’s research/work
- Seeking specific feedback on your own work
- Exploring opportunities for collaboration

## Develop a Networking Plan

**Spend time developing a networking plan and strategy.** There are numerous ways to connect with people in your field (e.g., via email, at conferences, or through mutual connections). Think about how you want to expand your network; consider starting small and building over time. It is important to identify your needs and set goals for what you hope to get out of and give to a networking relationship. Even when networking opportunities arise spontaneously, having a plan in place will help you get the most out of those interactions.



## Identify your networking needs and opportunities.

Consider questions such as:

- What are my career goals?
- How can networking help me reach those goals? What opportunities exist for me to further develop my strengths and address areas of need?
- What skills do I need to acquire or strategies do I need to implement in order to reach my networking goals?
- What types of professionals could help me? Where, when, and how can I best network with them?
- How could networking help me better contribute to the field?
- What kinds of conversations would I have with networking contacts, and what questions would I ask them, if given the opportunity?
- What would I do with their insight/advice?

**You will have different networking goals at different stages of your career.** As an early career researcher, you might be seeking to build a community of peers with similar passions and goals. Building that community will come more naturally if you know who you aspire to be as a scholar. Once you have started to establish yourself professionally and develop a research program, you may be networking to learn new things, find collaborators with particular skill sets to help fill in gaps, or develop relationships with people in the communities or institutions with whom you want to conduct studies.

# The “Who” of Networking

**Map your network.** Use paper and pencil, Excel, or more-advanced digital tools (e.g., [bubbl.us](https://bubbl.us) or [Lucidchart](https://lucidchart.com)) to record who you have in your professional network. List what you know about them, what you would like to learn, and what you have to offer them. Use this map to identify gaps in your network so you can begin thinking about strategies to fill those gaps. It can be difficult to identify the gaps if you do not yet know exactly what you need, so think of this as a working document. This map can help guide you as you continue to build and sustain your network.

**Design your map to fit your networking needs.** You can map out your entire professional network or focus in on a particular context, such as a conference like AERA, NCTM, or NARST. If you plan to attend a conference, review the program beforehand to learn who will be there. From this list, identify who you already know, who you would like to get to know better, who from your institution will be in attendance, and who you would like to meet. You might also consider reviewing your reference list and comparing it with the conference program. Conferences are a great opportunity to connect with the people who have influenced your work.

**Identify people to connect with for specific reasons.** Networking is not about collecting business cards; it is about making valuable connections.

**Explore shared connections.** If you are uncomfortable reaching out to someone directly, figure out if the two of you share a mutual connection who can introduce you in person or through email. (LinkedIn can be a good tool for this.)

**Do not underestimate anyone.** You do not necessarily know how important a connection is going to be in the moment, so take the time to get to know people and familiarize yourself with their work. Do not just focus on the “stars” in your field—project PIs or people with a lot of publications; rather, take an active interest in everybody, and work to build relationships over time. After all, fellow students, for example, eventually move on to positions on hiring committees, advisory boards, and review panels. Put effort into connecting with peers and near-peers in your field. You are the next generation of scholars; support one another and build a strong community.

**Connect with people who are good at networking.** These individuals often have vast networks, which can be a good resource for you. They can make recommendations or connect you to others in the field. This is an especially useful strategy for those who are more introverted. If you are strategic about making connections, you do not have to be particularly “good” at networking to have a large network.

# The “How” of Networking

**Nowadays, many networking relationships begin through email.** When emailing to initiate a first meeting (whether that meeting will be by phone, virtual, or in person), briefly introduce yourself, describe your research interests and why you want to speak with them specifically, demonstrate that you are familiar with their work, and highlight ways in which the conversation could be mutually beneficial.

**Keep initial conversations brief.** While it is okay to see where the conversation takes you when you talk with a contact, also be respectful of their time. Have a goal for the meeting and some questions to help guide the conversation. This will help ensure you get the information you are looking for.

**To break the ice with other researchers, find out what they are passionate about.** Ask about their work, mention how it connects with your own, and see where the conversation goes. Show enthusiasm but do not be overly aggressive. Pick up on cues to gauge their interest.

**Develop tools or “props” to aid in your networking.** Draft guiding questions or sentence starters in preparation for conversations. Develop and practice your elevator pitch (a concise speech that provides an overview of your work). Create a personal webpage that is professional and tailored to your position. For academia, this might include your educational background, courses you have taught/wish to teach, your research interests, a list of your publications and awarded grants, and any honors or awards you have received.

**To the extent that you are comfortable, consider using social media to enhance your networking.** Find platforms that work for you. Facebook, for example, may connect you with a lot of users, but it requires active management, which can be time-consuming. Twitter or Instagram, on the other hand, may require less of your time and have a higher reward. LinkedIn is designed for professionals and may be particularly useful for people on a non-academic track. [Academia](#) and [ResearchGate](#) are great for people in and outside of academia. Join online groups related to your research interests. Whatever you choose, build your

social media presence carefully and thoughtfully. Use social media as a member of your professional community. Do not just promote yourself and your work; engage in online conversations and support your colleagues.

**Networking must be a two-way street.** That is not to say that every interaction must have equal give and take, but it is essential that both people benefit from the networking relationship. Give people a reason to want to begin and continue interacting with you. If their research is meaningful to you, identify precise reasons why, and share how it has influenced your own work. Offer suggestions for how your work could be valuable for them. Sometimes, as an early career professional, it can be challenging to identify exactly what you have to offer a more experienced scholar. But your background is unique and you bring a fresh perspective to the field. Spend time figuring out what unique strengths and skills you have and how you can offer them to others. Simply exchanging ideas or discussing your shared interests can help you both identify similarities in your work that can generate new ideas. Take advantage of opportunities to learn new things and work with people in your field. You always have something to bring to the table.

**Decide on your boundaries when it comes to networking.** Ask your advisor or others you trust what is appropriate to share with new contacts. Consider sharing, for example, only part of a chapter of your dissertation. If they use it, they should cite you. Consider PDFing the documents you share.

## The “What” of Networking

### ELEVATOR PITCHES

**Decide how you want to present yourself and your research, and how you might change this message depending on who you are talking to.** Identify the most important points you want to convey. It can be challenging to condense your research into sound bites, but decide what you most want to convey about yourself and your work, and let that be the substance of your pitch. Adapt this pitch for different audiences. For example, if you are speaking with people who have expertise in your area of

study, contextual information probably is not necessary; you can dive into the specifics and begin discussing your work immediately. If you are conversing with someone less familiar with your field, you will need to set the stage: a brief description of your area of study, the need, and how your work addresses that need. To make your pitch more accessible, think of concrete examples that illustrate the need for this type of work. In addition, you will need to adapt your pitch for different time frames—figure out what points you want to highlight in a two-minute pitch, a one-minute pitch, and a 30-second pitch. The order and structure will vary, but make sure you are communicating your key points consistently.

**Structure your elevator pitch in a way that sounds most authentic to you.** If you prefer, you can offer a brief introduction to your work, and then turn it over to the other person and ask questions to learn more about their work and interests. This is particularly relevant if you are someone who is more comfortable listening than talking. After your conversation, take time to think about what you have in common and how you could benefit from a continued relationship. Pose this in your follow-up with them. Make sure the person knows what you are interested in, how your interests intersect, and that you are eager to work together.

## TOPICS OF CONVERSATION

- ✓ Pose questions that arise as you review the literature in your field.
- ✓ Ask about their writing process or a project management strategy; these are areas of interest most scholars have in common and can be an opportunity to exchange best practices.
- ✓ Take a genuine interest in their work. Ask about how they are addressing their research questions or what they are doing in the classroom.
- ✓ Connect over a shared cultural identity.
- ✓ Ask how they navigate bridging two fields (e.g., science education and EL).
- ✓ Discuss different perspectives on your area of research, particularly from people with similar interests but whose work is grounded in different theories.

- ✓ Do not just talk about research; get to know each other as people. People are complex, with many intersecting identities and interests. Do not let the desire to form professional connections allow you to overlook personal connections.

# The “Where” of Networking

## NETWORKING AT CONFERENCES

**If you are attending a conference, try to be proactive in setting up networking opportunities with people of interest.** Set networking goals for conferences, such as a specific number of new people you want to meet. You can approach them once you arrive or contact them by email before the conference to inquire about setting up a one-on-one meeting. If you are unable to work out a time to meet, briefly introduce yourself when you see them, keep the conversation short, and ask if you can follow up with them via email or over the phone. At a minimum, use the conference interaction to plant a seed, share a business card, and then plan to follow up at a later date.

**Manufacture opportunities to build community.** If your goal is to make connections and develop relationships, set up specific times and places to meet with people during the conference and invite others to join you.

**Sign up for a mentor at conferences if you have the option.** This can help with visibility and making connections. At a minimum, mentors typically introduce mentees to the conference, describe the structure, and introduce them to other scholars. You can come into the conference with your own agenda to ensure that you get what you want/need out of the relationship. It is possible that you may continue this relationship beyond the conference.

**Connect with people during your conference presentations.** Those attending your session likely have interests that overlap with yours. You may come from different backgrounds but share a similar professional or research goal. Not only can attendees offer valuable feedback on your work, but you might identify places where

your work intersects, which can lead to ideas for future collaboration on papers or projects.

**Be strategic in deciding which sessions to attend.** If your goal is to make connections and develop relationships, think about attending roundtables, workshops, and sessions with several talks happening in the same room. Support other early career researchers by attending their sessions. If you have a genuine interest in the panelists' work, ask questions, stay after to introduce yourself, or invite them to coffee if you would like to learn more.

**Attend conference poster sessions.** Poster sessions provide a great opportunity to engage in authentic dialogue. The environment tends to be more relaxed than formal presentations, and the poster itself offers substantive talking points to help begin a conversation.

**Consider pre-conference workshops and special interest group events.** These sessions can be good spaces to meet people with similar research interests. They often include a mix of professionals—from PIs and more established scholars to up-and-coming researchers and graduate students—which provides you with access to an array of perspectives and expertise. Becoming involved in leadership for these groups can offer even greater opportunities to connect with others in the field. Attending graduate-student or other themed events are also great ways to meet new people.

**Take advantage of informal opportunities!** A lot goes on at a conference outside of the official program of events, and networking opportunities are all around you. Engage in casual conversations at the café during breaks or over lunch/dinner. Attend social events arranged by the host organization and others. Get to know people on a more personal level in a relaxed atmosphere. Signing up to volunteer at a conference is another great way to meet new people.

**Do not forget about small conferences such as single-discipline STEM conferences or practitioner-focused regional and national meetings.** Large events can be overwhelming, with so many activities and distractions. People can be more relaxed at smaller conferences, which can allow for less hurried, more organic conversations.

**Take the time to jot down a few notes about your interactions.** In a notebook or on the back of your

contact's business card, write down a few key words and/or ideas to help jog your memory about this person later. Begin drafting a follow-up email with key points from your conversation or record a message on your phone as you are walking to your next location. Keep in mind that if you know their name, you can find information about them online, or you can revisit the conference program later to refresh your memory.

## NETWORKING AT OTHER VENUES

**Serve as a reviewer for an academic journal or for NSF, or join a committee related to your field of study.** This could allow you to gain new experience, demonstrate your expertise, learn from others with different backgrounds and interests, and get to know editors, program directors, and committee members.

**Pay attention to events happening at other universities and organizations in your area.** Events at neighboring institutions can bring together people outside of your network and provide opportunities to connect with new peers. Pay attention to school or community events as well, particularly if your work involves building community partnerships.

**Invite guests to lead a brown bag discussion at your organization or to speak in your classroom, whether virtually or in person.** Not only will you be able to learn more about this scholar's work and start to build a professional relationship, but your students or colleagues will also have an opportunity to make a connection and expand their networks as well.

# Sustaining Networking Relationships

**Keep track of your contacts.** Do not let business cards pile up with no plan to use them. Consider keeping a spreadsheet with the names and contact information of those you meet. Include columns to describe the context of your meeting, what was discussed, who connected you (if applicable), the date of your last contact, and follow-up goals.

**Always follow up after you have made a connection.** It is important to thank the person for their time and to

communicate why the interaction was beneficial. If you see an opportunity for future collaboration, let them know this is something that interests you (e.g., “Keep me in mind for work in this area,” or “I am happy to be an extra set of eyes”). If face-to-face interactions are nerve-wracking for you, take extra care to shine in your follow-up message.

**When you do establish meaningful connections, work to keep those relationships going.** Take time to think about the potential benefits of a connection with a particular person and what about their work appeals to you as a professional. Is it the content of their work? their methodology? Are they publishing in journals that interest you? Follow up if you have additional questions or want feedback based on your most recent conversation. Share with your new contacts interesting articles or new resources that become available. Think of creative ways to keep in touch. For example, if you see they have a recent publication, promotion, or major life event, send them a congratulatory email! Similarly, put effort into maintaining the connections that people initiate with you.

**Do not reach out to people only when you want or need something.** Consider what you can offer others. Remember that networking should not benefit just you. Think about how you can make connections that are beneficial for both parties and for improving STEM education.

**If you are unsatisfied with the quality of an interaction, think to the future.** The STEM education world is relatively small; you will likely have other opportunities to connect with that person.

**Sometimes you receive great advice in short, spontaneous interactions; take it for what it is.** It is not always necessary to continue a networking relationship.

## Just Do It!

**Understand that networking is something you learn and improve on as you go.** If networking feels awkward to you, know that it does get easier with practice. Take into account your personality type, and be strategic about making meaningful connections in a way that feels right for you. At a minimum, show enthusiasm and keep

an open mind. Be able to summarize your research for maximum effect, and be willing to answer questions about your work. Listen intently as your contacts discuss their work with you, and try to identify places where your interests intersect.

**Focus on forming and cultivating authentic relationships.** Follow the work. If you desire to learn more about each other’s work, it is an authentic connection. These are the relationships you want to invest in.

**Remember that in many cases, your reputation as a researcher and the quality of your work precede you.** As you continue to progress in your field, you will have more and more opportunities to connect with others. Keep doing thoughtful and creative work that you are passionate about, and you will have plenty to offer your peers!

## Additional Resources

- [6 Networking Tips That Work for Me](#)
- [7 Tips to Supercharge Your Academic LinkedIn Profile](#)
- [15 Helpful Questions to ask in an Informational Interview](#)
- [20 Ways to Network That Do not Feel Like Networking](#)
- [A Brief Guide to Research Collaboration for the Young Scholar](#)
- [Academic Self-Branding](#)
- [Authentic Networking: 9 Questions to Ask to Discover Who is in Your Network](#)
- [How Leaders Create and Use Networks](#)
- [How to Maintain Your Professional Network Over the Years](#)
- [How to Make the Most of Academic Conferences—Five Tips](#)
- [The Elevator Pitch: Presenting Your Research in Conversation](#)

[Additional resources](#) available at [cadrek12.org](http://cadrek12.org).



# Tips for Developing NSF Proposals

*“Think about how you can translate your research agenda into projects that you lead and other collaborations.”*

## Developing Your Research Agenda



See your dissertation work as a foundation for developing your research agenda. In the process of addressing one question through your dissertation, you have likely raised several more. You are not starting with a blank slate.

**Develop a system for documenting and tracking questions or curiosities that arise.** Note why they are interesting to you and how they connect with the work you have done previously. You do not have to answer all of your questions right now, but keep the curiosities alive so you are ready to take advantage of opportunities to engage with those questions in the future.

**Identify a big, overarching question that you are always working toward.** From there, you can begin identifying cascading questions. Each time you have a major insight, you will be in a better position to develop the next series of questions you want to explore. It is okay if you are not able to formulate those questions concretely right now; it is hard to know early in your career exactly how these ideas will evolve. Stick with questions that motivate you, and make sure they are getting you closer to answering your overarching research question.

**Determine how you are going to build on what you have studied previously to move your research agenda forward.** Will you use different methods or a new framework? Are you applying a framework to different aspects of a phenomenon? Are you examining a topic that has not really been explored in your field? If during your doctoral program you were part of a research team that didn't align with your long-term professional goals, think specifically about the work that you initiated as part of this larger project and how that helped shape your research trajectory. Ask advisors, mentors, and others who are familiar with your work to help you develop your argument.

**Think about how you can translate your research agenda into projects that you lead and other collaborations.** You want to conduct research through projects that you are leading to build the trajectory you want for yourself. At the same time, working on collaborative projects can contribute to your own research while also demonstrating how your work connects to what others are doing, and giving you direct access to the knowledge, skills, experience, and connections of colleagues.

**Engage in identity work to start constructing a narrative about who you are as a scholar.** While your research agenda will likely evolve throughout your career, take the time now to think about the connection between your current research agenda and how you identify as a scholar. What do you want to say? What conversations are you trying to join? Who do you want to be within the larger community?

**Be intentional about the core ideas you are going to pursue as an early career scholar.** If you are in academia, think ahead to promotion and tenure. Prioritize the questions you really want to answer first. This will help you be more focused in the types of collaborations you want to pursue and hopefully avoid feeling scattered or spread too thin as you learn to balance research with your other professional responsibilities.

## Developing Your Proposal Idea

See the proposal as a vehicle for accomplishing your research goal(s). Ask yourself:

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

**Project ideas can arise at any time and in many different ways.** A proposal idea often 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. Being in conversation with practitioners and fellow researchers interested in similar work can be generative and keep you grounded in the field. 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.

**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 respond to the request for proposals (RFP)?
- What contribution can I make to the field and a funder's portfolio of projects?

### 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. If you are considering a DRK-12 submission, read about funded projects and PIs on the CADRE website: [cadrek12.org](http://cadrek12.org).

**Get feedback from your peers to assess the need for the proposed work.** Consulting with others you trust 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.

**Talk to other successful 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 share them; consider asking to see only their project descriptions because sharing a proposal budget can cause problems in terms of releasing confidential information. Even if the researcher says no, you have made a connection.

**Consult with funder program directors.** Once you are in a place where you can clearly articulate your idea, share a one-page concept paper with a program director via email. For NSF, check the 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. Read the solicitation and proposal preparation guides carefully before you contact them; some of your questions might already be addressed. Be prepared with questions for the program director that demonstrate you have done your research. Bouncing your ideas off of a program director can be extremely helpful. Most directors will generously give some of 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. However, because NSF program directors make final

funding decisions based on input from reviewers, they are limited in how much guidance they can offer related to proposal development. The level of support program directors can offer varies among funding agencies depending on their roles and responsibilities.

# Funding Your Research

## FIRST STEPS IN SECURING FUNDING

It can be challenging for young professionals to become funded researchers. Many funders, including NSF, want to support the next generation, but they also want to see a record of success. It is hard to compete 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. It will also help you begin to think about your research agenda in terms of concrete project ideas. During this time, you will have an opportunity to further flesh out your research trajectory before you begin applying for faculty positions.

**When you are applying for research positions, get to know what your institution expects of junior faculty or researchers.** Research 1 institutions and nonprofits will likely expect pre-tenure faculty to secure grant funding. An R2 institution or liberal arts university may prioritize publishing. Clarify these expectations during the interview process; this will help you develop a timeline for your first few years. Institutions have different research supports, so it is important to learn what types of support your institution offers junior faculty. If an institution has expectations for grant writing pre-tenure but little to no support for junior faculty, this could be a red flag. Proposal writing takes time away from publishing, which can put pressure on the tenure clock for those with academic positions. Consider keeping proposals and projects in various stages to strike a balance between proposal writing, project management, and publishing.

**Your first proposal should be relatively modest—something small-scale but interesting to you and in line with your research agenda and career trajectory.** 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 is 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.

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

**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 teaching and educational goals. While CAREER grants are extremely competitive, you are 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.

## FUNDING LARGER AND MORE COMPLEX PROJECTS

**Once you are ready to lead a larger project, invite a more senior researcher to serve as co-PI on your first project, someone who has an intellectual stake in the project but also a desire to support you as a first-time PI.** This can lend your project credibility. Your project advisors can also add credibility to your proposal. 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.

**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. Whichever approach you choose, make sure that the project you are proposing stems from a place of genuine curiosity and aligns with your research agenda. Do not allow the requirements of a solicitation to design the project for you; this can appear forced and lead you away from your overarching research question.

**Explore how aspects of your research fit under different funding solicitations.** Look closely at lists of awarded projects to understand what type of work different funders are supporting and note the strengths of those projects. It is likely that no single funding source or program will fund your entire research agenda over time, but you can focus on obtaining funding to address different parts of it 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 agenda forward.

**One of the best ways to learn about what it takes to get funded through a specific program is to serve as a proposal reviewer.** Volunteer to 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.

**Keep informed about funding opportunities.** Take time to identify funding sources that align with your work, and set aside time to review their solicitations when they are issued. Build this into your schedule, and make it part of your professional routine. Sign up for funder elists (e.g., NSF and IES); they send out solicitations and Dear Colleague letters. Sign up to receive emails from your



institution's research office. Research the people who are receiving grants, and ask them about their process for identifying opportunities. You probably won't respond to the majority of the calls, but knowing what's out there can spark creativity and help you think more expansively about your research.

**Do not apply for grants just for the sake of applying for grants.** Identify a problem and develop an idea for solving the problem. See grant funding as a resource that gives you the capacity to work on the problem you want to solve.

## Early Stages of NSF Proposal Development

**Timelines for proposal development will vary depending on what is being proposed.** A continuation of previous work requires a different amount and type of effort than proposing a brand new project idea. For most early career researchers, you will be proposing a new idea, so it is important to give yourself extra time. It is recommended that you start the process 1 to 1.5 years in advance.

**Understand the funding process and timeline for your institution.** Most academic institutions require that proposals be reviewed by the grants office to ensure that you are 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. Learn what paperwork is required and when internal processing deadlines occur. Talk to your grants office early and often!

**Consider how you will move from your research questions 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?
- What is the logic model?
- Who needs to be part of the team to successfully research these questions?

## COLLABORATION AND PARTNERSHIP-BUILDING

**Remember that we as individuals do not know and cannot do everything.** What unique characteristics or experiences do you have that position you to be able to do this work well? What can you bring to the project that others might not be able to bring? Conversely, to do the work well, what additional knowledge, skills, experiences, and connections do you need to bring to the project through collaborators?

**A strong proposal and project usually require more expertise than any one individual (or even one institution) has.** Collaboration can make your proposal more competitive and allow you to better execute the project. Consider how a team of researchers, developers, partners, collaborators, advisors, and/or evaluators will bring the expertise needed to properly address the research questions. Look for people with whom you have good relationships, share value systems, and enjoy working; you will be working together for a while. Once you have compiled a team, work together to identify your relative strengths and discuss and document who will lead various aspects of the work, authorship, and how funding will be allocated.

**Successful proposals can be built on existing relationships or through fostering new relationships.** If you are seeking new collaborators, use your networks to find individuals who share your interests. Conferences are a great place to start identifying common interests, values, and approaches to research and practice. Explore the places where your work and others' intersects, and propose opportunities for collaboration. You can decide beforehand what you want to research and invite others to join, or you can decide on the focus of the research as a group.



**Consider working with community partners to design the project.** You can engage in co-development work in order to develop the proposal or propose co-development as part of the funded project. Co-development can build trust and help local practitioners become co-creators and invested in the knowledge generated through the project. Working with community partners can also help to keep funding in that community.

**Establishing relationships and engendering trust with community partners can be a complex process, particularly if you and your team are not part of that community.** In this case, it can help to have an intermediary or a cultural liaison—a professional contact who is connected to the community and who can vouch for you. Do not attempt to establish a formal partnership until you have visited the site multiple times and have established rapport with your potential collaborators. If you are planning to work with underrepresented communities, know that these communities might not have good prior experiences with researchers. Be understanding of and sensitive to their concerns or hesitations.

**Start establishing partnerships early—at a minimum, six months to a year before the solicitation is due.** It takes that long to build your team and relationships with schools, teachers, and other institutions, and to get to know the issues and needs that they identify as important. Take time to get to know your collaborators. 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.

**Funders generally require external review of projects during their award period.** If an independent evaluator will fill that role for your project, you can use your network to find the most suitable evaluator—someone whose opinion you respect and who can be a critical friend. Experienced PIs or NSF program directors 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.

**Evaluators often prefer coming on board during the project design stage and before the proposal is finalized.** An experienced evaluator can bring years of experience working with STEM education projects and help you think through your logic model, research design,

and aspects of project implementation and dissemination.

**Do not be afraid to reach out to new people to serve on your advisory board, if you plan to include one in your project design.** Invite people whose work interests you and who you think would add a unique perspective, even if you do not know them personally. The task of assembling an advisory board can help you 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 in particular to serve.

## NSF Proposal Writing

### 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. Other times, a team not only informs the conceptualization of the project, but also helps to write the proposal. 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 approach helps create buy-in from the team and may strengthen 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 colleague (or two) to read your draft.** Are there missing pieces? Is it coherent? Does it make sense to an outsider? It is better to receive feedback from critical 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.

## FOCUS ON THE PROPOSAL CONTENT

**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, the need relates to a problem of national importance, you have an approach to addressing this problem, and your team is in the best position to carry out the implementation and study of the approach.

**Use the first two pages to convince the reviewers to fund you; use the remaining pages for elaboration.** The introduction to your proposal is critical. You have to hook the reviewer and make them excited to learn more. Introduce everything clearly 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. Do not 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.

**Dedicate time and attention to framing your project in a way that reflects the current work happening in the field.** Keep it concise while making a compelling argument. Include a thorough review of the most up-

to-date literature. Serving on an editorial board or as a peer reviewer for a journal is a great way to stay updated on the current literature.

**When developing a particular section, write for the highest expert in that field in terms of substance, but use language and examples that can be understood by everyone.** You are writing for a diverse panel of experts. It is 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. Do not 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 do not understand all of the intricacies.

**At the same time, remember that experts will review the sections of your proposal that deal with their particular field.** For instance, a methodologist may read your methodology section; a teacher educator may review your plan for professional development. If an expert discovers a weakness in a section that addresses their area of expertise, they may convince the panel not to invest in you.

**Tell 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 are writing, check in periodically to make sure your storytelling is consistent. Be sure that for everything you propose, you follow the thread all the way through the proposal; do not leave anything unresolved. It is your story that will stand out for reviewers. Make it compelling!

**Develop a logic model to describe what you are proposing and how the pieces of the project fit together.** Use the logic model to show reviewers how you envision the progression of your grant and how different people will be involved. 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.

**A common thread in successful proposals is a solid theory of action—a clear, simple schema that provides the following:**

- What is the context?
- What is the intervention?
- What mechanism will manifest from the intervention?
- How are you going to measure the specific changes that are a product of that mechanism?

Having that picture in the reviewers' minds will make it easier for them to assess details about methodology and other aspects of the proposal.

**Be specific in describing how you will move from initial implementation to the final stage of the project, even if things do not go as planned.** Demonstrate how you will operationalize what you are proposing, that you have a plan to pull it off with the money you are requesting, how you will measure what you are proposing, and why 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. Be clear about how you plan to measure success, and interpret and deal with setbacks. Reviewers will want to know that you are thinking about mitigation or mediation of risk. Write the proposal as if everything will go according to plan, but demonstrate that you are adaptable and dependable should obstacles arise. 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 of teachers from your sample? Describe any preliminary work that you and your partners have done to address potential risks. Know that any weaknesses in your proposal will be identified. Show the reviewers that you have a backup plan that will allow you to maintain the integrity of the project.

**Be considerate to your readers.** 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. For instance, consider matching research questions to their respective data sources and expected outcomes for ease of reading.

**Interrogate your proposal. Develop a habit of asking questions such as:**

- Can I envision what the data collection process will look like?
- Can I imagine how data analysis will be conducted?
- Can I imagine this project being productive if it does not go according to plan?

## RESEARCH DESIGN AND DATA MANAGEMENT PLAN

**Use preliminary data to build a case for why your work is important.** Pilot studies are a great way to gather preliminary data, as is analyzing your dissertation data in a different way or replicating your intervention at a different site. Not including preliminary data can be a red flag for reviewers. Use these data to show evidence of promise for your project idea.

**Common issues with research design and data management include questions of feasibility and whether the data will yield new insights that justify the investment.** Be realistic about what it takes to collect these data as you have proposed. If what you are proposing seems risky, building in a pilot phase could strengthen your case.

**There is not one type of methodology that is favored; good research design is what matters.** Sometimes proposals come up short when using mixed methods since people tend to be trained in one or the other. Do not underestimate what it takes to do qualitative or quantitative work, and ensure that you have team members or advisors who can provide guidance.

**Describe your data management plan in detail.** Think about all of the data you will collect: video, audio, documents. Where are they going to be stored? How secure is the location? How will you de-identify the data? How long will you store your data? What data will you share? What is your process for destroying the data?

## ADDRESS 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.

**A project's intellectual merit and broader impacts can make or break proposal competitiveness.** Position your work within the national conversation around broader impacts. At a minimum, follow the specific NSF guidelines for intellectual merit and broader impacts.

**Convince the review panel that your work is a worthwhile investment.** What contributions do you hope to make both conceptually and empirically? Do not just describe what you are going to do; describe how it will make a difference. Put yourself at the end of the project and ask:

- What was accomplished?
- How did it contribute to the field?
- Who is impacted by this work?
- Why should society care?

**Think about broader impacts as extending beyond numbers.** It is not just about reaching X number of people or certain populations; it is also about the substance of the work and how it will transform some persistent inequality or problem in the field. Your broader impacts could relate to theoretical and/or methodological advancement, types of products, new educational models, or ways of establishing partnerships. Broader impacts are not only about people served by the project but also the knowledge generated.

**When describing broader impacts, proposers often overclaim relative to what their project can actually do.** You, as an individual researcher, may not solve this problem, but you can make a valuable contribution to the collective knowledge base that seeks to address the problem. Every study has limitations. Be honest about those limitations.

## 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 cannot be done or done well. Likewise, red flags will be raised if you are 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, do not 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 government 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?
- Have I budgeted for graduate students or postdoctoral researchers?
- Have I allowed adequate time to do my work as the PI, including course buy-out, if necessary?

**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 will 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.

## KEY PROPOSAL ATTACHMENTS

Proposal attachments provide valuable information for the reviewer that is vital for the assessment of your project's feasibility and viability. Read through the guidelines carefully to ensure that you have all the information and forms necessary. Ensure that your proposal is not rejected for a simple oversight.

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 letters detailing their roles 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.

If you are working with postdoctoral researchers, do not forget to include a mentoring plan. Take time to consider how their participation in the project will enhance their education and future as a researcher. Ask your colleagues what type of mentoring they have offered. Sample mentoring plans are available at [cadrek12.org](http://cadrek12.org).

## Between Submission and Notification

Do not contact NSF while the proposal is under review. It is advisable to consult with program directors when you are developing your idea, but be hands-off once you have submitted.

If the program director gets back to you with questions or feedback from the review panel, answer every question as thoroughly as possible and within the requested timeline and page limit. 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 have 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. If it seems like a reviewer may have misinterpreted your work, pay particular attention to their comments. It may mean you have not communicated your idea clearly, and this could be an opportunity to clarify.

If you submitted a collaborative proposal, meet as a team to discuss how you will respond to the reviewers' comments/questions. It is important to remain a cohesive group throughout the negotiation process.

## The Successful NSF Proposal: Getting Your Project Started

Do not shortchange yourself on the time it will take to get the project started. Getting a project off the ground is hard work. Use the proposed timeline to create and implement a work plan. During this phase, you may need to hire staff and students, firm up your partnerships with school districts, prepare subcontracts and consultant contracts, set up your management systems, or address Institutional Review Board (IRB) issues.

Introduce yourself (virtually or in person) to the program director assigned to your award. 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. The annual report is 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!

**We all get proposals rejected at some point in our careers.** Failure is part of the experience. Do not feel bad if your very first proposal is rejected. Many 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.

**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 cannot 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. You do not necessarily have to wait 10 years, however!

**You can revise the proposal and resubmit.** If your proposal is rejected, schedule a meeting with the program director who was assigned your proposal for additional feedback on the reviews and how the proposal can be improved. Ask yourself what you can learn from this. Many people do not take advantage of this opportunity.

**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 is important to discuss feedback with the program director who was in the room.

**Make sure the program you submitted to is the best fit.** If you are considering submitting the proposal to another program, make sure that you can revise your project and proposal so that it is responsive to the other 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.

## Additional Resources

- [10 Tips for Successful Grant Writing](#)
- [Grant Proposals \(or Give Me the Money!\)](#)
- [Grant Proposal Writing Links and Resources](#)
- [NSF Programs: Directorate for Education & Human Resources \(EHR\)](#)
- [Old Advice for New Researchers](#)
- [On the Art of Writing Proposals](#)
- [Sample Awarded Proposal Template](#)
- [Ten Tips for Developing a Programmatic Line of Research](#)
- [Where to Search for Funding](#)
- [Writing the Broader Impacts Section of Your Research Proposal](#)

[Additional resources](#) available at [cadrek12.org](http://cadrek12.org).

# Part II

# CADRE Fellows: An Approach to Supporting Early Career STEM Education Researchers

## About

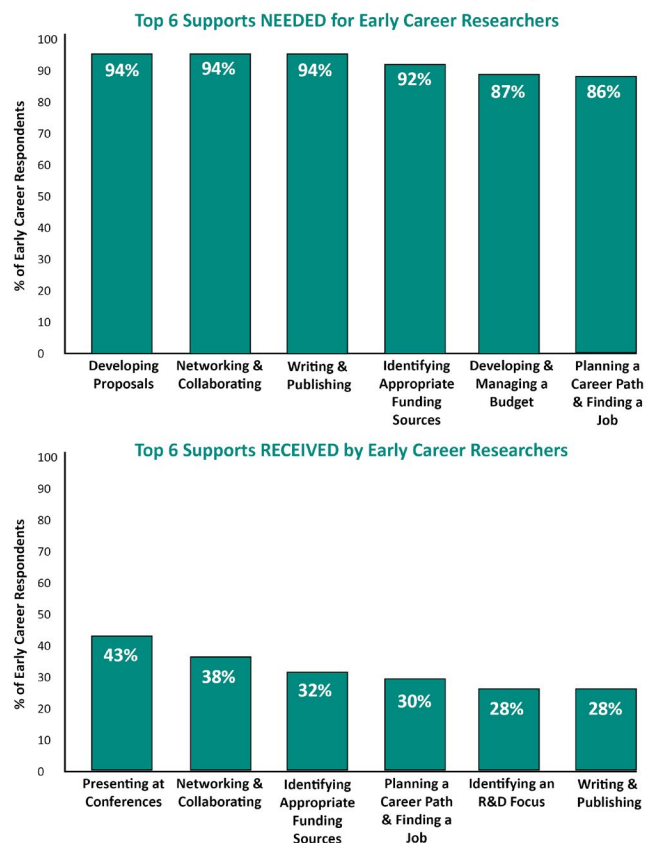
This section of the guide provides a detailed description of the structure and objectives of the CADRE Fellows program, the design of the learning activities, and benefits and challenges of the program for Fellows.

## Anatomy of the CADRE Fellows Program

Established in 2009 as an extension of the supports offered by CADRE to DRK-12 grantees, the CADRE Fellows program is designed to build the capacities of early career STEM education researchers and to provide experiences that Fellows may not have in their current roles but that are helpful for their professional growth and development.

The activities of the CADRE Fellows program center on four strands of work: academic and non-academic career pathways, writing for publication, building professional networks, and developing NSF proposals. These topics were identified as needed areas for professional growth for early career researchers by CADRE staff, CADRE advisors, and the Fellows themselves (confirmed in the 2014 report [Early Career Researchers and Developers in the DRK-12 Program: Needs, Supports, and Recommendation](#) (Riley & Butler, 2014)). See the Topics on Which Early Career Respondents Needed or Received Support graph to view collected data. Fellows engage with these topics through a variety of activities, including in-person and virtual meetings, independent and collaborative assignments, discussion with panels of experienced researchers, networking opportunities, and communication with NSF program directors.

**TOPICS ON WHICH EARLY CAREER RESPONDENTS NEEDED OR RECEIVED SUPPORT (N=50)**



The program also provides an authentic environment in which the Fellows can develop collegial relationships with their peer colleagues.

## HOW ARE THE FELLOWS SELECTED?

As of the spring of 2019, 98 early career researchers have participated in the evolving CADRE Fellows program. Each year (with the exception of year 1), we have selected a cohort of 10 Fellows. With this number of Fellows, CADRE can ensure that each Fellow will have something in common with someone else in the cohort—discipline focus, stage of career, etc.—and that there are enough Fellows to bring a variety of perspectives and experiences to the meeting conversations. The number also allows a small enough group for effective community building.

Fellows are identified through a nomination process by the head (PI or co-PI) of their projects as future leaders in STEM education. They are doctoral students, research associates, or postdoctoral researchers who represent a variety of institutions, disciplines, backgrounds, and geographic regions. Nominees apply for the Fellows program by submitting an application, CV, personal statement, and letter of recommendation from their nominating PI or co-PI. Applicants are evaluated on a number of criteria by a team, including CADRE staff, DRK-12 awardees, and Fellows alumni. Criteria include the following:

Individual criteria:

- Limited access to the kind of support the CADRE Fellows program offers
- Strong letter of recommendation
- Evidence of leadership and/or self-motivation
- Clear career goals with a path toward future research and development endeavors
- Diverse background, experiences in education, and/or unique skills
- Desire and capacity to advance the field and contribute to broadening participation in STEM education
- Expressed willingness to work with and learn from other Fellows

Group criteria:

- Gender balance
- Science, technology, engineering, and/or math representation
- Research focusing on different grade levels (e.g. preK, elementary, middle, high)
- Racial/ethnic diversity
- Geographic diversity
- Institutional diversity (e.g., higher education, nonprofit, industry)
- Representing projects/Pis/institutions that have not been represented by past Fellows



*A presentation at the in-person orientation meeting.*

From the rich pool of applicants, the team selects 10 Fellows to form the cohort for the upcoming program year, typically aligning with the academic year.

## PROGRAM COMPONENTS

### Getting Started

Fellows are accepted and welcomed to the program through an email to the nominee and the DRK-12 awardee who nominated that Fellow. CADRE sends a press release template that Fellows can share with their institution's communications department. In addition, CADRE announces the new cohort of Fellows via social media, an email to the contacts in CADRE's network (including those at NSF), and a special section of [cadrek12.org](http://cadrek12.org).

Fellows participate in an introductory virtual meeting hosted by CADRE. The meeting, which serves as a soft launch of the program, provides an opportunity for Fellows to introduce themselves to each other and CADRE staff. CADRE also provides a brief introduction to the program, including expectations and logistical information for the in-person orientation.

### In-person Orientation

Fellows meet in person during a two-day orientation where they learn about each other's project work and research interests, discuss their professional trajectories, meet other STEM education researchers, and work with CADRE staff to refine the agenda for the upcoming program year. Several activities are meant to increase the Fellows' familiarity with the wide range of resources, information, and contacts available to the greater DRK-12 community. CADRE also invites Fellows to offer input on discussion topics for the virtual meetings, collaborative assignments, and even new strands of focus during the program. (The addition of the networking strand, for instance, was added in response to needs expressed by Fellows at an orientation meeting.) Most importantly, perhaps, the orientation—through one-on-one and group discussions—enables the Fellows to develop relationships with each other and form a cohort of supportive peers.



*Fellows collaborating during the in-person orientation.*

NSF's [Faculty Early Career Development \(CAREER\) Program](#) offers awards in support of early career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their departments or organizations. CADRE provides early career supports designed specifically for DRK-12 CAREER awardees.

A sample agenda includes some of the elements of a more extensive list of past orientation activities:

- CADRE staff provide an overview of the CADRE resource network and Fellows program, and introduce Fellows to resources.
- Past Fellows share their experiences in and beyond the CADRE Fellows program.
- Fellows illustrate their career trajectories and timelines, and then learn about each other's interests, professional backgrounds, and career trajectories when they share their illustrations.
- Fellows explore ways to build and leverage the DRK-12 community of peer, near-peer, and experienced awardees and colleagues.
- Current NSF awardees share their experiences and respond to questions.



- An NSF program director provides information about the DRK-12 program and NSF
- Fellows provide a brief overview of their research and/or the DRK-12 projects they work on, followed by Q&A.
- Fellows reflect on research talks, identify commonalities (e.g., across research, academic pursuits, and professional growth needs and opportunities) that have emerged, and consider implications for the program year.
- Fellows discuss issues and questions related to the topics (e.g., career trajectories, writing for publication, grant writing) to be addressed during the year.

### Monthly Virtual Meetings

Once a month, Fellows meet virtually for a discussion with guest panelists about one of the program strands. During these 60-minute panels, DRK-12 grantees discuss their experiences with the given topic and respond to Fellows' questions. In preparation for these meetings, Fellows are sent the tip sheets included in Part I of this guide as well as a draft of the questions that will be sent to the guest panelists. The Fellows are invited to add to or change the questions so that they best address their collective interests and need for information. (See sample questions in the strand sections below.) The questions seek to unearth the tacit knowledge and insights into the practice of being a researcher that are not often transparent or accessible to early career researchers. The conversation during the virtual meetings is then guided by the series of questions that were co-developed by Fellows and CADRE staff.

This structure provides a level of safety for Fellows who may not feel comfortable directly asking the more renowned panelists these questions. Afterward, Fellows and CADRE staff meet to debrief, discuss collaborative activities completed since the last meeting and next steps (including new collaborative activities), and assess how well the program is meeting Fellows' needs.

CADRE identifies and invites panelists for the virtual meetings who have the following characteristics:

- Are peers, near-peers (including past Fellows and CAREER awardees), or more experienced STEM education researchers, and therefore offer the Fellows opportunities to hear the perspectives and learn from the experiences of researchers at different stages in their career.
- Represent various STEM disciplines, demographics, backgrounds or experiences, types of institutions, etc., over the course of the virtual meetings and, to the degree possible, for each virtual meeting.
- Have not previously served as a panelist in the Fellows program, thereby increasing the number of researchers familiar with the program while also not overburdening them with repeat service.

### Monthly Collaborative Activities

Building on the knowledge gained during the virtual meetings, Fellows spend the next month collaborating in pairs or small groups on an activity of their choosing related to one of the four strands (e.g., peer reviewing a manuscript in progress or researching academic institutions or non-academic organizations of interest). In some cases, there are individual activities. CADRE provides a set of resources to each group related to these topics for additional support. During the next month's virtual meeting, Fellows report out on the results of their collaboration. Fellows who develop products (e.g., a guide to postdoctoral fellowships or a list of non-academic STEM education research organizations) as a result of their collaboration share those resources



*A CADRE Fellow working on her visual map during orientation.*



with the group during this virtual meeting and upload them to a shared folder online so that every Fellow can access, comment on, and, in some cases, update the work at any time.

The activities allow Fellows to further develop their knowledge or skills within a particular area while also giving them an opportunity to build a community with one another and engage in peer-to-peer learning. Fellows are generally given several options to choose from and rank in order of preference, so the Fellows can focus their time on something that most interests them while allowing CADRE to more easily identify the “right” working partner for each Fellow. Details about the activities are provided in the section, Meetings and Activities: Strand Content, below.

### Additional Opportunities and Resources

The CADRE website includes an Early Career section that contains information about the [CADRE Fellows](#) and [Postdoctoral](#) programs and the [NSF CAREER Program](#). In addition, the website includes a collection of [early career resources](#) that have been shared through the Fellows program over the years related to career pathways, writing for publication, building professional networks, and developing proposals. CADRE also advertises opportunities of interest to early career STEM education researchers and showcases the work of CADRE Fellows, CADRE Postdocs, and DRK-12 CAREER awardees in [Early Career News & Opportunities](#).

CADRE has hosted networking sessions at national conferences, inviting current and past Fellows, CAREER awardees, and more experienced PIs/co-PIs (particularly those who nominated the Fellows). The sessions have been organized so that attendees can informally meet others at a similar stage in their careers, with a similar connection to the DRK-12 funding program, and with STEM education research interests.

Read CADRE’s other resources about working with early career researchers, including our tips for mentoring:

[Mentoring Early Career STEM Education Researchers and Developers](#) (CADRE, 2015a).

Fellow also independently organize meet-ups with each other at conferences, often using the attendance information that CADRE has collected and shared with the early career network.

In addition, Fellows have access to the many resources and events that CADRE provides to all of the DRK-12 community (e.g., webinars, an NSF proposal toolkit, the CADRE newsletter).

“The advice for early career individuals was very helpful and am currently putting that into action. The relationships made with others in similar positions to myself was also helpful in having someone outside the institution to discuss issues of practice.”

—CADRE Fellow Alumnus

## Meetings and Activities: Strand Content



### CAREER PATHWAYS

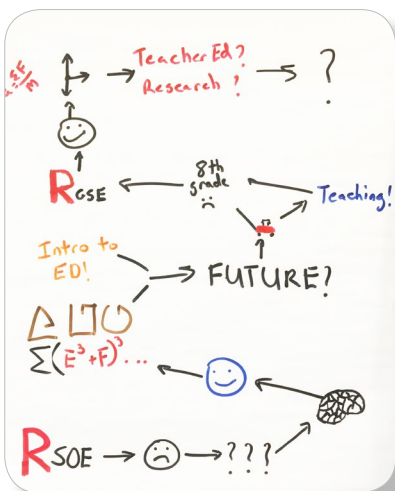
The Fellows, the majority of whom are doctoral students, report not having tacit information about the inner workings of getting a job in academia or knowing very much prior to their participation in the Fellows program about career options outside of academia (CADRE, 2015b). One goal of the program, therefore, is to provide exposure to career options Fellows have not only in academia, but also at nonprofit organizations, state departments of education, and other institutions where they may continue to engage in STEM education research. No matter where Fellows may look for positions, they also need to know how to present themselves and make decisions about job offers. This strand addresses these areas.

## Orientation

Fellows begin the career pathways strand by exploring and sharing their career trajectories during the in-person orientation. Fellows create a visual map of their career paths, share stories of how they developed their research interests, and describe the factors that influenced their educational and professional choices. Through this activity, Fellows begin to get to know each other on both a professional and personal level, and get a glimpse of alternative pathways to STEM education doctoral programs. During the orientation, Fellows also have the opportunity to engage in conversations about career pathways with more experienced researchers and Fellows alumni who work in various settings.

## Virtual Meetings

Fellows also engage in conversation with a panel of experienced DRK-12 researchers during a virtual meeting on the topics of academic and non-academic career pathways. In a separate virtual meeting, Fellows discuss the specifics of applying for academic and non-academic jobs with Fellows alumni who have recently secured jobs following their doctoral studies or postdoctoral fellowships. Because the majority of Fellows are from academic institutions, the focus on non-academic opportunities offers insight that is usually new to the group but helpful to many since academic positions are limited and some researchers prefer working outside of academia. CADRE invites the panelists from academic and non-academic institutions to discuss their career trajectories and share advice related to choosing the right career track, the job search and application process, interviewing and negotiating for a position, and what to expect after securing a position. (See Tips for Pursuing Academic Career Pathways and Tips for Pursuing Non-Academic Career Pathways in Part I.)



Examples of visual career path maps. Fellows share their career pathway stories in a presentation.



“CADRE was the only place that ever provided me with information about non-academic career pathways.”

—CADRE Fellow Alumnus

## GUIDING QUESTIONS FOR THE VIRTUAL MEETING ON CAREER PATHWAYS

### Choosing the right career track:

- Why did you choose your career path? What contributed to this decision?
- What should one consider when deciding on a career path? What are the advantages and disadvantages of working in academia or in the nonprofit sector?
- How easy or difficult do you think it is to switch career tracks (e.g., from nonprofit to academia and vice versa)? What recommendations do you have for keeping yourself qualified for either track?
- What do you wish you had known about careers when you were just starting your career?
- Where do you find mentors, and how do you ask someone to be your mentor?

### Job search:

- What kinds of work opportunities exist outside of academia?
- What are the available resources for identifying opportunities in academia? in the nonprofit sector? in the for-profit sector?
- What is the job outlook like for these sectors? What types of positions are more readily available?
- How does one build networks within these sectors?
- How did you become interested in the institution where you now work?

### Job application:

- What are hiring committees looking for in applicants where you work? What factors are more or less important, and how are these qualities assessed?
- What should early career researchers do to make themselves competitive on the job market?
- What tips do you have for preparing a strong application (e.g., What experiences should we have on our CVs? What should we address in our job talk?)

### After securing a position:

- What is the approximate breakdown of your time between different responsibilities (e.g., research, administration, teaching)?
- What are the best ways to prepare for a tenure-track position?
- What are some aspects of your career that you find the most fulfilling? What are some aspects that you find the least fulfilling?
- What are your tips for maintaining a work-life balance?

### Research agenda:

- How did you go about developing your research agenda?
- What advice do you have for early career researchers about how to hone your identity as a researcher?
- What is one new thing you want to try in your research or practice?

## GUIDING QUESTIONS FOR THE VIRTUAL MEETING ON APPLYING FOR JOBS

### Job search:

- What was your process for conducting your job search? How did you find your current position?
- Did you engage your network to help identify positions or make connections with staff at institutions where you were interested in a position? If so, how?
- Did any mentors help you in your job search process? If so, how did you identify those mentors? How did they help you?
- Did you do any self-reflection or identity work to determine which positions were most suitable or how to present yourself in your application? If so, what types of questions did you consider?
- How did you decide which positions to apply for? What factors influenced your decision?
- Had you served on any search committees while in graduate school? If so, what did you learn from that experience?
- What advice do you have for balancing the job search with your other professional responsibilities?

### Application process:

- Describe your process for developing your application (CV/resume, cover letter, teaching/research/diversity statement, or other materials).
- How did you tailor your CV for a non-academic position?

### Phone interview:

- Describe the initial phone or virtual interview.

### Campus visit/in-person interview:

- How did you prepare for your campus visit/in-person interview?
- How did you prepare for your job talk, if applicable? If you had a diverse range of projects/previous work, how did you choose what to focus on and make those experiences fit together?
- Describe your campus visit/in-person interview.
- What kinds of questions did you ask during the in-person interview?
- What kind of correspondence did you have with the search committee following your campus visit/in-person interview?

### Job offer:

- How long was the turnaround time from a job offer to the decision deadline?
- What factors did you consider when deciding whether to take the position? How did you make the decision that was best for your family?
- What items did you negotiate and when did you begin those negotiations? How did the negotiations proceed?

### Miscellaneous:

- Describe your transition from doctoral candidate/postdoctoral researcher to assistant professor.

## Activity

Building on the information from the virtual meeting, Fellows work collaboratively with another Fellow to choose and complete one of the following activities, each completing the activity, sharing their product with the other Fellow, and providing feedback on the partnering Fellow's product:

Activity options have included:

1. **CV/resume revision:** Update/revise a CV or resume for either an academic or non-academic position. Your partner will review and provide feedback. An additional review by a PI is optional.
2. **Job talk preparation:** If you are planning to interview for faculty positions soon, or would like more practice with a job talk, prepare an outline of a job talk and/or conducting a practice job talk with another Fellow. Review by an experienced researcher is optional.
3. **Research, teaching, and/or diversity statement development:** Draft a research, teaching, and/or diversity statement that describes the context of your past experience, your current work, and your short-term and long-term goals. Your partner will review and provide feedback.
4. **Postdoctoral fellowships research:** Research and identify resources (e.g., websites, e-lists, organizations) that advertise postdoctoral positions and provide ongoing support to postdoctoral researchers.
5. **Academic institutions/non-academic organizations research:** Work individually or in pairs/small groups to research at least three institutions/organizations of interest based on type of work, faculty/staff, geographic region, etc. Set up an informational interview with at least one person at an institution/organization you identified.



## WRITING FOR PUBLICATION

Doctoral students must publish to advance their careers. While they are likely to receive support from their advisors or project leaders, Fellows have fewer opportunities to speak with journal editors and researchers outside of the Fellows' institutions. This strand offers those opportunities.

### Virtual Meeting

Fellows engage in conversation with a panel of both experienced PIs and near-peers during a virtual meeting on the topics of writing and publishing. CADRE invites panelists with experience writing for publication and/or reviewing manuscripts for academic journals to discuss their experiences and share advice related to choosing the right journal, understanding writing guidelines, developing your writing process, understanding the review process, and dealing with rejection. (See Tips for Writing for Publication in Part I.)

“Along with colleagues, I led my first publication that will come out this fall. I think the advice that I received at the writing webinar was invaluable.”

—CADRE Fellow Alumnus



“The CADRE fellowship year has really expanded my network with other early career scholars and has provided me with opportunities to collaborate with others and share my work with the CADRE/DRK-12 community.”

—CADRE Fellow Alumnus

## GUIDING QUESTIONS FOR THE VIRTUAL MEETING ON WRITING FOR PUBLICATION

### Choosing a journal:

- What are some tips you can provide for identifying journals for your work?
- What should authors know about a journal before submitting a manuscript?
- Are pre-submission inquiries common practice?
- Do you have an experience that illustrates how and why you made a particular choice of journal for your article? Was it the right choice?

### Writing guidelines:

- Are there any unspoken rules or etiquette involved in submission for publication (e.g., being sure to cite work from the editors/reviewers of a given journal)?
- What ethical issues do you need to be aware of when writing a paper for publication?
- What is your process for co-writing an article? How is authorship negotiated? How is the work organized?

### Understanding the review process:

- What factors affect the likelihood of acceptance?
- In what ways may the editor respond? How should you respond to the editor if revisions are required? How do you make the most out of reviewer feedback?
- In an editorial role, how and why do you make the choice to accept/reject an article?
- As the author, how do you know when to revise and resubmit v. move on?

### Miscellaneous:

- What are some of your strategies for broadening dissemination? What is your experience writing for different audiences, including the public?
- In what other ways besides journals and white papers do you share your research? What trends do you see that are important for early career researchers to understand and/or take advantage of now (e.g., blogging, tweeting)?
- How do you remain accountable to the communities that you serve/work with?
- What tips do you have for balancing life and work while still making time to write?
- Are you (or have you ever been) part of an academic writing group? If so, how was it created and how was it maintained?

### Long-term thinking:

- Do you have any general advice or lessons learned to share with early career researchers who are hoping to embark on successful writing careers?
- What advice do you have for publishing from a dissertation?

## Activity

Building on the information from the virtual meeting, Fellows choose one of the activities and work collaboratively with another Fellow. The goals of the assignment are to (1) provide Fellows with time, structure, and support to work on at least one area of writing that is most aligned with their current needs and interests; (2) have them collaborate with and support another Fellow who is in a similar place in terms of writing experience or a current writing project; (3) help them develop a resource or draft that will be useful to their efforts to get published, perhaps in the near future; and (4) prioritize time to share their experiences, insights, and learnings with the Fellows group to clarify their thoughts and inform their publishing-related efforts.

Activity options have included:

1. Draft an outline or section of a manuscript: Draft an outline of a paper you want to write or the sections of a paper that are appropriate for you to write at this time. (*This might include the introduction/problem, literature review, or theoretical framework.*) Share your draft outline or section with your partner to receive feedback.
2. Peer review of a manuscript in progress: Review and provide meaningful feedback on another Fellow's manuscript.
3. Prepare a conference proposal: Very often conference proposals are the "first step" for writing an article. If you are at this stage and there is an appropriate conference deadline coming up, draft a session proposal to share with another Fellow for feedback. For a list of conference timelines, see [Conferences for STEM Educators, Policymakers, and Researchers](#) on [cadrek12.org](http://cadrek12.org).
4. "Flipping" papers, or providing a new lens (e.g., methodology, theoretical framework, research question) on a study or pre-existing data set: Create an outline for a paper and/or an abstract based on one aspect of your project or dissertation. Your partner will serve as a resource to help you focus and review your outline or abstract. You might consider how you could repurpose an existing dissertation section, article, proposal, etc., for a new audience.
5. Research potential journals that align with your proposed paper: Work independently or in pairs to identify potential ideas or topics for a paper, and research journals to find appropriate outlets for your research. (*You can start with CADRE's list of [STEM education publications](#).*) After you have each identified journals, discuss your selections with your partner. Prepare a one-paragraph summary about the journals you identified to be shared with the Fellows.
6. Draft a pre-submission inquiry: Identify a journal, and draft a pre-submission inquiry letter to the editor to gauge whether the journal is a good fit for your research. (*You can refer to CADRE's list of [STEM education publications](#).*) Exchange draft letters with your partner for both to review and provide feedback.
7. Write a blog post: Work independently or in pairs/groups to write a blog post about a current STEM education or research issue of your choice for the DRK-12 Community Voices blog on [cadrek12.org](http://cadrek12.org). Some possible topics include approaches to addressing research implementation issues, advice for early career researchers, interesting findings from Fellows' research around new approaches to improving teaching and learning, a short perspective piece, or a summary of a conversation/interview with another STEM education researcher.



## BUILDING PROFESSIONAL NETWORKS

Compared with other topics, early career researchers report that support for networking and collaboration is both needed and received to a great extent (see the Topics on Which Early Career Respondents Needed or Received Support graph); however, opportunities to network depend significantly on institutional affiliation and facilitation by PIs or mentors. Even with all that help, networking support and opportunities have always been on the top of the list of what Fellows value about the CADRE Fellows program.

### Virtual Meeting

CADRE invites panelists who are relatively close to Fellows in their career trajectories, such as Fellows alumni and CAREER awardees, to share their experiences and offer advice on networking strategies and etiquette, how and where to make connections, and how to sustain professional relationships. CADRE also seeks panelists who have developed strong networks with teachers, principals, and other education audience. (See Tips for Building Professional Networks in Part I.)

### GUIDING QUESTIONS FOR THE VIRTUAL MEETING ON NETWORKING

#### Establishing needs, identifying opportunities:

- What have been some of your goals for networking?
- How have you identified authentic networking opportunities?
- How did you go about finding your academic or professional community?

#### Making connections:

- What are some of the different types of networking relationships you have formed? What strategies did you use to make those connections?
- How do you break the ice with other researchers? What are some peer networking techniques that you employ? How do you approach networking with more senior scholars?
- Do you have examples of networking gone wrong through which you have gained insights about what not to do? Please share lessons learned from these experiences.
- What tips do you have for using social media as an academic/professional? What platforms do you think work well and why?

#### Leveraging connections:

- Have any of your networking connections grown into a longer term collaboration? What did you do to make that transition happen?
- If networking has been a factor in your job searches, how has it helped or hindered your success?
- How have you leveraged formal networks (e.g., professional association membership?) informal networks (e.g., friends?)
- How do you leverage your friends' and/or colleagues' networks?
- How have you leveraged serendipitous or otherwise unplanned networking opportunities?

#### Miscellaneous:

- What tips do you have for maintaining your professional network?
- How do you make use of conferences to build or maintain your networks? What advice do you have for graduate students at conferences with regards to networks?
- What do you wish you would have known and/or done with regard to networking at the start of your career?
- How has your thinking about networking changed over time? How have your networking practices evolved over the course of your career?

## Activity

Building on the information from the virtual meeting, Fellows collaborate with one another or work on their own on an activity to identify networking needs and opportunities, map their current network, identify people to reach out to and plan a strategy for contacting them, and develop strategies or tools such as an elevator pitch, guiding questions, sentence starters, a personal webpage, and/or a LinkedIn profile. Fellows are encouraged to tailor the activity to their particular networking needs at this stage of their careers. Here is the activity overview:

“I am still using the network that CADRE helped me build.”

—CADRE Fellow Alumnus

### Step 1. Establish needs; identify opportunities

Assess your networking needs. Decide what it is you want to get out of and can give to a networking connection and what that implies for whom you want to have in your network.

### Step 2. Map your current network

After you have identified your networking needs, begin thinking about who can help you meet those needs.

- List those you already know.
- Think about those you know; who do THEY know?

### Step 3. Identify and prioritize additional contacts, and plan your strategy for contacting them.

### Step 4. Track your networking plan and effort

As you identify potential contacts and make connections, keep track of those contacts. You may use a spreadsheet or your email program’s contacts function (or a good old Rolodex or a notebook)!

### Step 5. Work on your strategies, skills, and “props”

Consider creating a personal webpage, updating your LinkedIn profile, or joining a LinkedIn group. Develop and practice your elevator pitch. Draft guiding questions or sentence starters for a conversation. (See Networking Resources for examples and tips.)



## DEVELOPING NSF PROPOSALS

Early career researchers have reported that developing proposals for funding is the topic in which they most need support, yet they receive it infrequently (Riley & Butler, 2014). In response to this need, the CADRE Fellows program includes an opportunity to read real NSF proposals, discuss those proposals with their authors, and engage in a mock panel review led by an NSF program director.

### Virtual Meeting

Fellows engage in conversation with a panel of PIs who have received funding from a number of sources and talk about the commonalities and differences in seeking and receiving funding from those sources. This webinar is followed by another featuring experienced PIs on the topic of proposal writing. CADRE invites panelists who have been funded by the DRK-12 program and/or served as reviewers for NSF to discuss their experiences and offer advice on developing a proposal idea, moving from idea to finished proposal, the proposal review process, and

dealing with rejection. (See Tips for Developing NSF Proposals in Part I.) Panelists also share their funded proposals with Fellows beforehand to help inform the conversation and to provide Fellows with examples of successful proposals.

“I learned a lot about the structure of NSF, how to get on NSF review panels, and more about the types of projects and ideas that NSF wants to support. All of this information has been invaluable in writing my own proposals and working on NSF projects.”

—CADRE Fellow Alumnus

## GUIDING QUESTIONS FOR THE VIRTUAL MEETING ON FUNDING AND PROPOSAL WRITING

### Developing your project idea:

- What advice do you have for early career researchers on identifying appropriate funding opportunities for your research?
- How have you interacted with the funder before and after the proposal was submitted? How does this differ across funders and funding agencies?
- How did you begin to translate parts of your research agenda into concrete project ideas?
- How did you go about forming research collaborations with project collaborators and partners? How have you defined roles and responsibilities? What should those who are just beginning to form research collaborations keep in mind?
- How did you develop collaborations with research sites?

### Writing your proposal:

- How does proposal writing differ by funding agency (i.e., government agency, foundation, state/local funders, and university grants)?
- How do you begin developing your proposals? Do you have a general timeline for developing proposals? What is your approach?
- How have you managed the proposal writing process? Do you work with a team? What roles and responsibilities does each person take?
- How many of the project details do you have in place when submitting a proposal? For example, do you have agreements to participate from teachers/school districts?
- What preliminary data do you incorporate in a grant proposal?
- What do you take into consideration when developing the budget and how does that change with different funders?

### After the award selection has been made:

- What have you learned from your proposals that did not get funded? What do you do with ideas that are not funded?
- What are your first steps when a proposal is funded?



## GUIDING QUESTIONS FOR THE VIRTUAL MEETING ON WRITING DRK-12 PROPOSALS

### Developing your project idea:

- How did you align your research agenda with a proposal idea and the DRK-12 solicitation guidelines?
- How did your proposal ideas build off of past work?

### Writing your proposal:

- How did you approach responding to the solicitation in your proposal narrative?
- What was your approach to fitting your proposal narrative into 15 pages? How did you leverage proposal attachments to provide additional information?
- What did you incorporate in your postdoctoral mentoring plan, if applicable? Data management plan? What approach did you take to addressing NSF's broader impacts?

### Interacting with NSF:

- How did you interact with NSF before and after the proposal was submitted, e.g., asked preliminary questions or submitted a concept paper prior to the final submission? What did you learn from engaging with NSF in these ways?
- What happened during the negotiation process?

### General Advice:

- If you have served as an NSF reviewer, what did you learn from the experience that you have applied to writing your own proposals?
- What advice do you have for early career researchers about applying for NSF funding?

“I am not intimidated to apply for NSF funding. I know that I can reach out to program officers. I have more confidence in navigating education research.”

—CADRE Fellow Alumnus

### Activity: Mock Proposal Review

In the proposal strand's culminating event, Fellows gather in person to meet NSF program directors and engage in a mock proposal review. Building on the information from the virtual meeting on proposals, Fellows review two DRK-12 proposals and write comments that address the strengths and weaknesses of the proposals with references to the central merit criteria of intellectual merit and broader impacts, using the review guidelines outlined by NSF.

The Fellows then participate in a panel discussion led by an NSF program director. During the mock review, one panelist summarizes a proposal for the benefit of the rest of the panel. The other panelists, in turn, comment on the proposal and state their ratings. All panelists may follow up with questions or comments, and may change their rating of any proposal. One panelist records the entire discussion and writes a summary of the panel discussion.

During the NSF visit, CADRE also arranges for Fellows to meet with program directors one on one or in small groups to learn more about the proposal review process, the structure of NSF, and NSF funding priorities, or to discuss Fellows' project ideas.

# Benefits and Challenges of the CADRE Fellows Program

Fellows have reported many benefits from participating in the program, such as the following:

- A better understanding of NSF funding mechanisms and the elements of successful proposal writing
- Networking and community building with early career colleagues
- Professional contact with and learning from more senior researchers and other professionals
- Awareness of different career opportunities in STEM education
- Increased confidence in participating in professional conversations
- Increased knowledge related to writing and publishing, and a better perspective of what it means to be a STEM education professional
- Developing an identity as STEM education researchers

CADRE's previous research found that early career researchers (who were not in the CADRE Fellows program, or prior to their participation in the program) reported feeling isolated, often not having meaningful engagement with colleagues outside of their institutions. Furthermore, early career researchers entering the program have described a need for more authentic networking experiences with colleagues.

They said that “authentic” networking occurred when they were engaged in collaborative work, activities, or experiences. CADRE added a networking strand and offered opportunities for more engagement between Fellows, as well as with Fellows alumni, CAREER awardees, and more-experienced PIs. At the end of each program year, the Fellows stated that one of the primary benefits of the program was the opportunity to engage with peers from other institutions by meeting in person, discussing the strand topics during virtual meetings, working together on monthly assignments, and informally meeting outside of the program.

Fellows reported the intention to continue to stay in contact with each other, sending updates about work, publications, etc. Fellows alumni have reported formally contacting each other to provide writing support (peer critique) and share job information, and meeting at conferences where they share updates. They also report sharing tips and materials from the program with their colleagues.

“Being a CADRE Fellow was an enriching experience for me since it allowed me to exchange ideas with peers, expand my professional network, and learn more about NSF’s review process for proposals and funding.”

—CADRE Fellow Alumnus

“A better understanding of the NSF, of academic careers, and of the field in general will positively impact my ability to operate in the field. In addition, I will have long-term contacts at various institutions for collaboration and networking.”

—CADRE Fellow Alumnus

We continue to identify opportunities to improve the selection of candidates and the structure and content of the CADRE Fellows program. For instance, CADRE has selected Fellows who are at various stages of their doctoral programs or early career work; occasionally we have accepted postdoctoral researchers. The professional growth needs of a first-year PhD student, a final-year PhD student, and a postdoctoral researcher are different. Since CADRE serves the community of DRK-12 funded projects and, therefore, invites nominations from a limited pool of projects, and since CADRE seeks to compile a cohort of 10, we accept

Fellows who are at any stage of their PhD programs, or at a similar stage in their career at other professional settings, and postdoctoral researchers—when we are not offering a separate postdoctoral opportunity. Programs that serve researchers at a very particular stage of their careers (e.g., early stage PhD students versus later stage PhD candidates) may be better able to design activities to best meet the needs of those early career participants. However, CADRE Fellows also report that there is benefit to engaging with researchers at various stages. A larger program could offer opportunities that cater to researchers at a more limited career stage while also offering opportunities for researchers at various stages to interact with each other.

The Fellows report that in-person meetings have been crucial to their abilities to network with each other and develop a cohort that supports their professional growth. Travel for these meetings is expensive. One solution is to leverage travel that was already planned and paid for by other means (e.g., project funds). CADRE arranged meetings at national conferences and NSF PI meetings; however, not all Fellows typically attend the same meetings. An expansion of the program that is responsive to evaluation findings would increase the number of in-person meetings.

Finally, we continue to make adjustments to the content of the program. For instance, each cohort of Fellows have highly rated the funding portion of the program. Cohorts of Fellows that include more-advanced PhD students and postdoctoral researchers have rated the publication strand less highly. They have often already published and received support to do so. Fellows further along in their careers are more interested in learning more about funding, proposal writing, and NSF. For cohorts of postdoctoral researchers, we will adjust the program to include more support in those areas.

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