

# ARISE Project Evaluation

## Final Report

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## EXECUTIVE SUMMARY

Led by the American Association for the Advancement of Science (AAAS), the ARISE program was funded by the National Science Foundation (NSF) (Grant No. DUE-1138038) to provide resources, tools, and a community to foster research and evidence-based innovation in STEM pre-service teacher education and leadership development programs. ARISE works with the NSF Robert Noyce Teacher Scholarship Program to identify and disseminate information about effective practices and strategies for attracting, selecting, and preparing K–12 STEM teachers and retaining them in the STEM teacher workforce. ARISE also seeks to develop a research agenda to help build effective STEM teacher education and leadership programs for high-need schools.

The Education Development Center’s Center for Children and Technology (EDC/CCT) served as the external evaluator for the ARISE project, examining how the resources and activities provided through ARISE support Noyce grantees, as well as documenting grantees’ current research activities and ideas for future research. As part of the evaluation, we conducted a series of baseline and follow-up interviews with 15 Noyce grantees from Track 1: Scholarship and Stipends Track, Track 2: Teaching Fellowships Track, and Track 3: Master Teaching Fellowships Track. In addition, we conducted focus groups with grantees from Track 4: Research Track. This report presents the results from these interviews and focus groups.

## KEY FINDINGS

- Grantees across all Noyce tracks view ARISE as adding great value to the Noyce program, and reported that it provides opportunities for them to connect with each other, share best practices, and forge new partnerships.
- Across all Noyce tracks, the majority of grantees agree that ARISE activities—particularly the Noyce Summit, regional dialogues, and webinar series—exposed them to evidence-based practices for attracting, preparing, supporting, and retaining STEM teachers in high-need schools that they could apply directly to their programs. Likewise, most grantees agreed that ARISE activities and resources increased their awareness about topics and strategies for future data use and research on those same areas.
- The focus on culturally responsive pedagogy (CRP) emerged as a strength of ARISE resources and activities. Multiple grantees from Tracks 1 through 3 reported that they have infused CRP into their programs, and said they especially appreciated that the webinars, workshops, and speakers at the Annual Summit and regional dialogues offered actionable ideas for how to incorporate CRP.
- Track 1 through 3 interviewees engaged with an average of four ARISE activities and resources (ranging from 2 to 8). All attended the Annual Noyce Summit, and all but two either attended or hosted a regional dialogue.
- All but two grantees from Tracks 1 through 3 reported having made changes to their program since our baseline interviews in 2017. For many projects, these changes were inspired by what grantees learned through the Annual Noyce Summit, regional dialogues, webinars, and conversations with other grantees. These changes tended to increase a program's focus on practices, strategies, and activities that prepare new K–12 STEM educators to teach in high-need schools, with the ultimate goal of increasing retention.

- With the exception of one project, all interviewees from Tracks 1 through 3 reported that their project is conducting research. In many cases, the data collected by the project team is supplemented by an external evaluation.
- Grantees who participated in the proposal preparation webinar reported that it was very helpful in understanding NSF's priorities and the key proposal components.
- Most projects have not yet completed data analysis; however, most have taken advantage of opportunities to share their work, mostly through presentations via Noyce meetings and at other professional conferences.
- Grantees from Tracks 1 through 3 discussed the need for additional research, and described multiple ideas they are interested in exploring. Some grantees focused on the impact of their particular program on students. Others were interested in identifying the particular aspects of their program and the context of high-need schools that support scholars and alumni and may contribute to retention.
- Track 4 grantees valued meeting other Track 4 grantees, noting that these meetings provide strong opportunities for networking, which they said has inspired new research paths, collaborations, and avenues for dissemination. Grantees especially value smaller meetings, such as the PERSIST Pre-Summit Meeting, where they can easily identify and speak with grantees from other Track 4 projects. Likewise, they view the Noyce Summit as a time to discuss research and best practices with their colleagues.
- Grantees believe there are opportunities to better support Track 4 grantees by offering more workshops on research design, instrument development, and dissemination.
- The Track 4 participants who attended the STEM Teacher Retention working meeting felt it was well organized, well facilitated, and provided the time and space to dig deeper into questions relevant to education research.

- Most Track 4 grantees we interviewed were not familiar with the ARISE website, but they see its potential as a repository for sharing instruments and best practices.
- Grantees in both collaborative and individual Track 4 projects use a range of rigorous qualitative methods to address their research questions. Where possible, grantees use instruments from other studies that have been validated, adapting and testing as necessary.
- Participants in the collaborative Track 4 focus groups engaged with an average of 2.7 ARISE activities and resources, and an average of 3.3 for participants in the individual Track 4 focus group. As shown in Table 4, all Track 4 interviewees attended the Annual Noyce Summit and all were familiar with ARISE's research agenda.
- About half of participants in both Track 4 focus groups are collecting data on teacher retention in high-need schools, including longitudinal data that follows program graduates. Multiple grantees noted that collecting these data is challenging since not all projects have direct access to scholars or alumni.
- Nearly all grantees from the Track 4 collaborative grants believe their projects are strengthened by the diversity of perspectives and expertise that their collaborations yield. Managing these partnerships, however, can be challenging.

## BACKGROUND

This report presents findings from the external evaluation of the American Association for the Advancement of Science's (AAAS) Advancing Research and Innovation in the STEM Education Pre-service Teachers in High-Need School Districts (ARISE) network. Funded by the National Science Foundation (NSF) (Grant No. DUE-1138038), the ARISE network includes representatives from NSF Noyce projects, other NSF and U.S. Department of Education teacher pre-service and leadership development programs, STEM research efforts, state and local education agencies, and professional educational societies. Overall, ARISE seeks to accomplish the following goals:

- Foster research and evidence-based innovation in STEM pre-service teacher education and leadership development programs;
- Identify and disseminate information about effective practices and strategies for attracting, selecting, and preparing K–12 STEM teachers and retaining them in the STEM teacher workforce; and
- Develop a research agenda to help build effective STEM teacher education and leadership programs for high-need schools.

To address these goals, ARISE provides resources and organizes activities that support grantees from the NSF Robert Noyce Teacher Scholarship Program (see Table 1 for a list of ARISE activities and resources).

**Table 1. Resources and Activities Supported Through ARISE**

Noyce Summit	ARISE organizes and co-hosts the Annual Noyce Summit, which brings together Noyce grantees from across the country.
Regional dialogues	ARISE hosts focused local meetings to survey the landscape of pre-service STEM teacher education.
Proposal preparation webinars	ARISE hosts webinars for potential Noyce grantees to foster a better understanding of the features of winning proposals.
ARISE website	ARISE developed and maintains a website to support dissemination and outreach.
Newsletter and blog	ARISE disseminates a newsletter and blog for Noyce grantees highlighting new resources and events.
Community Webinar Series	ARISE organized and hosted a series of three webinars focused on evidence-based transformative STEM teacher preparation, specifically Active Learning Pedagogy, Culturally Relevant Pedagogy, and Supporting All Learners.
STEM teacher-retention working meeting	In May 2019, ARISE hosted a working meeting that sought to explore and advance the role of teacher preparation programs in the retention of STEM teachers in the workforce, particularly in high-need schools.
Research agenda and a blueprint for innovation	ARISE has convened working groups to develop commissioned papers and other resources related to teacher preparation and retention, teacher induction programs associated with retention, and measurement of STEM teacher preparation.

## EVALUATION APPROACH

This qualitative evaluation examined how the resources and activities provided through ARISE support Noyce grantees, and documented grantees’ current research activities and ideas for future research. To do this, EDC conducted a series of individual interviews with 15 Noyce grantees from Track 1 (Scholarship and Stipends Track), Track 2 (Teaching Fellowships Track), and Track 3 (Master Teaching Fellowships Track). In addition, we conducted focus groups with grantees from Track 4: Research Track.

## Track 1 Through 3 Interviews

In July and August 2019, EDC/CCT conducted follow-up interviews with 15 Track 1 through 3 Noyce grantees. These interviews build on an interview study EDC conducted in 2017 with the same group of grantees.

The interview probed the following key areas:

- Engagement with ARISE activities and resources;
- Changes in grantees' STEM Teacher Education Programs;
- Grantees' current research and dissemination practices; and
- Grantees' vision for future research and interest in pursuing a Noyce Track 4 grant.

EDC designed the interview protocol with input from ARISE project staff, drawing from a subset of questions from the pre-interview, along with new questions to probe program changes and engagement with ARISE resources and activities. The current interview study includes 15 of the 20 grantees interviewed in 2017. Two of the projects from the initial study ended shortly after the 2017 interview (these grantees reported that they had nothing new to share). We were unable to connect with grantees from the remaining three projects despite repeated attempts to reach them through email and voicemail.

## Track 4 Focus Groups

In July 2019, EDC conducted two focus groups with Track 4 Noyce grantees. Track 4 is a research track of Noyce that funds collaborations among universities, professional societies, research institutes, and similar organizations to conduct exploratory research on STEM teacher effectiveness and persistence and teacher retention in high-need schools. NSF requires that Noyce Research Track projects include substantive collaboration among STEM faculty, STEM education faculty, and education researchers. Track 4 grantees that include a collaboration with current or past Noyce awardees are eligible for an additional \$100,000 in funding per current or past awardee (not to exceed \$2,300,000 over five years). Although all Track 4 projects are collaborations either within or across universities, for the purposes of this report, we will refer to Track 4 grants that partner with current or past Noyce awardees as Track 4 **collaborative** projects.

The first focus group included six grantees from the Noyce Track 4 collaborative projects. The second focus group included five grantees from the Track 4 non-collaborative

projects. To accommodate grantee schedules and to increase our sample, we conducted two additional individual interviews; one with a Track 4 collaborative grantee, and one with a Track 4 non-collaborative grantee. We used the same protocol for both focus groups, as well as for the individual interviews (see Appendix B). For the sake of analysis and reporting, the results of these interviews are combined with those of the focus groups.

The focus groups probed the following key areas:

- Engagement with ARISE activities and resources;
- Grantees' current research and dissemination practices; and
- Feedback on the Pre-Noyce Summit meeting for Track 4 grantees.

### Analytic Approach

Each interview and focus group was recorded and transcribed. Drawing on the principles of thematic analysis, we used a qualitative analysis platform to code each transcript. We first reviewed transcriptions, generating a new set of codes to supplement those used in the first set of interviews in 2017. We then applied these codes across the data; reviewed themes; and produced a report of the findings.

# FINDINGS

We organize the findings into two sections: (1) Track 1 through 3 interviews, and (2) Track 4 focus groups.

## Track 1 Through 3 Interviews

### Overview

Track 1 through 3 Noyce grantees view ARISE as adding great value to the larger Noyce program, and all but two reported that ARISE activities provide opportunities for grantees to connect with each other, share best practices, and forge new partnerships. Eleven grantees also noted that ARISE activities—particularly the Noyce Summit, regional dialogues, and webinar series—exposed them to evidence-based practices for attracting, preparing, supporting, and retaining STEM teachers in high-need schools that they could apply directly to their programs. One grantee described the role of the Noyce Summit and regional dialogues as “critical for a collaborative environment” and discussed how these meetings support grantees in learning about new ideas that they can bring back to their programs:

*It's a time to share best practices...it pushes the whole teacher ed community to understand important ideas...Dr. Tonikiaa Orange [the keynote speaker at the 2019 Summit] really pushed my colleagues in STEM [to consider] preparing teachers for high-need contexts...I really appreciate both the regional dialogues and the Summit as an opportunity to have these critical conversations.*

The focus on culturally responsive pedagogy (CRP) emerged as a strength of ARISE resources and activities. Multiple grantees reported that they have infused CRP into their program, and said they especially appreciated that the webinars, workshops, and speakers at the Annual Summit and regional dialogues offered actionable ideas for how to do this. One grantee commented: “At last year’s regional meeting in St. Louis, there was a really great keynote speaker on culturally relevant pedagogy. And I found that particularly

inspiring because he gave really great examples of CRP being applied to STEM lessons.” This interviewee and others also appreciated that speakers framed CRP as applying to multiple subject areas, not just social studies and current events.

*Lots of times when you talk to colleagues, they assume you have to be dealing with culture or social issues explicitly in order for CRP to be relevant to your teaching. And since in the science and math we’re not talking about history, culture, or social issues directly, [the assumption is] that it’s not relevant. But they gave really great examples about how it is.*

Nearly all interviewees agreed that ARISE activities and resources increased their awareness about topics and strategies for future data use and research on attracting, preparing, supporting, and retaining STEM teachers and leaders in high-need schools. As demonstrated by the quotes below, opportunities to share research approaches and provide feedback at the Noyce Summit and regional dialogues were key to meeting this goal.

*Last year at the Regional Summit we presented our emergent coding scheme for this analysis of our written work. And, I mean, the feedback that we got on our coding scheme, even by itself, is so valuable. The discussion afterward was, you know, the attendees were really excited about what we were doing, but they also provided some really valuable insight.*

*I think it’s very helpful in terms of, you know, just disseminating what’s working elsewhere and giving you ideas about how we could change what we were doing here.*

*Yes, I think [the Summit and regional dialogues] allowed me to develop ideas around what a Track 4 is and what types of questions that I would want to ask in that realm...yes, certainly, the resources have helped me think about data I would like to collect or types of research questions to propose for Track 4.*

## Participation in Noyce Activities

Interviewees engaged with an average of four ARISE activities and resources (ranging from 2 to 8) As shown in Table 2, all interviewees attended the Annual Noyce Summit, and all but two either attended or hosted a regional dialogue. Eight interviewees attended the proposal preparation webinar, which they felt reinforced NSF priorities and helped them understand how to best frame key components of their proposals. Seven interviewees participated in at least one of the webinars on topics critical to the preparation and retention of teachers in high-need schools. The webinar on culturally relevant pedagogy (CRP) was the most popular webinar. Although engagement with the ARISE website (n=5) and newsletter/blog (n=6) was low relative to other activities and resources, interviewees see the potential of these resources as a place for projects to collaborate, share findings, and provide promising strategies for addressing challenges commonly experienced by grantees:

*I think it's good what the ARISE grant is trying to do...I think it needs a little more there before it'll get a lot of people to see it as a resource. When I talk to people who have Track 1 grants, the biggest things they're worried about are, 'How do I recruit teachers locally?' And that's not something I think is really on the ARISE website yet. There could be some kind of how-to guide like 'Here's some things that you might try for recruitment.' ...to make it useful there's got to be a little more on the practitioner side like 'How do I do this?' Or, 'Here are the instruments that people are using for collecting data about teacher beliefs.'*

Finally, four interviewees participated in the meeting on STEM teacher retention in high-need schools; three more reported that they would like to have attended, but said they learned about it too late.

**Table 2. Interviewee Engagement in Noyce Resources and Activities: Track 1 Through 3 Grantees (N=15)**

	Number of interviewees
Annual Noyce Summit	15
Regional dialogues	13
Proposal preparation webinar	8
Webinars	7
Research agenda	7
ARISE newsletter/blog	6
ARISE website	5
Retention Working Group meeting	4

## Changes Made to Grant

All but two grantees reported making changes to their program since our initial interviews in 2017. For many projects, these changes were inspired by what grantees learned through the Annual Noyce Summit, regional dialogues, webinars, and conversations with other grantees. These changes tended to increase a program’s focus on practices, strategies, and activities that prepare new K–12 STEM educators to teach in high-need schools, with the ultimate goal of increasing retention. For example, grantees added new activities (e.g., peer mentoring), shifted recruitment strategies (e.g., seeking new pools of applicants by partnering with community colleges), and infused progressive practices into coursework and lesson planning (e.g., infusing CRP into existing coursework). One grantee developed a peer mentoring program and added a computer science certification to her teacher education program based on discussions at a regional dialogue, the Noyce Summit, and conversations with the ARISE team:

*The regional dialogue meeting helped spur this whole idea. Some of the issues that came up in discussion groups, you know, the need for more computer scientists, more computer science teachers, that kind of thing I learned more from going to the Summit or talking with the ARISE team: 'Okay, this is a place we need to fill, a gap that we need to start working on.' So that definitely helped make me more aware of where the needs are.*

Another interviewee explained how hearing the Gloria Ladson-Billings speech at the Noyce Summit inspired her to provide workshops on CRP and make cultural competency an explicit focus of her teacher preparation program.

*At the summit last year or two years ago, Gloria Ladson-Billings spoke and she was so dynamic and that's her. She coined the phrase, 'Culturally relevant pedagogy.' Then we invited her and she came and was a guest speaker at our college last year, and people are very excited about it. They have a strong commitment to that at our university, and so we wanted to make it more explicit that not only our Noyce scholars, but all our pre-service teachers need to be competent—culturally competent.*

Multiple grantees described program changes that were focused on boosting enrollment. For example, one program struggling with recruitment opted to offer a dual degree in computer science and another STEM-related subject area. Although this was a recent change, the grantee has seen interest in the program increase. Three universities increased the length of their teacher education program to make it more manageable for scholars, with the ultimate goal of increasing enrollment. Because these changes were implemented only recently, the impact is not yet clear. Said one interviewee:

*The problem was, nobody could complete the program in four years, so even though it was a four-year program, there were so many credits that they just could not complete it in four years. So time will tell whether or not that increases the number of students that we have considering teaching going into it as undergraduates. You know, we don't know that, especially after the Noyce support ends. It was not problematic before, because the additional year—generally the*

*Noyce scholarship covered that. So we'll see in the next couple of years whether or not there is any impact.*

Finally, a few interviewees described changes that were dictated by state mandate. For example, one state reduced the number of credits necessary to graduate, which one grantee said forced her program to eliminate general education courses.

*We had to make a change recently in response to a state mandate to reduce the number of credits in our program. We tried not to take from the content. We had to reduce from the gen-ed, which, you know, we weren't happy about either...We didn't want to touch the professional sequence; we didn't want to touch content, but we were under the gun to have to remove something, so some of the general education courses were lost.*

## Research & Dissemination

All but one grantee reported that their project is conducting research. In many cases, the data collected by the project team is supplemented with an external evaluation. The external evaluator typically collects data on enrollment characteristics, retention, scholars' self-efficacy regarding teaching STEM in high-need schools, and overall feedback on their program. Ten grantees teams are evaluating the impact of their programs across a range of outcomes (changes in scholars' pedagogical approaches, use of CRP, and how well-prepared scholars and alumni feel to teach STEM in high-need schools). Five grantees reported conducting research that will contribute to the larger field of preparing STEM teachers for high-need schools (e.g., program and school characteristics that influence retention).

Most projects have not yet completed data analysis; however, most have taken advantage of opportunities to share their work, mostly through presentations at Noyce meetings and at other professional conferences. Ten grantees have presented at the Noyce Summit, and nine have presented at a regional dialogue. Eight grantees have presented at professional conferences, such as NARST, NCTM, and ASTE. Two grantees are working on chapters; one has written a practitioner article for ASCD; and four are hoping to publish their results

in peer-reviewed journals once analysis is complete. Interviewees categorically agreed that they need more time, staff, and money to do research and dissemination.

*Really, to do more research, what we need is more people. Because we are—we're working pretty much at capacity. And we have people doing a lot of research in math and science education.*

*It takes time and personnel.*

*We need more time, yeah, we all need more time. Not only to do the research, but then to write it up.*

## Future Research & Interest in Pursuing Track 4 Grants

Grantees discussed the need for additional research, and described multiple ideas they are interested in exploring. Some grantees focused on the impact of their particular program on students (e.g., specific aspects of program that alumni found useful; impact of program on longer-term teacher retention). Other grantees were interested in identifying the particular aspects of their program and the context of high-need schools that support scholars and alumni and may contribute to retention (e.g., identify program-based factors across Noyce projects that increase retention; document what CRP looks like in practice). Two interviewees are interested in identifying methods for studying Noyce programs that go beyond randomized control trials (RCTs) (see Appendix A for list of all future topics grantees discussed).

Three interviewees are already working on a funded Track 4 grant, and nine expressed interest in pursuing a Track 4 grant. Of the nine grantees who said they might be interested, seven said they would only consider a Track 4 grant if someone else would take the lead. Finally, three grantees said they would not consider a Track 4; two explained that they are at the end of their careers, and one said they needed a break.

## Challenges & Areas for Growth

- Interviews suggest that grantees are only beginning to become familiar with the ARISE website, newsletter, and blog. This is not surprising given that these resources are relatively new.
- ARISE is perceived to be focused on pre-service teachers, a perception which keeps programs that work with master teachers from using available resources.
- Grantees expressed the need for more time and staff for dissemination, and voiced frustration that NSF limits funding for administrative staff, which grantees said helps with project management.
- Three interviewees voiced the need for more sessions at the Noyce Summit related to measurement and spaces to share measurement tools. One interviewee suggested using the ARISE website to house resources related to measurement and actual instruments that grantees have validated.

## Track 4 Focus Groups

### Overview

Track 4 grantees valued meeting other Track 4 grantees, noting that such meetings provide strong opportunities for networking, which they said has inspired new research paths, collaborations, and avenues for dissemination. Track 4 grantees appreciate the Noyce Summit, and view it as a time to discuss research and best practices with their colleagues. Grantees especially value smaller meetings, such as the PERSIST Pre-Summit Meeting, where they can easily identify and speak with grantees from other Track 4 projects.

*I think this is the first time I've heard about the 15 of the 17 other Track 4s, right? We were always trying to find each other in the crowds the last two years. And now we actually know who we are, so I think from a community-building perspective, that was the biggest bonus.*

*I think the opportunity to talk with each other and—it just felt a whole lot different than being at the national meeting and catching somebody in between sessions...I mean, this was actually a lot of people sitting down, talking about a lot of important stuff. I don't know what connections will come out of this, but it's pretty clear from all those things that we did here today, that there could be some more connections to come out of all this. I think there will be future Noyce Track 4s that come out of it.*

*I actually see a really strong possibility for a third paper coming out of this meeting that would partner this—your Track 4 with our Track 4. And that wouldn't have happened had we just been—had a conference of 300 people.*

*It's really nice to have those conversations when we're really thinking about research, because that's what really pushes you down to see what matters and what doesn't, and how you want to go and how you want to move forward. I think that can move us forward in ways I think as somebody who does teach a*

*preparation, that's a big piece and I've met people—you know, everybody gets to talk to somebody here who is a little different, who brings the perspective.*

*I really valued the opportunity to hear about your programs [at the Pre-Summit PERSIST meeting], learn about new instruments I didn't know about, see connections updated that already exist in our projects that we can synergize on, and then having the time to talk informally and formally, both before and during lunch as being the more valuable part.*

*[After the Pre-Summit PERSIST meeting] everybody is saying, 'Wow, it's really great to see we all struggle with the same things.' ... I really appreciate community building. I think bringing people together in person is so important, incredibly important, especially as researchers and practitioners. Also allows us to say 'Oh, there's an avenue maybe we could collaborate on.'*

The Track 4 participants who attended the STEM Teacher Retention working meeting felt it was well organized, well facilitated, and provided the time and space to dig deeper into questions relevant to education research, while engaging grantees from other tracks in discussions where there is not consensus.

*That was, in my opinion, the most, because I'm not on a Track 1, 2, or 3 grant. I'm not a teacher educator. That was the most useful thing related to Noyce that I've participated in. It brought policy researchers and teacher educators together. It was really collaborative. Like people spoke. There were specific questions to answer. I did feel like we actually dug deep, there was enough time to actually think through research questions...I think Suzanne Wilson as a moderator, she just did a fantastic job synthesizing things, like asking really critical questions and pushing back on people who—I would say that empirical work was not guiding what they were talking about—as a policy person stepping into a teacher educator space. And sometimes I feel like we're talking—like things that I think that I know, teacher educators—and I'm speaking in broad generalities and I'm not—like we don't know the same things. And I don't think that we always—I mean, it's a big epistemological question. We don't always accept the same evidence for how we*

*know what we know. And I think, like the Track 4 grants, because they're trying to be collaborative like with research scientists and content people and teacher educators, like that brings it kind of to a head. And it was the first space I've been in, where that was like kind of openly acknowledged and challenged, which with like lots of really smart people on all three sides.*

*There was a lot of talk about data that has been analyzed or is being analyzed and ideas of the large data sets and...it was very well planned. It's probably the best NSF meeting I attended...The flow of the meeting was also really well, like building up and on what we did in three days was very well done.*

Interviewees believe there are opportunities to better support Track 4 grantees by offering more workshops on research design, instrument development, and dissemination. Grantees remarked that they would also benefit from developing a repository for research instruments used by Track 4 grants in a place that is accessible to all grantees, for example, on the ARISE website.

*We're having difficulty trying to figure out instruments for direct measurements with students that are ones that we can use with all of the students of all of the teachers in our study, and there's a lot of instruments out there, like I mean, there's—for example, Mozart instruments, right? But those are about misconceptions and that's not what we're trying to understand, and measuring misconceptions is not a good measure of a student's capacity to think as a function of the ways in which they interact with the teacher who teaches them.*

Most Track 4 grantees we interviewed were not familiar with the ARISE website; however, they see its potential as a repository for sharing instruments, best practices, and other types of resources for grantees across all Noyce tracks. Grantees recommended better publicizing these resources, though ARISE is already implementing most of the strategies that were suggested. For example, one grantee suggested that the email for the newsletter and blog might get more traction if it were to come from a trusted source, such as an NSF program officer, which it does. Participants also speculated that the email likely gets lost in a sea of emails they receive on a regular basis. One participant believes that

the ARISE website would become better known if it served as a repository for projects to share instruments, findings, and reports. Finally, although grantees believe that ARISE resources, webinars, newsletter, and the blog are likely helpful, as noted, grantees from the Track 4 collaborative track said that they are already stretched thin, and they are unlikely to be able to read or contribute to the newsletter or blog.

*I think it might be worthwhile to sort of survey the project and find out how much time are you spending on these projects and how much additional time do you have available for things like ARISE or other kinds of things as well? I mean, there's a lot of time and energy going into this and that—I'm not trying to be negative here, but just to say it might be worthwhile just to say how much more could or should people be asked to do? And how much more could you, as a project, take on? Because we're getting ready now for, you know, three other conferences and a book and all kinds of stuff. It's all good stuff. Don't get me wrong.*

## Generating Research Questions & Selecting Research Methods

Grantees from both the Track 4 collaborative and individual focus groups reported that their research questions emerged from previous work, some of which was funded through Noyce. One grantee added that their research questions were also reinforced by the call for proposals, particularly the focus on retention. Two grantees from the Track 4 collaborative project said their questions were informed by a review of relevant literature, along with the call for proposals. Finally, one non-collaborative Track 4 grantee said that the idea for her research came from her experience as an external evaluator for Noyce projects: "I was seeing the different futures, the different Noyce projects, and I wanted to study overall how these networks look across the nation."

Grantees in both collaborative and individual Track 4 projects use a range of rigorous qualitative (e.g., interviews, document analysis) and quantitative (e.g., surveys, social network analysis) methods to address their research questions. Where possible, grantees use instruments from other studies that have been validated, adapting and testing as necessary. In cases where no existing instrument is available, grantees develop their own instruments, engaging in a rigorous process to pilot test and establish validity, for example, through cognitive interviews and expert reviews. See Table 3 for details on the research topics, measures, and validation process.

**Table 3. Track 4 Research Topics, Measures, and Validation Processes\***

Research Topics	Measures	Validation Processes
Collaborative Track 4 Projects		
To what extent are Communities of Practice: <ul style="list-style-type: none"> <li>• relevant to teacher development</li> <li>• measurable as social networks</li> <li>• related to outcomes in identity, self-efficacy, and disposition to remain in teaching</li> </ul>	<ul style="list-style-type: none"> <li>• Ego-centric Social Network Analysis to assess embeddedness in Community of Practice</li> <li>• Teacher Self-Efficacy Beliefs (TEBS-Self)</li> <li>• Discipline-based Teacher Identity (validated)</li> <li>• Disposition to Remain in Teaching (teacher follow-up survey)</li> </ul>	Drew from existing, validated instruments
Influence of teacher leadership development on the persistence and professional trajectories of Master Teaching Fellows	<ul style="list-style-type: none"> <li>• Social Network Analysis</li> <li>• Teacher leader inventory</li> <li>• Teacher survey</li> <li>• Teacher interviews</li> </ul>	Adapted existing, validated instruments; conducted literature reviews; and conducted cognitive interviews
Impact of pre-service teacher research experience on effectiveness, persistence, and retention	<ul style="list-style-type: none"> <li>• Alumni surveys</li> <li>• Alumni interviews</li> <li>• Supervisor interviews</li> <li>• Comparison teacher interviews</li> <li>• Student surveys on 21<sup>st</sup> Century skills, STEM career awareness, and NGSS/CCSS practices</li> <li>• Student achievement data in math and science</li> </ul>	Adapted existing, validated instruments; conducted reliability analysis
How program components and state policies relate to recruitment, retention, and time to completion in university-based Noyce scholarship program  How teacher participation in Noyce-based preparation relates to K-12 student performance	<ul style="list-style-type: none"> <li>• Focus groups with program faculty and university supervisors</li> <li>• Program data</li> <li>• Descriptive information about institutions</li> <li>• Teacher retention data</li> <li>• School context data</li> <li>• State requirements, district policies</li> </ul>	Adapted existing, validated instruments; conducted expert reviews; conducted cognitive interviews; conducted literature review
Longitudinal impact of Noyce on subject matter knowledge of beginning STEM teachers	<ul style="list-style-type: none"> <li>• Praxis II Content Knowledge Assessment</li> <li>• Demographics</li> </ul>	Used existing, validated instruments

Non-Collaborative Track 4 Projects		
Role of social networks and self-efficacy in the retention of Noyce teachers	Developed social network survey, with questions drawn from existing validated measures	Conducted reliability analysis and cognitive interviews
<ul style="list-style-type: none"> <li>Teacher assessment practices and how they change over time</li> <li>Relationship between teachers' formative assessment practices and conceptual, pedagogical, cultural and political challenges</li> <li>Relationship between assessment practices and student performance on science and math exams</li> </ul>	<ul style="list-style-type: none"> <li>Discourse analysis</li> <li>Analysis of teacher unit plans and assessments</li> <li>Teacher interviews about school context and assessment practices</li> <li>Retrospective video reflections (teachers record and reflect on a lesson)</li> </ul>	Adapting existing, validated instruments; conducted validity and reliability testing
Characteristics of programs that produce persistent STEM teachers with high-quality instruction	<ul style="list-style-type: none"> <li>Instructional Quality Assessment</li> <li>Classroom tasks assigned to students</li> <li>Student work</li> </ul>	Adapted and further validated existing instruments
How to prepare secondary science and mathematics teachers to implement reform-based teaching in culturally and linguistically diverse classrooms	<ul style="list-style-type: none"> <li>Teacher survey</li> <li>Teacher interviews</li> <li>Teaching performance assessment (edTPA)</li> <li>Written reflections</li> </ul>	Adapted and further validated existing instruments
Retention of novice science teachers based on district induction and mentoring programs	<ul style="list-style-type: none"> <li>Staffing reports (e.g., education, salary, role)</li> <li>Case studies</li> </ul>	Pilot tested protocol for case studies

\*Please note that this is not an exhaustive list of instruments or validation methods for the Track 4 projects. Given the limited time of the focus group, participants gave examples of instruments and validation methods they are using. Several could not remember the name of existing instruments they were using. Similarly, several said that they were likely forgetting measures and validation methods.

## Participation in ARISE Activities

Participants in the collaborative Track 4 focus groups engaged with an average of 2.9 ARISE activities and resources; and an average of 3.5 for participants in the non-collaborative Track 4 focus group. As shown in Table 4, all interviewees attended the Annual Noyce Summit, and all were familiar with ARISE's research agenda. Five participants from the collaborative Track 4 focus group and two participants from the individual T4 focus group said they had either hosted or attended a regional dialogue, and three participants from the non-collaborative focus group attended the STEM Teacher Retention working meeting. Those who attended the meeting noted that it was a collaborative experience between policy researchers and teacher educators that was well

facilitated, addressed critical questions, and dug deep into the research. Engagement in the remaining ARISE activities and resources was very limited. One of the participants who uses the ARISE website noted that it is helpful for finding and linking to other Noyce projects. Although participants in both focus groups recognize the value of a newsletter and blog, they were unsure that they would have time to read or contribute to either.

**Table 4. Engagement in Noyce Resources and Activities: Track 4**

	Collaborative (n=7)	Non-Collaborative (n=6)
Annual Noyce Summit	7	6
Regional dialogue	5	2
Proposal preparation webinar	1	-
Webinars	-	2
Research agenda	7	5
ARISE newsletter/blog	-	-
ARISE website	-	2
Retention Working Group meeting	-	4

### Data on STEM Teacher Retention

About half of participants in both Track 4 focus groups are collecting data on teacher retention in high-need schools, including longitudinal data that follows program graduates. Multiple grantees noted that collecting these data is challenging since not all projects have direct access to scholars or alumni. A few projects have been able to create databases of scholars and have found that providing incentives, such as free movie tickets, increases survey response rates. Other projects must rely on PIs of other Noyce grants to distribute the survey. Several grantees stressed that PIs are often protective of their scholars' time and therefore do not pass on surveys to their scholars.

*I have a really hard time with [Track 1 through 3 PIs]. I actually really think that NSF should address this, because I got a lot of mean emails from PIs. We send information [to PIs] and we ask them to forward it to their Noyce teachers. Once they forward it, my participation rate is 92 percent, because we pay them \$50 to*

take an online survey. They're adults. Whether or not they will take a survey and spend time is up to them. But PIs are so protective. They're like, 'I'm doing my own little research. I'm doing this and this. Like I don't want to...' If we cannot create a positive, collaborative environment to do research, I really don't think that track four will go so far, because it is the same teachers we are all trying to get information out of.

## Collaboration & Managing Partnerships

Nearly all grantees from the Track 4 collaborative grants believe their projects are strengthened by the diversity of perspectives and expertise that their collaborations yield.

*I think the collaborative has been really important. I know it's not NSF's favorite thing to do, but I want to put a plug in that it's incredible, because instead of being a sub-award that eats up a lot of the overhead from a prime award, we were able to bring a lot of expertise from multiple institutions that we couldn't have afforded if it hadn't been collaborative...each place was so essential to our collaborative and we needed to be able to have these five institutions. Everybody has their expertise.*

Managing these partnerships, however, can be challenging. Projects that have been most successful in this regard stressed the importance of clearly defining project roles, establishing a shared vision of goals, and having regularly scheduled meetings.

*It's just regular meetings every week. We have a set time. We all get together. We know. We talk, we troubleshoot. We've gotten to know each other very well in terms of being able to talk about issues that have come up as we work with individual districts. Where we are with data collection, where we are with surveys...but just having a regular standing meeting time...that was just critical and we all knew to be there. We talked to each other frequently. To be there with that has been a huge piece in helping us do things that we need to do, to collect all the data, work with the schools, think about any issues that come up with data analysis, data collection, find out who can support who.*

*One of our co-PIs is a post-doc who has taken on the responsibility for managing this project...we meet every other week by Zoom conference and then we have three sub-working groups for each of the research questions that meet in between these other meetings, and they're tasked with accomplishing more things, and then we discuss bigger issues when we come before the full group.*

One grantee discussed the value of having one partner manage project logistics, including data collection, management, and analysis. Likewise, grantees discussed the value of having a partner with the infrastructure and experience carrying out large-scale data collection. One grantee explained that partnering with a research institute that had experience performing large-scale data collection was instrumental.

*Each district is different to work with their students to get that data, for that classroom, that student data, and then to get the data that we're looking for, the long-term achievement data, longitudinal. You know, it's finding the right people, doing all the stuff and each one is a different case. I can't overstate what it's like to have [research institute] taking the lead on those has been so huge. I mean, I'll give you an example...one of the school sites required paper surveys. So AIR had to box and organize them and do it to make sure the surveys were 12 sections of students and send them by FedEx to the student...I would have gone like, 'Oh God, this is never going to happen.' And they [the research institute] did it and came through. Worked with the teacher and sent out all the directions, everything went...having them organize that and lead that and do all the sending and then sending it all back to them. That made it doable. I mean, I don't know how we would have—if any other—if any of us in an academic institution to try to take that on, it would have been like to send all that to get it back and do it, I don't know if we could have done it.*

Along those lines, one non-collaborative grantee voiced frustration about working with non-research universities due to their lack of infrastructure:

*It's been easier to work with other research-intensive universities because they have like an office of research and the infrastructure that some of the smaller teaching*

*colleges don't have. And they don't have that. So as we've thought about submitting another grant, you know, as we've looked through the list, we've really focused on talking to these other research universities, because we think they might be easier to work with.*

Another grantee explained that managing expectations was difficult for them because with the low amount of funding they gave partners, they wanted to minimize the burden; however, as a result partners “didn't feel as integrated.”

*I think each campus that wasn't ours, got by design of the call that year, got \$50,000 over the entirety of the grant, which was three years, and so it's a really very small, I would argue, very small amount of money. And so we were conscious of that and intentional about trying to reduce the expectations we were placing on folks or the requests we were making of folks in the enterprise. Where I think that fell short is we unintentionally overdid it and so in our effort to try to minimize burden and bring together folks regularly, but not—you know, much more in a 'Let's share out in almost a consultative way.' I think people didn't feel as integrated into the sort of hard work of it in a good way as we had hoped. So we've tried to moderate our behavior in that the grant is wrapping up and engaging folks in the analytical work, which has been somewhat successful, I would say. But it's a hard balance, really, I would say, from a resource perspective to try to engage people meaningfully, authentically, and appropriately.*

Grantees from the individual and collaborative Track 4 grants stressed the importance of having staff “on the ground with districts” to help establish and maintain relationships and facilitate data collection. One non-collaborative Track 4 grant explained:

*My university is not an R1 university. We're a majority-minority university. We have an extremely dysfunctional alumni office, so we have zero information from there, and the only way we can contact Noyce, previous Noyce scholars, is by keeping our own data. So that's—my co-PI and I play off each other's strengths in doing that. I was a teacher in the school system where we're currently working. I've been working with that school system for 18 years now, since I've been a professor. And she has*

*been working—she’s been associated with the school board of the school system. We now know lots and lots of teachers and principals in lots of neighboring school districts that are all urban, so we’re able to keep our tentacles in those systems, but it requires an unbelievable amount of networking.*

Grantees from a few collaborative Track 4 projects noted that the volume of data generated from collaborative research projects can be overwhelming and it can be difficult to weave a coherent story.

*I will say too, just to be kind of authentic about it too, I think it’s challenging. I mean, I think it is a challenge. I mean, for us in the sense, because it is—the exciting part is it is such a big group, but like we have so much data. This is our experience. We have so much data, so as we add on like doctoral students, post-doc, sometimes I think it is a challenge, because sometimes it feels...like a little fragmented too. So I think it’s great, but sometimes I feel like it’s just hard to keep your head around...but we’ve talked about it in our group in the sense of having experience with smaller kinds of research projects and so now having larger [projects]—these huge amounts of data and trying to just be conscious of how to steward. I love that word. Like be good stewards of that work. So anyway, sometimes I feel like our group is so big, sometimes it feels more fragmented and I think that’s just the nature of the work. So I guess I just want to say that...but anyway, but I totally [think] it’s amazing and I’ve said to our doctoral students that, you know, I think for them to have this experience is enormous and something that—it’s great for them.*

*How to distribute work effectively and doing coding across four or five institutions and it’s not good all the time. I think a lot of us are struggling with that...It would be worth having a session some time around that.*

## Project Findings

Many of the Track 4 projects represented in the focus groups are either still collecting data or have not yet completed analysis. Below we highlight findings from projects that have completed at least part of their analysis.

- Using social network analysis, one Track 4 collaborative project found that female scholars tend to have established social networks (both within and outside of school) and maintain them over time, while men start with fewer networks, but catch up over time:

*There's a delayed effect for men—they both end up at the same place, but women just sort of start and maintain it and the men have to figure it out.*

- The Noyce program has allowed one project to forge meaningful relationships across disciplines within their campus community, and has allowed them to foster connections with school districts.
- Initial analysis suggests Noyce teachers are retained at high-need schools at similar rates as their counterparts at the same Education Preparation Program (EPP), but after Noyce teachers have fulfilled their commitment, they are more likely to leave the classroom compared to their peers not in Noyce; the team is planning additional analysis to determine whether the teachers are leaving education altogether or moving into leadership roles.

## Dissemination

Track 4 grantees have presented their work at the Noyce Summit, along with professional conferences such as NARST. Multiple grantees said they are still in the analysis phase, and are therefore still considering appropriate venues for publishing their work. Participants placed the greatest value on peer-reviewed journals; however, a few voiced concern that their research is qualitative in nature and that journals tend to favor quantitative research.

*I think one of the things I'll just throw in here, if I can quickly, is I think that we're kind of struggling with the idea that we really have case studies here, and it's hard*

*to put them together into one paper to make them sound like it's a—to make them come across as a unified project, because all the projects were so different to begin with. You can get data from the students and do quantitative things with that on surveys, but it's hard to contextualize the collaborative nature of these projects.*

A few participants noted that this offers an opportunity to push editorial boards of journals to recognize the rigor of qualitative and mixed-methods research. Finally, many grantees agreed that lack of time makes publishing chapters and articles a challenge.

## Challenges & Areas for Growth

**Data collection.** Participants from multiple projects discussed the difficulty of working with teachers to complete data collection. Although they believe teachers have the best intentions when agreeing to participate, they may not necessarily realize the level of commitment.

*I'd say that our challenges are maybe around data collection. Like one—and data relevance. So getting teachers who are very busy people and sometimes extremely complicated people to provide us with the data that we know that they have, but they, for whatever reasons, are not able to respond in the ways that we want them to, that just takes an unbelievable amount of personal power. So I'll give you an example. There was a teacher who was a participant in my Noyce Track 4 this year, and there's a certain amount of data that she was supposed to provide. She was supposed to [comment on] two classroom videos and the unit plan and do an interview and on all the classroom videos. We selected segments of those that she had to comment on those. We have a system where we put it up on "Securly" and tag particular places where she's supposed to comment. We need her to do it in a timely way, because if she does it five months after she gives the lesson, she's not going to remember what decision she was making. So we're super rapid in getting it up there so the teachers like two days later, when they still remember what they did, can comment on like, 'Oh, well, that's because that kid said this yesterday and that's why I said this at this moment.' And we need to know that in order to analyze the data based on interaction analysis. Just getting this teacher to do things. Every*

*single time I needed something from her, I had to send somebody to her school and it had to be a different person that I sent to her school, because she would—because that person would just like—she would only have a limited tolerance for being able to work with that person and then she would just turn off and kick the person out of the room. And I didn't know she was going to be so difficult and so—like the amount of work that I needed to do with her and this is not—it's not a single case. The amount of work I had to put into just getting data from this one teacher, multiply that by several other teachers who were similar, but not as bad as her. That's a challenge.*

**Lack of a shared database across Noyce projects.** Several participants in both the individual and collaborative Track 4 focus groups expressed great frustration that there is no shared database across Noyce projects that includes demographic and retention data for current and past Noyce scholars. Participants see this as key to investigating the impact of the larger Noyce program. Unfortunately, NSF is unable to share this data because of IRB concerns; however, NSF encouraged participants to pursue funding focused on creating such a database.

*I think one huge failure of the Noyce program is that we don't have a shared database of all our information. Like the fact that we're 15 years in and that we don't have a repository of 15 years of information that people can do research on I think is a huge blot on our community. The last couple of projects that I've worked on tried to at least leverage five projects' data or, in one of our others, it's seven or nine sites, but of the hundreds of sites that we have, the fact that we don't have an understanding of what's going on across the country is just, I think, really problematic. It makes it difficult for us to get any traction.*

# FUTURE CONSIDERATIONS

As ARISE considers the design and development of future resources and activities, we recommend the following:

- Continue creating opportunities for Track 4 grantees to collaborate in smaller settings, where they can share findings and discuss possible partnerships.
- Change branding of ARISE so it is clear the focus goes beyond pre-service teachers.
- Building on the success of ARISE's focus on CRP, future workshops and discussions about innovative practices should focus on providing concrete ideas and strategies that grantees can infuse into their programs.
- Grantees want to both share and access research instruments that have been validated, as well as findings and reports from other Track 4 projects. Grantees in other tracks could benefit from successful strategies for boosting enrollment. Using the ARISE website as a repository for these resources could raise awareness of the site and further engage grantees in ARISE activities.
- Some Track 1 through 3 grantees may benefit from working groups with Track 4 grantees to help focus research questions, as well as develop plans and a timeline for data collection, management, analysis, and dissemination.
- To help facilitate partnerships across Track 4 grants, consider offer training in project management, as well as having current and past projects share successful strategies for managing multiple partners.
- Provide workshops and additional supports to grantees from non-research universities to help them prepare for large-scale data collection efforts.

# APPENDIX A: IDEAS FOR FUTURE RESEARCH

## Social Network Analysis

- What is the relationship between support networks and teacher effectiveness?
- What is the relationship between perceived visual network structures and calculated network structures?
- What relationships, groups, and information are present in bridged or dense overall structures that are significantly correlated with outcomes?

## Teacher Retention

- Identify conflating factors related to the impact on teacher effectiveness and retention
- Explore whether effective teacher leadership can lead to increased teacher persistence and effectiveness
- Identify extent to which Noyce alumni are moving into instructional leadership positions
- Conduct longitudinal study of sources of self-efficacy and retention

## School-Level Features

- Identify school-level conditions that mediate retention
- Explore influence of Communities of Practice on classroom effectiveness
- Explore how state, district, and school policies can better support teacher leaders

## Program-Level Features

- Examine the programmatic features of Noyce teacher preparation programs that are associated with STEM teacher effectiveness and retention
- Explore how research-practitioner partnerships support teacher leadership development
- Research eased-entry models (beyond SASS)

## Methods and Measurement

- Define and determine how to measure teacher effectiveness
- Investigate reliability of self-report versus institutional data for tracking retention
- Examine the use of classroom observations, artifact analysis, and other triangulation tools for measuring teacher effectiveness
- Address challenges of measuring teaching effectiveness across grade levels, subjects, and school contexts

## Impact of Noyce

- How are Noyce investments influencing, more broadly and comprehensively, educator preparation programs?

## Other

- How to make research actionable for teachers
- Establish partnerships with states to access teacher-level data and explore data around teacher retention, especially related to inter-district inequality
- How does additional undergraduate teacher preparation impact (1) attrition rates in teacher education programs and first years of teaching, and (2) ability to navigate challenges of first years of teaching

# APPENDIX B-1: ARISE FOLLOW-UP INTERVIEW PROTOCOL

## Introduction

The Education Development Center (EDC) is a non-profit research and development organization. We are working with the American Association for the Advancement of Science (AAAS) as external evaluators to document the impact of the ARISE project, sponsored by NSF's Robert Noyce Teacher Scholarship Program. This is the second of two interviews. The purpose of this interview is to collect follow-up information about how different Noyce grantees organize their programs and the kind of research they conduct. AAAS and EDC would like to understand the impact that ARISE resources and activities may have had on Noyce grantees, and collect their feedback on these activities. This is not an evaluation of your program.

Do you have any questions about the interview?  
Can we record this interview? [Start recording.]

## 1. Participation in and Use of ARISE Activities and Resources

ARISE is working with the NSF Robert Noyce Teacher Scholarship Program to identify and disseminate information about effective practices and strategies for attracting, selecting, and preparing new K-12 STEM teachers and retaining them in the STEM teacher workforce. ARISE has also sought to develop a research agenda to help build effective STEM teacher pre-service education and leadership programs for high-need schools.

ARISE has supported the Noyce grantees in a number of ways, including:

- Organizing the Annual Noyce Summit
- Conducting regional dialogues
- Organizing proposal preparation webinars
- Developing and maintaining a website for Noyce grantees (ARISE website)
- Disseminating a newsletter and blog
- Conducting webinars on topics critical to the preparation and retention of teachers in high need schools (e.g., culturally relevant pedagogy, supporting all learners, retention)
- Conducting a meeting on STEM teacher retention in high-need schools
- Developing a research agenda and a blueprint for innovation.

1.1 Which of these activities have you participated in?

1.2 What resources have you used?

1.3 How helpful have you found these activities and resources for increasing your awareness about standards-based and evidence-based practices for attracting, preparing, supporting, and retaining STEM teachers and leaders in high-need schools?

1.4 How helpful have you found these activities and resources for increasing your awareness about topics and strategies for future data use and research on attracting, preparing, supporting, and retaining STEM teachers and leaders in high-need schools?

1.5 How could these activities/resources be improved?

1.6 What, if any, additional activities/resources would be helpful?

## **2. Your Pre-service STEM Teacher Education Program**

2.1 When we talked with you previously you were working on the following Noyce-funded program(s) [summarize]

2.2 Have you made any changes in your Noyce-funded STEM teacher education program over the past two years?

- If yes, please describe these changes (Probe for goals of the program, STEM disciplines, recruitment strategies, key components of the program, strategies for preparing STEM teachers and leaders to work in high needs schools, department in which pre-service STEM teacher education program is based, partnerships or collaborations with others, retention strategies)
- What motivated the change(s)? Did ARISE activities or resources contribute to the change(s)?
- What, if any, outcomes have these changes resulted in? (Probe for: enhanced STEM teacher and leader quality, improved recruitment and retention, improved preparation to work in high needs schools, improved K-12 STEM practice, improved achievement in STEM by high needs K-12 students)
- If no, please explain.

2.3 Have you received any new Noyce funding since the last time we spoke? If yes, please briefly describe the goals and activities of this new project/program. In what ways, if any, did the ARISE resources and activities inform the development of your new program?

### 3. Research

3.1 If your program includes evaluation and/or research, what are you investigating? Who is conducting the research? Who is conducting the evaluation?

**Probe for:**

- What data are you and/or your evaluator collecting and how are you using these data (beyond reporting to NSF)?
- What data are you and/or your evaluator collecting on STEM teacher retention in high-need school districts and/or schools?
- Are you staying in touch with grads of your program/tracking them beyond checking if they meet their service requirement? If yes, how so?

3.2 Have there been any changes in your research over the past two years? If so, please describe. Did ARISE activities or resources contribute to the change(s)?

3.3 In what ways, if any, are you sharing findings from your program?

3.4 Have there been any changes in how you are sharing findings from your program(s) over the past two years? If so, please describe. Did ARISE activities or resources contribute to the change(s)?

3.5 What types of research questions would you like to see addressed in the future to inform the refinement of your pre-service STEM teacher education program?

3.6 What kind of support would you need to enhance your program's capacity to conduct more research in the future?

3.7 Have you considered applying for the research track? Why or why not?

# APPENDIX B-2: ARISE FOCUS GROUP PROTOCOL

## 1. Information about the research that grantees are working on and how they are conducting this research

- 1.1 What aspect of STEM teacher preparation is the topic/focus of your research grant?
- 1.2 Where did your research question come from? [Probe: How much did the call for Track 4 proposal influence your research questions? Did you conduct research on STEM teacher preparation prior to the existence of the Noyce Track 4 funding? To what extent are your research questions based on your prior research, the research literature, and/or practice?]
- 1.3 What methods are you using? [Probe: How and why did you choose them? How did you validate your methods?]

Probe for:

- Are you collecting any data on STEM teacher retention in high-need districts and/or schools?
  - What, if any, longitudinal data are you collecting on program graduates and how do you obtain access to these data?
- 1.4 Does your research project involve partnerships or collaborations across multiple departments or institutions? If yes, describe. [Probe: Does your research project involve collaborations with Track 1–3 projects? How does your partnership work? What supports facilitate the partnership?]
  - 1.5 Who is on your project team? How did you put it together? What roles do different team members play?
  - 1.6. What are your findings so far? How are you using your findings to inform program development? How are you disseminating your findings? What are your next steps?
  - 1.7 What, if any, challenges did you run into? What are some specific issues you encountered and how did you address them?

## 2. Feedback about the Pre-Summit meeting they participated in

- 2.1 In what ways, if any, do you anticipate will the Pre-Summit meeting influence the implementation of your Track 4 grant?

2.2 What aspects of the meeting did you find particularly helpful?

2.3 What suggestions do you have for improving possible future meetings?

### **3. Participation in and use of ARISE activities and resources**

ARISE is working with the NSF Robert Noyce Teacher Scholarship Program to identify and disseminate information about effective practices and strategies for attracting, selecting, and preparing new K-12 STEM teachers and retaining them in the STEM teacher workforce. ARISE has also sought to develop a research agenda to help build effective STEM teacher pre-service education and leadership programs for high-need schools.

ARISE has supported the Noyce grantees in a number of ways, including:

- Organizing the Annual Noyce Summit
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- Conducting a meeting on STEM teacher retention in high-need schools
- Developing a research agenda and a blueprint for innovation

3.1 Which of these activities have you participated in?

3.2 What resources have you used?

3.4 How helpful have you found these activities and resources for increasing your awareness about topics and strategies for future data use and research on attracting, preparing, supporting, and retaining STEM teachers and leaders in high-need schools?

3.5 How could these activities/resources be improved?

3.6 What, if any, additional activities/resource/supports would be helpful?