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SAUL ROOM

SUPPORTING STEM TEACHERS: INSIGHTS FROM THE NOYCE PROGRAM

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**HANSEN:** Good afternoon everyone. I'm Mike Hansen, senior fellow in the Brown Center on Education Policy here at the Brookings Institution in Washington DC. Welcome to today's event on supporting STEM teachers with insights from the Noyce program. The Robert Noyce Teacher Scholarship Program is a federal program administered by the National Science Foundation designed to increase both the quantity and the quality of STEM teachers in high need schools. Over two decades of operation and more than \$1.6 billion in funding and scholarship awards, it has become one of the federal government's most significant events, investments in the STEM teacher workforce. This is the third and final event in a series on K-12 STEM and STEM education that the Brown Center has hosted over the past year.

In our first event, last May, we examined the challenges facing the STEM teacher pipeline and the shrinking supply of newly certified candidates and what policy policymakers and institutions can do to address it. And then last June, we turned to the classroom itself exploring what high quality STEM instruction looks like and how schools can better support it. Today we'll hear what a rigorous national scale research effort has found about STEM teachers and the Noyce program's role in supporting it. The event will proceed first with a presentation of the research findings. Li Feng is a professor of economics at, at Texas State University and the Stephen R. Greg Senior Excellence Professor researching teacher labor markets. She leads NSF funded studies of the STEM teacher workforce and is a co-principal investigator of the, of an IES funded R and D center on the special education teacher workforce. And she serves as an editor for the Journal of Education, Finance, and Policy. Li will take the stage in just a moment here. And Dr. Feng was the lead principal investigator on the research project that we're gonna be discussing today. And following Li's presentation, I'll invite two other panelists to the stage to listen in or to listen to their reactions and offer their complimentary perspectives on STEM teaching and the Noyce program.

And I will introduce them in just a moment when we get there. Now before going to the presentation, a couple of quick housekeeping items. First off, this event is being streamed online and online. Viewers can submit questions via email to the email address [events@brookings.edu](mailto:events@brookings.edu). That is the word, events with a plural s@brookings.edu. We'll get to audience questions later in the program. And second, I want to acknowledge that the research presented today was supported by the National Science Foundation under Brookings grant number 1950284. And it's a collaborative project, so all of the

collaborating institutions have their own respective grants. Without any further ado, let me go ahead and welcome Li to the stage to present those research findings.

**FENG:** Good afternoon everyone. I'm Li Feng, professor of economics from Texas State University. I, before I start, I want to give a big shout out to the Brookings team for putting on this event. It has been for five years in coming, and we really appreciate everyone turns out on a snowy DC day. So, this is a multi-year collaborative project funded by National Science Foundation. We're examining the STEM teacher workforce and the role of Robert Noyce Teacher Scholarship program and all of these co-authors we are thankful to be working with these wonderful authors. Of course we have to do this acknowledgement. I do want to say that sort of disclaimer applies. I, I wanted to mention the three leading research institution, Texas State University and Brookings Institution and the Florida Atlantic University. Thank you for the financial support and the research assistant postdoctoral scholars that have devoted their time, energy into this project.

So let me give you a tour. Okay. I am gonna take you on a helicopter tour. I'm not sure I can fit everyone in, but we'll take a helicopter tour. What is where are we going? We're gonna start at 30,000 feet. We'll have a good view of the national STEM teacher workforce over three decades. Okay. We are gonna ask what does it look like from top here? Is it healthy? Where are the weak spots? Then we're gonna descend we're gonna zoom in on the communities surrounding Noyce institutions. We're gonna ask, are those school districts better off in these high needs school district? Are these high needs school district Better off than places without a Robert Noyce program nearby?

Lastly, we're gonna zoom we're gonna zoom in. We're gonna go to some really nice places Miami, Florida. We're going to go to Pensacola. Miami, Florida is Florida's International University. We're gonna go to University of West Florida in Pensacola. We're gonna go to University of Texas, Arlington, and also Texas State University, San Marcos all examining these four Noyce programs and to investigate what's happening. How are they preparing Noyce scholars? Just to orient you before we actually dive into the three objectives we wanted to in the beginning of the project Mike and David and I sat down. We said, we know a lot about Robert Noyce program, but we don't, we're not sure the public knows so much about this program. So, what we did is to put out together a Robert Noyce program dashboard. If you're looking at it, and you can take a picture, you can, that, that QR code will

take you to the Noyce program dashboard. To give you a picture, a general idea, the Noyce program has invested about 1.6 billion through over 14 over 1,400 grants since 2002.

So, placing STEM teacher in high needs school districts across all 50 states. Okay. You're gonna see a wide state that's Nevada. The time when we prepared the pro, the program dashboard and Nevada doesn't have a noise program, but now they do. It's a major federal investment and we wanted to know if it, this is working before the finding. Here's why it matters. STEM teachers face a perfect storm, declining new teacher certification, growing STEM course requirements and competition from higher paying private sector jobs. You would expect this to produce a workforce in serious decline. That's what we expect it to.

But hold on a second. Okay. Surprisingly we find some counterintuitive results. Despite all those pressures, the qualification of STEM teachers in high needs schools have been remarkably stable, even modestly improving on some measures across the three decades of nationally. Representative data master's degree which is on your left-hand side, master's degree share has slightly increased in high need schools. STEM degree share is stable in high need schools even as it decline in low need schools. This doesn't mean everything is fine. High need schools are still consistently less qualified than the low need schools, but the gap is not widening. The way the pressure that we just talked about is predicting. The aggregate picture masks some important field level variation, physical sciences, which is in the middle, and computer science we run outta space. We didn't put it on here, but it's in our publicly released a report, so you're welcome to check that out. And so, computer science are in especially bad shape, right? So, if you look at the gray area, the gray bars, those are the area you should focus your attention.

Of course, my eyes are always drawn to the orange, but anyway, it's, the gray area indicates how much of lack that we, the gray area is in indicating teachers with no subject specific credentials. So, for physical sciences that's about 45% in the most recent year that we have data for. So, what is a key takeaway here? A one size fits all approach will not work. Field specific solutions might be necessary, especially when it comes down to computer science or physical sciences. One reason that's so hard to staff these schools is STEM teachers earn significantly less in high poverty settings and not more. A STEM teacher in a high poverty school earns about 18% less than the baseline and a salary

premium. The salary premium theory would predict simply does not materialize. This is a structural barrier. The labor market is not compensating teachers for going where the needs is greater.

Now, how are these schools or school district coping with this? Two coping strategies stands out first, and you'll find in our report we find there is growing reliance on foreign trained teachers. Second, the high needs school districts seem to have being adopting different targeted incentives. So, if you look at the one on here, so the high needs schools district have been looking at using a lot more pay incentives for shortage fields, training in shortage fields, incentive in teaching less d desirable locations. Now in these schools the signing bonuses, they have reduced the usage of signing bonuses of student loan forgiveness and relocation assistance.

Now let's look at objective two. We're gonna zoom in a little bit, right? We're gonna fly all over the country and to look at the high need school district. And this is the example of that. So let's say we're looking at Texas State University, that's the university in the middle, and we're going to be looking at the school district surrounding the university and find out what is what is different, what is we use a difference in different design to compare STEM teachers workforce in district, near Noyce institution to those are not before and after the program are launched. What do we find high needs? School district, near Noyce institution are significantly more likely to have STEM degree teachers after Noyce program start. The effect is 1.5. To 1.6 percentage points, and it's specific to high needs district, low need nearby district don't show the same boost. We will provide a little bit of caveat here.

We can't claim this is pure noise. Causation. Other programs such as you teach and other programs could be co-locating and the pattern. However, the pattern we find here is consistent with programs intended targeting. Another key finding in objective two is we find that district near noise program also report fewer vacancies, about 7.5 percentage point fewer mass vacancies. About five about 4% physical signs vacancies and about five. Five percentage points lower a vacancy rate in biology. Now, if you combine the finding on last slides with this slide, these two independent indicators, one, you have more qualified STEM teachers. Two, the vacancy rate got reduced. These seem to be pointing out that we have more qualified teachers and fewer hard to fill vacancies. Now we're going to go on our tour.

These pictures are actually the Noy scholars in these programs that we are partnering with.

Objectives three, we're gonna zoom in even further. We work directly with our collaborating noise institution in two popular states. One is in state of Texas, the other two, two in state of Texas and two in Florida. And to understand how these programs operate and whether scholars feel prepared for high needs settings. All of these four programs that we surveyed required our student teaching high needs school observation and subject specific methods. Course three of the four program required diversity and inclusion training. Two of the four program require student teaching to be completely, specifically in a high needs school.

The preparation was genuinely tailored to the high needs context, not generic. Teacher training here is an important nuance when we ask alumni whether they would have considered teaching in a high need school without a no scholarship. 85, 82 to 85% said yes across different racial groups. This suggests. Noyce is largely attracting candidates already oriented towards high needs service and providing financial and training support to act on that commitment. The program may be less about recruiting new STEM teachers and more about enabling the ones already committed. We also find a meaningful discrepancy. Noyce institution reported a strong collaboration with partner in district. However, district level interview told a different story. Several district staff didn't even know their student teacher were no scholars. This is an area for improvement. Stronger communication loops could lead to better placement matching and more targeted support for these teachers. Just to summarize, what I just talked about. As a researcher, we always do those key takeaways in the beginning, but I'm gonna do it here.

So, these four takeaways. The STEM teacher workforce in high schools having surprisingly stable, despite the, that I talked about. Schools are adapting through targeted recruitment policies and growing reliance on foreign trained teachers. Noyce seems, appears to be part of the broader response district near Noyce program show more STEM degree teachers and feel hard to fill vacancies. Stability does not equal sufficiency. Persistent qualification gap remains, especially in physical sciences and computer sciences. The evidence called for both hope and caution. Programs like Noyce are making a difference, but the structural pay problems have not been solved. More substantially more substantial sustained financial support remain necessary. Last but not least, we would like to thank all for collaborating institutions, Texas State University, University of Texas at

Arlington, Florida International University of West Florida, and our advisory board members Michael, Lisa, Italia for their participation and feedback to our study. That ends the presentation part of our panel discussion.

**HANSEN:** Thank you Li, for that presentation and I'm really now excited to invite our other two panelists to the stage. They're going to react to the presentation and offer some of their own perspectives on STEM instruction and the role of the Noyce program. Lemme briefly introduce them first, right here to my immediate right. On your left we have Anne Peterson. Anne brings a state level policy perspective on what supports teachers and schools need. Dr. Peterson currently works with the Virginia Department of Education as the Director of STEM. She has worked in rural and urban public-school divisions as both a Biology and Chemistry Teacher, Division, Science Supervisor, and STEM Academy Director.

And second we have Jhosse Prado Guerrero. He is a Math Teacher at Cesar Chavez Middle School in the New Haven Unified School District in California. Jhosse is a Noyce scholar himself. Previously working in the Middle College program at Gua College, Jhosse is someone working every day in the kind of high-need setting. This program is designed to serve, and he's particularly motivated to search for techniques to better serve students in a technologically advanced era in which the tools we use tend to dominate student thinking. And also, I want to add, we have a reminder for those who are joining us online that you can go ahead and send questions to the email [events@brookings.edu](mailto:events@brookings.edu). That's events with a plural 's' @brookings.edu.

And we will be monitoring the inbox and getting to those questions later. So now I'm gonna go ahead and take a seat and we'll get to the panel. So first are you able to hear me? Great. First lemme go to Jhosse. Jhosse, the Noyce scholarship is. Often primarily described as a financial support for young candidates young teacher candidates, but you've suggested it's much more than that. What resources did the Noyce Pro did the Noyce program provide to you? Beyond the scholarship funds.

**GUERRERO:** Gotcha. Ultimately, it's access to a community that will inspire the desire to remain. This is my second time coming to Washington DC. The first time I visited was in 2023. I was invited by the wonderful Dr. Julie McNamara at CSU East Bay to join the 2023 Robert Noyce Summit. She also

put word in for me to join this panel today, other than the wonderful Dr. Mack, what is the common denominator? Robert Noyce says, suppose you train three pupils how to ride a bike. Pupil A is on a skateboard, pupil B has training wheels, and then pupil C has your average Bri, your average bike, who do you see who do you send to the spelling bee?

**FENG:** Training wheels?

**GUERRERO:** None. Were trained for the spelling bee, so you should not send any of the pupils. The Robert Noyce community will properly hold you accountable and challenge you to be your best so that if you learn to maintain balance in this field, you'll be ready for any curve ball. It is extremely reasonable to seek well prepared and well received candidates to teach your student. The Noyce community is not composed of subpar educators. Anyone can teach a student, however, not everyone can reach a student. Robert Noyce scholars put in the work to strive and survive in a daily curve ball.

**HANSEN:** Okay, great. Thank you Jhosse. Next I'm gonna go to Anne. Anne, we wanna hear about the, how these national trends that Li was talking about. How these look from your perspective in Virginia. How are your approaches to STEM instruction what do you see as the main challenges in providing quality instruction to your students? Are you seeing the same kind of trends that Li said that she's seeing in the helicopter, or are you seeing something different?

**PETERSEN:** Sure. So, from the Virginia Department of Education side, I work with K 12 instruction. So that is a small subset of what the overall agency does. And within the department of STEM, we really look at three main pillars. The first pillar is we wanna ensure that all students have a strong K 12 foundation in each of those STEM disciplines. So, providing that robust and rigorous experience in computer science, in science and mathematics is foundation to be able to be successful in STEM fields. The second pillar is we wanna provide those integrated. STEM learning opportunities for students starting in kindergarten, really allowing them to apply what they understand in science, mathematics, and computer science to authentic problems using an iterative process and making sure those connections are explicit for teachers as well as students.

And that we have ways for students to demonstrate how I have mastered those concepts and how I'm applying those concepts to those authentic problems. The third pillar is of course, preparing them for workforce readiness. Now they're doing that as they're engaging in the STEM problems because we wanna have students to give them opportunities to engage with critical and creative thinking. We want them to have discourse. We want them to be able to explain their mastery. But we also want them to be aware of what are those opportunities ahead of them in STEM fields. If you look at 2024 data in the Virginia Office of Economics Education Dashboard, you can see that in the state of Virginia, data science engineer fields our very high areas of need in Virginia and anticipated to have high areas of growth.

So how are we making those pathways visible to students? How are we preparing them for students to pursue those fields? So, it's awareness and providing those educational opportunities. And then how are we helping and enabling our teachers to allow them to get there? What are those pathways that we have for those kids? So, some of those. Areas that you struggled or that you indicated as areas of high need. Having that prepared workforce, making sure that our teachers have the skills, making sure on our end we're providing those resources so that those connections are visible. Some of the problems that we have, I would say, particularly at elementary level, K through five, is that the teachers are generalists in those grade levels, and they may not have efficacy to be able to look at it in the cross-disciplinary approach.

So how are we providing structures to increase the teacher efficacy in those areas? How are we providing resources to enable that type of instruction to occur? Those are key focuses within the department of Education.

**HANSEN:** Thank you, Anne. That's a great response. One of the things that I want that I was struck by with this report, and I'm gonna go to you Li, is that. Is that the report found that there was a surprising amount of stability, and I think surprising was the word used in the report. And Li were you surprised by that? And I'm also curious Joe, say if you see stability in the workforce around, around you and the schools that you're in, go ahead. Why don't you start off, Li?

**FENG:** Yeah, I think we, we were truly surprised. I do wanted to say that there is actually additional information in the report. And one thing I wanted to mention is sometimes when we are measuring things, we're forgetting other parts of the conversation. And in one of the paper that we're still in development is we look at the course offerings, right? When we say we need more STEM teachers in the classroom, however, if a school district do not offer, let's say, calculus class or offer it in a very limited fashion, and in that way, it makes it harder for us as a researcher to actually measure the true impact of the needs on the ground. That's my quick response to you. And I'm curious what you're, say you are observing on the ground.

**GUERRERO:** Absolutely. At the end of the day, it ties back to community. And now if you're part of the community, you need to have the same affinity as those around you. So, I was always fascinated by STEM. I, math was easy to me and I enjoyed science class. I learned. I, unfortunately, I didn't get to dissect a frog, which would've been awesome. However, nonetheless, just being in a school environment, the community is what drove me to do my best. Now at my school, we have a fantastic community of math teachers. We have teachers that are less than five years into the field, or 30 plus years into the field. So, it's, we have veterans and newbies, so it's awesome. We can lean on each other, we can look to each other for support, and we can just listen to each other's advice and suggestions on anything. Anything that goes beyond the curriculum. And so, I think it all comes down to what is your community and who's in your community, and how are you taking care of each other in your community? So, I'm not surprised that. The numbers show their stability.

**HANSEN:** Okay. So, you're hearing some stability, some corroborating evidence from your experience. Anne, let's go to you. Do you feel like stability is an adequate description of what you're seeing in in Virginia schools? Or do you see some fragility there?

**PETERSEN:** So, in terms of Noyce scholars...

**HANSEN:** not necessarily Noyce scholars per se, just STEM instruction in general, stem instruction.

**PETERSEN:** I think right now we're at a, there's a lot of change going on in Virginia. There's a lot of different initiatives. Right now, nationally, there is an emphasis on literacy education. And teachers

are going through trying to meet all these different initiatives, trying to do everything. You also have a society where it is acceptable to say, oh, yeah I can't do math. I can't, yeah. I don't understand science. And that is acceptable. You don't, you have a society where it's not acceptable to say, I can't read. So, you have perhaps mindsets even of teachers that say, I can't do math that is being sent down to students. And then you have this setting where it emphasizes literacy.

So, I think there is some instability there, caused by that. You have some initiative overload. So, trying to figure out where we can really enable teachers to have strong, effective STEM instruction where we can lay them for their instruction, where we can validate learners in their ability and she and increase that STEM awareness. I think that is something that we struggle with because of the different competing initiatives. And I'm not sure I answered that as you fully intended, but I think that is an obstacle that we're seeing nationally and in Virginia.

**HANSEN:** Okay, thank you. So, one of the research findings is that the Noyce program has been part of filling some of the gaps in the pipeline. But one of the things that that was also surfaced in that research was that Noyce scholars many of them the majority of them, they had already indicated that they were willing to become a teacher before applying to the scholarship. They were already thinking about or planning to teach in high need school settings. And does this mean that the program is essentially supporting those who would've taught anyway? And if so, is that a problem or is there something, is there a different way that we should be thinking about this? Lemme go to you first, Li.

**FENG:** Okay. I'm gonna tell you a little bit of story. So, I have a computer science student and he's trying to figure out what his major is gonna be, right? He wants to do computer science, but also he also wanted to economics. And then he developed a dashboard, what he was comparing computer science majors with education majors. What is really shocking to both him and me is how much the salary gaps are for a computer science, a computer science major graduates versus an education major. I, what was your question again? I'm sorry I lost the train.

**HANSEN:** So, the question was so Noyce scholars in general appear to be already committed to going to teaching. They appear to already be willing to go into high need school settings. And so, does this mean that the Noyce program is give away money and it's not achieving what it's intended

to do? Or is there a different way to think about it? Can, going to your response is it really feasible that we can actually convince somebody who wants to go into computer science? Yep. Are we gonna actually convince them to go into education with a \$4,000 scholarship when they're for the last two years of their undergrad?

**FENG:** So, I think just going back on my train of thought, on the computer science versus education part of it so I think there's like a broader part of this discussion, which is how can we, when does, when the student teachers are in college, are we attracting them into teaching? Is it possible to do that? I, our study don't answer that question, but we're answer What we did answer is. Where yes, it the noise did work in terms of for teacher, for student candidates who are interested in teaching in the first place. When they're interested in teaching in the first place, maybe they have some financial difficulty.

For example, at Texas State, we have a lot of first-generation low-income students it, going, getting in, getting to that certification. And there are even some states talking about lowering the fees for passing. Teacher passing, the sorry, teacher test, testing fees. So, all of these different initiatives, what they're trying to do is trying to attract teachers into attract potential laborers into teaching. And what our study finds is. We're not influencing your primary decision, are you going into teaching? But we are influencing the teacher candidate decision as to where they're teaching, for example, are they going into the high needs school settings. So, I think the program is working in that way in terms of guiding because in high needs schools, oftentimes they struggle to, to staff teachers to have math teachers and science teachers. The vacancy rate in these schools tend to be a lot higher compared to low needs schools. So, it's important for a federal program to have this in investment. And also encouraging teacher candidates, like excellent candidates like Jhosse to go into those type of settings.

**HANSEN:** Yeah. Thank you.

**PETERSEN:** And I would say. One thing we want with teachers is we want people who wanna be teachers that have an affinity towards teaching. And some of those people prior to the Noyce scholar may have said, oh, I'd like to do that, but I don't have the capacity, I don't have the money, I don't

have the time. This gives that cluster of people that do have that affinity for the field, the wherewithal to be able to meet that. So yes, for right there, I know I taught as an adjunct professor for one of our universities, and that was the stepping stone that enabled them to become a teacher where they may have had to go and go into a different field because they didn't have the money or the capacity just due to life structures to be able to pursue that anyway. So, I would say yes, that they do have an affinity, but that's a good thing. That's what we want. And that was the steppingstone to enable them to go in the field.

**HANSEN:** Great. Thank you. Jhosse, do you wanna hop in as our Noyce scholar representative?

**GUERRERO:** Can you repeat the question one more time?

**HANSEN:** About affinity towards teaching Affinity to be in a high need school. Is that, was that something that you also demonstrated even before and, but does the scholarship still make a difference for your trajectory and what you chose to do with your career?

**GUERRERO:** I, in my head, I had a, I want to be an actuary, I want to be an engineer. And then my Z was being a teacher. It was there, but it was at the bottom of my list. However, things turned out to be the complete opposite. After graduating from Davis, I received a position offer and I got it, and I have not looked back. So, I, it is safe to say teaching is my only career. Now as far as. Where I'll teach, I don't think it really matters necessarily. I just want to be able to show students that math is, you're able to do math where no matter where you're from, it's like a chess game. It doesn't matter what you speak or where you're from, as long as you know the rules, you can play the game. And so, I wanna show math as a as a language, a game, something that's not traumatizing.

**Speaker 4:** Yeah. Thanks, Jhosse. To Anne I wanna ask you, so Virginia has both, of course, a lot of geographical diversity, urban and rural high need school districts. What tools does the state have to support the STEM teacher recruitment and retention in those settings? And do you feel like you have to do different approaches in both of those areas?

**PETERSEN:** So, our state budget. Does have in place several ways to retain and get mathematics educators. In particular, we have middle school Teacher Corps, which is an incentive program that is

available to those teachers who have proven success for the first three years of teaching or have three years of success. So that system is in place. We also have STEM incentives through the office of licensure for any of the STEM disciplines for them to come in. So those are both state based STEM incentive funding mechanisms in Virginia. So those are, I would say, the two primary incentive programs. We do require mentors in the state of Virginia and other ways to support teachers as they're coming into the field to hopefully increase the retention of STEM teachers and all teachers.

**HANSEN:** Great. Li, do you can you hop in and tell us what the, maybe the national picture looks like in terms of recruit targeted recruitment? That was something that you highlighted in the research?

**FENG:** Yeah. In these high needs schools it looks they're a, the coping mechanism that they rely on a lot more are these targeted incentive program and targeted recruitment efforts. One thing I will point out, and I'll bring in another piece of the puzzle piece to our discussion because Anne just talked about Virginia's state effort in terms of how, providing additional incentive for these teachers at rural One of the site studies that we conducted, we find that. Using these long three over three decades of teacher information and their salary information. We find in economic theory we say there is a compensating wage differentials, which basically the idea is if you have a high-risk job you're like you working in a high-risk job, then it's it, you should be compensated a little bit more.

To translate it into sort of the education context is oftentimes they say, when you're working in a more challenging schools we don't have a good way of measure challenges in the national data set. We just look at poverty and minority student shares. In, in, when we look at that we, one thing we notice is teachers in these schools, in high poverty schools are not paid more. So, there is no differentiated pay for these teachers. And also, there's a rural penalty. So, if you're teaching in a rural school district your salary is not there is actually a wage penalty associated with teaching at these type of schools. So, I think it, it is really interesting to see how these school district are coping. Again, even though the study just came out. But we I think the national data set, our data set stopped at 2017, I believe 17 or 18,

**HANSEN:** 20, 21.

**FENG:** 20- 21. But again, the data always lacks in our, in, in our world, the data always lacks in terms of what is happening on the ground. That's why it's so helpful to have and perspective on what is actually happening right now. And there are new legislation coming out in the state of Texas too, to actually have additional teacher pay. And similar to what Virginia have.

**HANSEN:** Okay. I wanna shift gears a little bit. Talk about actual instruction to Jhosse. First you draw a distinction between training and learning. When you're talking about STEM instruction, math arguing that too much of math education actually trains students rather than helping them to genuinely understand. How does that tension show up in your classroom? And what does it mean for how we how we are thinking about STEM instruction and math instruction in particular?

**GUERRERO:** Do have one question. Can you clarify what you mean by tension?

**HANSEN:** When, in our pre dialogue before coming here you had talked about training, you talked about learning and about how you feel like a lot of math education train students but doesn't necessarily help them to apply. And so, I guess let's I'd like to hear you talk a little bit about, about the application and helping kids really have an engagement around how they're learning in the classroom.

**GUERRERO:** Okay. If you, okay, suppose you teach two students, student A, student B, how to solve linear equations. Student A could say, oh, let's look for the point of intersection on a graph, or we can solve by elimination or substitution. And then student B says, Hey I want to put some story I into these equations. So, one equation describes the path of voyager. One and second equation in the system describes the path of a meteor and ignore large bodies. And the student says considering this scenario, are they gonna impact each other? And so, they can show graphically what the story.

The point of inter intersection and then they can justify their reasoning using the equations and the point of intersection, what I'm trying to say is who sounds like the teacher student A or student B student a's responsible as you can look at the point of intersection on the graph and then solved by substitution elimination. I've used those words when I teach, so that sounds like the teacher. Now students are quite creative. There, I was a student once, I was more or less creative, but students I see now are very creative. And so, if a student presented me with this whole scenario, application-

based understanding of system of equations, I think that's much better than circling A or circling D on an answer sheet.

**HANSEN:** Okay. Thanks. Thanks, Josse.

**PETERSEN:** I'll say that the difference between teaching and learning. I think we have seen nationally a movement of standards away from just concepts to really the application of concepts through the use of the scientific and engineering practices in science, through the mathematical process goals and through the skills and practices of computer science. So, when we can take education from regurgitating concepts to really having those strong, rich discussions, why is that gonna cede? Why is it not allowing the students to construct the models, explain the models, and then learn. When they revise the models allowing that justification and letting the kids develop the questions that guide the development of the procedures for their experiment. We are taking it from just teaching to really driving in that learning and giving those students that ownership, that enable them to apply these concepts in a variety of settings and also to become informed graduates within those respective career fields.

**GUERRERO:** May I add to something she said? Sure. So, I can offer this. I've, I went to, I forget how long ago it was. It was down in Long Beach. There was a STEAM, it wasn't a pd. It was before I was teaching. I was actually still a student. But it was a whole STEAM presentation, science, technology, engineering, art, and math. And I think that's amazing. And so, I do wanna ask you, Anne, with respect to Virginia Department of Education. Is there an interest in incorporating STEAM?

**Speaker 3:** Right now, I'm just trying to get STEM. I think I have heard so many different ways of looking at STEM and I've even heard hamster history, arts, math, science, hamster. So, at what point, yes, I think there is a place, I've there is a place for arts, but when I really think of that, what is the basis of STEM? It's the application of those practices to authentic process authentic problems using an iterative design. I think we can bring in other disciplines. I think reading is part of all of that. Communicating is part of all of that. But right now, my focus is more of how do we get these through and we can bring in through the lens of different disciplines, but really focusing on, first of all, developing that student ownership in those core areas. And then perhaps branching out from there.

So yes, I applaud you for thinking that, but I'm never gonna wanna go the hamster route because I don't wanna delude the message of STEM. But let's think of it as those core practices applied to other fields.

**HANSEN:** Okay, let's go ahead and tweet that out. No hamsters in Virginia. Li, did you wanna add something?

**FENG:** Yeah, I was gonna add something to this learning conversation. One of the things I think Noyce did right is they, Noyce is bringing teach bringing interdisciplinary scholars to the table, right? So, they're bringing department of Physics and then they're bringing College of Education. They're bringing all of them together. And when they are together, when they're trying to say, instead of teaching the, like the student a, which is solving linear, two linear equations, how do you do that? Instead of doing it that way, it's you. It's more like Mr. Jhosse. It is a way of saying, how do you apply to this problem to a real-world problem?

And I'm an economist, so I'm gonna ask them, can you solve supply and demand equation? So those are the type of question that we can encourage to have. And I think hopefully this is not bear borne out by our report, of course, but my suspicion would be teachers who are trained through no program, they're gonna have a lot more of this interdisciplinary kind of thinking, and they're gonna bring that to the classroom. Like what Mr. PG is talking about is really how do we think about the complex problem that we're faced with? I think that's even more important in this day and age with the technology developed so quickly. And how do we encourage our students in a classroom to really put their heads together to solve a problem together? In a sort of organic way rather than, oh, these two equations, I'm so confused by it.

**HANSEN:** That's actually a great segue. I was next wanting to talk about student engagement in the age of screens and media. Is what Joe say is describing here. By engaging the kids in the application and, developing more of a narrative story to help them see these applications, is that the way that we can try to actually keep their attention in STEM learning and in the classroom rather than screens and devices? I think just many kids are being wooed away. And how do you, how have you AP approached that in the classroom?

**GUERRERO:** First you gotta face the fact that you can't run away from. The phone or computer. At my site we're very fortunate to have one-to-one Chromebooks. And so, I think that's awesome. And so now the next step is, okay, you have this awesome computer that can do almost anything. What should you do with it? Now there are terms that are relatively new. Doom scrolling, brain rot. And so, I have a new A, B, C I like to think about anti brain rot class. And so, school, it's definitely not brain rot. It's good food for your brain, especially if you have dedicated teachers from Noyce. Yeah. A good community. And so, I think that making sure you teach the students how to use the technology rather than to just give it to them and expect them to know how to use it. We have to make sure we don't do that.

And unfortunately, most cases, that's probably what's happening. People just by their students, or kids, a phone or a computer and just let them be iPad and so making sure we can use the technology with a purpose and system equations, we can use, we can graph, we can use the graphing calculator with the technology we have. And so just figuring out what is the purpose and you need a community to be able to find a solid purpose.

**HANSEN:** Yeah.

**PETERSEN:** And I think something you say really resonated with me are the school leaders aware of. That when you are engaging in mathematics discourse, when you're engaging in scientific investigation, when you're collaboratively planning a program or whatever the case may be, it's gonna get a little loud and it's gonna get messy. And sometimes looking at a room full of chairs, 30 chairs in a row with a computer open and every kid just staring at a screen seems like a better classroom management. But what really is the true learning experience? It's those engaging opportunities. So, enabling a safe place for teachers to allow that to happen is very important.

And so, you're gonna have to, it's just not a teacher thing. It's not just a student thing, but it has to go throughout the system. What do we appreciate? What do we wanna see in the classrooms? And computers have their place. They're a tool just like anything else. But it's about the thinking and not the thing. One of my colleagues told me that once, and it resonates with me. The computer is a thing, a tool to get you to enable you to. Facilitate the thinking, so let's reshape the way that looks.

**HANSEN:** Yeah, thank you. And now that's a good segue to ai and of course ai. The fear is that it's going to replace student thinking and that we're going to we're gonna lose the facility or younger students might potentially lose that facility because the AI does all the thinking for them. Jhosse, I know that you had mentioned you had mentioned how AI was something that, that or you talked about how technology dominates student thinking nowadays, and you wanna try to flip the script. And specifically, is there anything that you're trying to do to counter AI or to work with AI? How are you approaching it?

**GUERRERO:** It's like what I said earlier, you have to teach the students how to use it with a purpose. And you can use ai, you can use Chad GPT just to name the most known, probably the most known ai you can use it for basically anything. Hey, I want a chili recipe. This is of course, something I've searched up. Easy chili recipe. You can say, Hey, what is, what's a tacky on? What's a neutrino? You can ask, and AI will offer your ideas on that subject based on people's ideas, hu other humans' words. And so, students will then use the software and then use the response at face value and then incorporate into their own idea. And so, they think it's their own idea, however. Use Chad GPT to better your idea so that you have another idea.

**HANSEN:** Yeah. Excellent. Excellent. How is the State of Virginia thinking about AI in the classroom?

**PETERSEN:** So, they're layers. It's just like an onion, right? Yeah. And so, you have both, from the teacher perspective and the student perspective. But the first thing is what is an understanding of ai? AI is uses patterns to assimilate large amounts of information and generated response. We start looking at what is AI in kindergarten through the computer science standards of learning. And it may not be called out as ai, but really having that understanding, we're looking at patterns in the mathematics class and that can tie into that. I think that core understanding of what is ai, exactly what it is not, is something that has students have to learn, but also educators have to learn. Once you get that, then you, what is appropriate use of ai? For use of ai, you can look at, how should it be used, how it is tool, what does it look like to ask those questions and to ask those really good questions that gets at the information you want.

But also, how is it used in business? How is it moving forward? And then the last layer is to evaluate from the teacher and student lens, how are you evaluating the output of that AI question to determine is it appropriate? Is it factual? Because who knows where that search engines are getting the information from? So, is it a evaluate from that perspective, but also evaluate, the more, the larger impacts? How is it if I'm using it all the time, how is it affecting my neurology? How is that affecting my brain and brain capacity? How is it affecting the state? I look at Virginia, I think we have the highest number of data centers now in the country, if not the world.

And I just got my electric bill. And I would argue that AI may be having an impact as it quadrupled, but it could be horribly cold weather. Yeah. But what are those impacts on the state? What are those impacts on the economy? What are the global impacts? So, you have the three layers of understanding how to have a basic understanding of what it is, how to use it, how it is used in in business, in technology and industry. And then how are we evaluating to us as a society and how are we evaluating the outcomes of responses that we've gone and solicited individually. So, it's multiple layers that have to be thought of and that we have to develop or have those discussions with students, with teachers to be able to see how we can use the tool of AI appropriately in the classroom setting.

Yet still our gauge our kids in those critical and creative thinking opportunities and not rely on ai. So, it's a balance and I think every state is trying to navigate right now, what does that look like? How can it be used appropriately? Do I use it? Heck yes. It is a great way to synthesize large amounts of data and turn it around in a quick fashion. Do I always go back and say, is this appropriate? Are the data sets appropriate? Is this a regional, a reasonable facsimile of the data that I expected to get? If not, where is it the error in my thinking? Is it an error in the search mechanism, the question I asked? So that type of critical thinking and an awareness that, that critical thinking needs to go on is critical with today's use.

**HANSEN:** Great. Thank you. Li, do you wanna add something?

**FENG:** Yeah, I'm gonna actually instead of looking at how AI is used in the classroom, I'm gonna bring the conversation back to. Look at the, how AI is actually going to affect the STEM teacher

workforce, right? One, one of the things we find in our report is there's a lot of field level differences in terms of, especially in computer science, right? So, the, there's not a lot of teachers on qualified to teach computer science. And I know in my son's high school they're struggling to staff their computer science classrooms. So, the question boils down to if we're interested in preparing a future ready, AI ready workforce, right?

So, computer science seemed to be the knowledge or the language or the future. Then what are we doing to prepare? I know Virginia's department of Education is it what's her name? Yeah she's here. Oh Keisha. Keisha is here, right? So, for, for computer science and it's those type of conversation, I think it's important to have, and I'm sure there are funders listening to our conversation right now. So those are the type of questions that the foundations and funders should be thinking about is how do we prepare enough STEM teacher so that we can teach the future workforce. That's all that is always my sort of question or the challenge to the field to think about that issue.

**HANSEN:** Okay. Thank you. And speaking of funders, the Noyce program is a federally funded national science, from the National Science Foundation. It's a federally funded initiative. We're in a moment of considerable uncertainty around federal education and research funding. But what does this mean? Is the fact that there is a bit of pullback is this a moment of peril for the STEM education pipeline? Is this a moment of peril for STEM education overall, or is it apparel of all education where we are all struggling for teachers that have the pedagogical and conceptual expertise to really lead informed instruction regardless of the area?

**PETERSEN:** Yeah. I worry. When I look at data science number one growing job in. The state of Virginia right now projected, I can't remember the exact amount, about 30% growth between now and 2030 with average salary of 117,000. I just know this because I had to do another presentation the other day, but why would somebody want to go into teaching where there is an average salary? Of what, depending on what community you're in. 60,000. 50,000 when they could go to some of those other fields. I will, I worry you do. We have a new generation of kids. You're a kid who don't stay in one career necessarily a long time. I'm old and I've been in education 30. Odd years, we won't go there.

I started when I was three. But we don't have people that stay in fields that long anymore. Yeah. We have a mindset that you, in order to get increases in salaries, to be able to be promoted, you move jobs. So, we have Noyce scholars, we have some wonderful programs for teachers, but how are we using those programs and if they go away, how are we using existing structures to entice people into the education field at all? That is, it's a big concern for STEM, but it's a big concern across education, I believe nationally and in Virginia.

**HANSEN:** Is the federal government the only one that's actually putting money into developing the STEM teacher pipeline, Li?

**FENG:** No, it's the federal government. It plays. One part of the row. And there's also state government and there's local and regional, actually regional offices of economic development. There's a lot of people interested in this issue, right? So, I think the federal government in, I will give you example, Texas. So, Texas had a new legislation that are going to pay teacher more. So, for examples like that could be helping, but. We don't know yet. We don't know whether that is going to be sufficient to support the whole, I think ultimately the question boils down to it's an ecosystem of a lot of different players in included U Teach program. It's a, it's a program based at University of Texas at Austin, and they're training SAM teachers and they have been long, they have been expanding across the country for different programs.

I know, like which state? They just implemented the whole, they implemented the whole U Teach program, one of the southern states. I can't remember exactly which state. And we also have beyond the 100 K a lot of different initiatives across the country. And there are a lot of local and state-based programs that are trying to solve this broad, challenge that we were faced with because the teachers I wanted to ask to bring back, to talk about the impact of a teacher, right? So, the teacher's lifetime earnings may not be that much, but their impact on our students are huge, right? So, they're teaching maybe 30 students 30 multiply five, and then however many years they stay in teaching and the impact they are training the future of engineers. They're training the future lawyers, they're training future doctors. So, if we don't invest in these training up these STEM teachers and prepare the future teachers, we're not going to have a future workforce to speak up.

**HANSEN:** Thank you. Thank you for speaking to that, so what you're describing is a web of federal government is part of the STEM teacher pipeline. Web ecosystem, yes. But there's also federal, or there's, excuse me, state and local initiatives that are helping to bring things in. There's also private initiatives. So, the loss of the federal, if there were a loss of a federal program or federal funding there is still a robust ecosystem that's there to help, but it would still be consequential, nonetheless.

**FENG:** Yes.

**HANSEN:** Let's go to Anne for, as a state education leader what do you think the, what do you think the state could be doing differently or in this environment where the federal role may become less reliable?

**PETERSEN:** I think we're already starting it in Virginia by having some of these incentive programs. I know we're trying to think outside of the box and become innovative with teacher endorsements now. We have to be careful if we're innovative. We also wanna have strong teachers with pedagogical and conceptual background in that discipline. So, thinking about what type of supports need to be in place to enable those teachers to have success and to stay in the field. I think, that's a process we're going through. At some point, where's the balance? You don't want to decrease the amount of mastery that a teacher has to demonstrate just to increase the number of teachers coming in without having some hand in hand support. So, we are trying to provide some of those structures, but I think all of the states are grappling with how does that look like? And trying to work around traditional set systems to see if we can think of some innovative ways to bring people in, entice them and keep them in the field.

**HANSEN:** Yeah. Thank you. And Jhosse, if you could wave a magic wand and offer some. Advice on the Noyce program. You're a Noyce scholar yourself. What would you do to tweak it to try to get more people in? What could, what would you do if, suppose I had a magic wand?

**GUERRERO:** I think I would do my best to speak to the child within them, the child that has the fear of public speaking, the fear of being ignored, the fear of being disrespected, the fear of everything. 'cause that, that's a, that's one day as a teacher, disrespected, ignored, et cetera, et cetera. It's a little too close to home, I guess.

**HANSEN:** Absolutely.

**GUERRERO:** And so, find a way to eliminate that fear of all of that, and just stay motivated so you can get innovative.

**HANSEN:** Okay. I like that. Jhosse. Why don't we go ahead to audience Q and A. We will have some mic runners around here. And we've also had a had some questions submitted online. Miriam, if any other questions come in, we'll be informed of those. But we have a question right here and as you get the mic, if you could please introduce yourself quickly or ask a question and not comments, please.

**AUDIENCE MEMBER:** Hi everybody. Good afternoon. My name is Travis York. I serve as the head of the Center for STEM Education and Workforce at the American Association for the Advancement of Science. I'm also the PI of a s Noce Initiative, which hosts that 2023 meeting that Jhosse was at. Which is an annual meeting of PIs and Noyce scholars. Pleasure to be with you all. Thank you so much for this research. Thank you so much for sharing about the incredible work that you do both in the classroom and thinking about this at different levels. First I'll just say an answer to your question about the indispensability of Noyce funding is that while there are a lot of robust support structures, the federal funding that comes from National Science Foundation far outweighs student pathways into STEM teaching, especially for high needs school districts.

And it is also the one area of National Science Foundation that had more than half of the cut this past year. So, I do think that we will see continued impact of that federal financing. My question actually is about I'm gonna ask you to do something that I hate. For that people ask me to do when I'm presenting research. And I'm gonna ask you to prognosticate a little bit. Your data primarily goes through 2020 in particular looking at need and retention of teachers. But we know from a lot of preliminary and current data that the impact of COVID and the impact of budgets more recently on school districts has really had a precipitous drop and a widening of the teacher kind of gap and need in the country.

We also know from some other research around Noyce teachers that they're much more likely to be retained as teachers on the whole. But I'm wondering if we have any data that's looked at that time

series around, what has been the impact since 2020? In particular in Noyce. Are we still seeing a greater resiliency amongst Noce teachers? We might hypothesize that I'm just, I know I'm asking you to look outside your report, but I'm curious about what we're seeing and where we might be able to glean lessons about that might be applicable to other pre-service teachers.

**HANSEN:** That's directed at you, Li.

**FENG:** All right. Travis, thank you so much for coming. We really appreciate you coming and listening to our report. I can since, this is not a research presentation, so this we're talking about policy here. So, I will say, there are rooms for improvement in terms of what we could do as a as a research, as a practice community in terms of looking forward, right? So, we, I, as a scholar, I always feel the data is so old. So, I'm looking at today and how can we solve today's policy challenge. The data is, has always been a challenge, but one of the things I will point out is the state longitudinal data set that are in Texas, that are in North Carolina that are in Washington.

There are a few states that have Florida that have these state longitudinal dataset. And wouldn't it be nice to have several of these state longitudinal dataset to come together, those state dataset, good thing is that they update them a lot more frequent, a lot more be able to answer this. The question I did that you posed at us, and unfortunately the NCES or the, US Department of Education has experienced a lot of upheaval in terms of data collection disruptions, including the NAEP. I'm not holding my hopes high in terms of the federal, the NCS will keep cranking out the wonderful data set like school and staffing survey.

I will give it a big shout out to NCS how much their, the data set they have provided to, to scholar, to the scholar communities have served us to answer important policy question like this one that, that Travis, you're posing to us. I would encourage funders or researchers, scholars out there to answer to. Travis gives us a sort of a research, future research agenda, right? So, we need to be looking at the, these issues, right? We say it's this stability, but we're looking back. I hope I have a crystal ball to look forward to saying what is gonna happen if I have a crystal ball. I'll make a guess, right? There are challenges on the ground, so we need to be cognizant of that. And we are reporting on historical data,

right? And I will say we have limitations in terms of how far the data go to present day and time. I don't know, Mike, if you have anything to add to that?

**HANSEN:** Yeah I'll just I'll take the moderator's prerogative and offer a couple more comments. Number one is that we do see some states and I'm flagging Texas here. It's flagged in the report that this is an area where we have especially high rates of alternative certification. Not just alternative certification, like for-profit certification not affiliated at all with institutions of higher education. These are especially those. Teachers who are trained through those programs have especially high levels of turnover. And it's they also have evidence of showing less effectiveness in the classroom. And there's real reason to be concerned. And quite frankly, this, that segment of the teacher preparation pipeline has been the only one that's really been growing over the last 10 years.

And so, I think overall though the finding of, the research finding that we presented today is one of stability, and even surprising stability. I think there is actually a lot of signs of weakness that are really shouting out at us and as something that we really need to take seriously. Unfortunately, I don't think we can address the question of exactly how is this playing into the post COVID era, just 'cause we don't have that data yet. But it is something that I think the early signs that we have are really jumping off.

**FENG:** Maybe in five years we'll have some couple post COVID.

**HANSEN:** Hopefully. Before that leaves let's go to any other questions? Hannah.

**AUDIENCE MEMBER:** Thanks, Hannah. Putman, national Council and Teacher Quality. This is building off of Travis's question, but it seems like the research is pointing to the success of this program and addressing local teacher shortages, potentially in addressing teacher retention. And it seems like this, I have a limited knowledge of the program, but it seems like there's a few key pieces around the funding aspects for candidates that clinical practice and getting them working in high need schools. You've mentioned some of the pedagogical techniques that they're being taught. To what extent are you able to tease apart like how much these different pieces of the program are impacting candidate success and what could we learn from that could help either inform. Local or state or

national funding efforts, or could it inform how prep programs are thinking about better preparing their candidates for these kinds of placements?

**HANSEN:** Do you, Yeah. Can you address that, Li?

**FENG:** Yeah. I can't address that, but again, this is an excellent future research agenda. And so, in our in this study we didn't, we you could so that, that will be a primary data collection effort a large scale one at that. In terms of collecting additional information on each program. What are the program features? I'll just give you even the four programs they do things so differently. So, for one program they're physics and they're targeting, they're using a model called a learning assistant model, where they, they do a lot more project-based learning, and they have college students who have taken this.

Course to support these future teachers and that in other places where they focus on more practical science training in University of West Florida they invite local marine biologists to come into their classroom and to give them training. So, I think each program has their own unique features, but I think your question is spot on in terms of, we don't know, we don't actually have a clear idea. It did work alleviate teacher sort of the vacancy, reduce the ace rate around the school district nearby. But what made it work? Like we know it worked, but we don't know what component of that program actually worked. If I had to make a guess it is those clinical experiences that, that are really boosting sort of training the teacher to be well, very proficient. Jhosse is here, is talking about applying those knowledge rather than just teach them, road knowledge and you memorization.

And I think those are the component. I have to make a guess. Those are the component. And another key piece I think. Just from reading their report, it looks like they do a lot more mentoring and they still kept in touch. There is this system of connection between the university, the teacher preparation program and the school district. And they do still talk to the students who are, and they sometimes they have professional development program. They invite the Noy scholar to come back to campus to really mingle, to learn about new things. For example, the ai right, that we're talking about as a teacher, you're struggling. You're like I don't know how to use this thing. Does other teacher know? Then you go to those PDs, and it realize, hey, other teachers are running into same challenges and,

but how do we solve it collectively as a group? Can't answer your question, Hannah, but I think that will be a really interesting study, future study.

**HANSEN:** Go ahead. Miriam's coming.

**AUDIENCE MEMBER:** Thank you. Curtis Valentine with the American Institute Boys and Men. My work is particularly around male educators, so great to see you. Is it Jhosse or Jhosse?

**GUERRERO:** Jhosse.

**AUDIENCE MEMBER:** Jhosse. Thank you. So, the question is, what percentage of these scholars are young men? Is it, is this a target? Are you all looking for sort of parody around male and female scholars, but also just say, what recommendations would you give the program to recruit particularly young men into teaching and particularly this the scholarship program?

**GUERRERO:** Okay. I think I can only answer the second part. I don't have the statistics unfortunately. However, in order to try to get more men, I think from my lived experience, there's been a lot more female teachers, so I understand why you're asking and then especially. Person of color. And so, to get somebody, I think you need to have a spotlight on those that are of the demographic you want, and allow them to have opportunities to demonstrate, Hey, you should be doing this because you're like me. And so, allowing teachers that have demographics that such as being a man or a person of color, giving them that spotlight to giving them that chance to speak to those that look like them and maybe grew up from where they were from just will, it'll go a long way. And so, I think this is a fantastic way to do that.

**HANSEN:** Let me, lemme pile on a little bit and just offer some of the stats beneath, beneath at least teacher education in general. I will say that the teacher pipeline is if you look at the traditional teacher training programs, so these are those associated with universities those tend to be the programs where teacher candidates tend to be disproportionately white and disproportionately female. If you look at more alternative certification programs or graduate programs, those are the programs that are more likely to be individuals of color and also men. And so, in that sense I do feel like there is

potentially, in terms of pulling on the lever for getting more men into the classroom the Noyce program is potent by positioning itself in the traditional teacher training space.

Maybe there are some folks that some men that they're missing. However, at the same time, offering the scholarship grant program, maybe that is something that is helping to bring them into traditional training rather than going through alternative certification. So, I, I don't know that we have a study to, firmly, to firmly conclude that could be the result, but that very well could be potentially what's happening with the, in the Noyce teacher program and how it could potentially be shaping the alternative pipeline.

**AUDIENCE MEMBER:** The percentage of men in the program at all tracks that...

**FENG:** that's an excellent question. I don't think they track that.

**HANSEN:** That, that was something that was in one of the objectives, at least for the four, at least for the four collaborating institutions that were part of our study.

**FENG:** Okay. Go ahead. Sorry. I, for the national picture, we don't have the detailed breakdown of the scholars. But for our, for the four programs, we do have information about men. I, but I don't remember off the top of my head. Yeah, in terms of, we can get back to you if you're curious about that. Yeah, it definitely is the program the intention of the program is to attract, teach student candidates who are yearly not attracted to teaching. So, I think in that way my suspicion is that it probably encouraged young males to enter into teaching, which is not traditionally, not heavily female in the past 10. In the past.

**HANSEN:** We have another question there on the back.

**AUDIENCE MEMBER:** This question is for Li. You used the, one of the words that you've used in your presentation is a high need. You kept on repeating. I thought you were saying high me schools not high needs. Now, is there a definition of high needs schools and where are they? In DC or in Virginia or Maryland? I guess you have persons on the on the podium. Can you tell me, is there a list of those high need schools?

**PETERSEN:** In Virginia? Yes, there is. They use different indicators. You can look at high needs in terms of poverty level, socioeconomic, but in Virginia we also use we have a new performance and support framework that identifies school based on a variety of factors 'cause schools encompass a variety of factors that include SOL testing, that includes graduation performance or graduation rate. That includes attendance, that includes the ability to, or they do, whether they've trained to go into higher level courses and advanced enrollment enlistment workforce readiness.

So, there's a score assigned to that of those scores approximately a certain percentage of schools are identified as needs intensive support, and that means high needs that they've been found, that they need a bunch of, state level support or additional structures to enable the kids to be successful. We also have a category categorized as off track, and those are considered high needs too. So, you can look at individual discipline performance. You could look at socioeconomic, but. For Virginia, that score designated by the different categories within the support framework will give a score that will give you, you can generate a list of what schools are identified as high need.

So, it is a quantifiable measure at our state. And I know many other states have similar processes. Do you combine those factors together? Yes. Yes. So, from our perspective we're looking at how we can support mathematics teachers, how we can support science teachers, whatever. We look at SOL as. I remember that SOL has other meetings in other states, but standards of learning test indicator performance. But the combined scores for looking at the school as a whole is a combination of all different factors. As I said. If you're looking at high school, are they ready to go into academic or career or military programs is one indicator.

SOL assessment performance is another indicator. Graduation rate is another indicator. So, we look at it through both lens. I know my team is more directly looking at the student performance and student growth in the area of mathematics, student performance in science, but as we support divisions in determining how funding is distributed that compilation of different factors is used as a score. So, we looked at it both ways. I know my way looks a little different than how money is awarded just based on what our roles are within the agency.

**FENG:** The high needs in our study setting so there is a specific definition actually defined by Congress in terms of what, how they define these high needs because the Robert Noyce scholarship funding is the, there several legislation. There has been some changes in terms of how high needs school districts are defined in the earliest of time. So, we're, it's more sort of stringent definition is if you are, if a school district have a school that are over 50% students on in poverty and the poverty the way they measure we measure poverty is students are eligible for free reduced lunch status.

So, the sort of the short answer to your question, there is a definition, but, and the definition also has a component of teacher turnover. So, whether the teachers in these schools have high turnover. Again, like this is where in the Noyce community there has been some struggles in terms of when these university are ready to apply for Noyce. Track one or track one is one of the tracks, and our track is at track four where we're doing research track. One is offering these scholarship support for these student teachers. So, it, people are not sure, like they are wondering what is my school district, the school district that are nearby to us? Are they, do they fall into high needs school? So that gets into the weed and I'll stop right there, but happy to take answer, have a discussion offline.

**HANSEN:** Yeah. Okay. Let's just do a quick lightning round of a couple of questions that were submitted online. This one goes to Jhosse. How can supporting STEM teachers translate to cultivating student leadership in the classroom? So, what can you do to cultivate student leadership and how can STEM teachers cultivate student leadership?

**GUERRERO:** Circling back to what I said earlier when I mentioned the triple A S Noyce Summit just having access to that. So, allowing students access to the opportunity to show leadership. So breaking students into small groups, that's one way to go about it.

**HANSEN:** Okay. Okay, great. Thank you. And here's a question I'm gonna direct to Anne again, lightning round. What actions might the panel recommend as being the most impactful that you've seen for incentivizing? In incentivizing STEM those who have STEM interests in K to eight grade. So younger kids, how can we incentivize them to engage in STEM?

**PETERSEN:** I think providing those robust learning experiences that allow them to engage in that iterative problem-solving process. We always have to, when working with administrators, we have to say this is aligned to instruction how, or of the standards, how, but providing those opportunities, allowing them to try things out to be wrong, to try it again, to work around issues that builds their confidence and enables me. And then making it explosive by the teacher. This is what engineers do. You go through it again and again until you get the right outcome. And making it engage yet making sure that we know that they have mastery of those underlying concepts.

**HANSEN:** Great. Thank you. We're gonna wrap up now and I want to thank our three panelists, Li Anne and Jhosse for a rich and wide-ranging conversation. Thank you to everyone who joined us in person and online. Thanks as well, the Brookings team, including Mariam, Al Hassani, and Nicholas Obino, and all the events and technical supporting staff that make this event possible. And this event marks the conclusion of our three-part series and from pipeline to the classroom and program evaluation. I hope this series has offered a useful evidence base for educators, policy makers, and advocates working to strengthen STEM teaching across the country. Thank you very much.