

# How Remote Teaching Impacted our STEM Noyce Scholars: Some Successes, Some Struggles

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## Abstract:

Improving the quantity and quality of STEM teachers is one of the goals of the Noyce Scholarship Grant Program implemented through the National Science Foundation. Here, we examine how the change to remote learning impacted [blinded university]'s Noyce Scholarship program. Our research question was as follows: what kinds of successes and struggles did STEM Noyce (a) in-service and (b) pre-service scholars experience in the first year of remote teaching during the pandemic? We interviewed three different cohorts of Noyce scholars: pre-service teachers, first year teachers and second year teachers. Results showed that some scholars saw benefits to remote learning including more free time for other learning activities. They also observed teachers dedicated to student success. Challenges included an inability to reach all students, a continued focus on standardized tests, and a lack of flexibility within the districts.

Keywords: Noyce scholars, STEM teacher education, remote learning

## Introduction

The Robert Noyce Teacher Scholarship Program is awarded by the National Science Foundation. The purpose of the program is to increase the number of highly qualified teachers in the United States, focusing on students who are often not exposed to high quality STEM curriculum. A link to the program can be found here: [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=5733](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5733). The purpose of our Noyce grant was to prepare and retain 24 new mathematics and science teacher scholars. We used an engineering framework of project-based learning in grades 5 – 8 classrooms to guide them. Over the course of three years, scholars were guided to become classroom leaders/mentors through a series of intentional activities to support new teachers in two high-need districts in our area.

Our premise was that middle school students' early exposure to exciting, engaging STEM activities will entice students to pursue these fields at the college level (Mohr-Schroeder et al., 2014). By providing students with positive STEM experiences early in their education, students may be more willing to work toward attaining a STEM education (Wingenbach et al., 2007) thereby meeting the employer needs for qualified graduates. However, qualified STEM teachers are not present in many urban and rural middle schools.

The importance of retaining teachers through induction is paramount in Arizona, where no state funding is provided for new teacher induction. In 2016, the massive teacher shortage in Arizona left 2,166 vacant positions and 2,221 positions filled with unqualified candidates (Hunting, 2017). Much of the teacher shortage mirrors the national shortage which is concentrated in STEM fields (Aragon, 2016; Hunting, 2017). Arizona's teacher shortage may be worse than other states because of the poor teacher salaries, limited funding, lack of respect and low standards.

To increase the number of qualified STEM middle school teachers, we designed a program that financially and academically supported scholars while also offering guidance and mentorship as they navigate through their first two years of teaching. However, Coronavirus disease-2019 (COVID-19) pandemic conditions and precautions presented unanticipated challenges to our scholars. The student teaching placements and teaching placements disrupted the cycle we had planned for when we were funded. COVID-19 necessitated adaptations that systematically disrupted school systems (Burgess & Sievertsen, 2020; Ferdig, Baumgartner, Hartshorne, Kaplan-Rakowski & Mouza, 2020) and created challenges for our scholars. Our research focused on how the school adaptations made during the pandemic affected our scholars' experiences. Our research question was the following: what kinds of successes and struggles did STEM Noyce (a) in-service and (b) pre-service scholars experience in the first year of remote teaching during the pandemic? We interviewed the scholars at various stages of their teacher preparation and induction into the profession: those in student teaching, during their induction year and second year of teaching as a professional educator. We present qualitative findings contextualized in two groups: (a) in-service first and second year teachers and (b) pre-service scholars.

## Methodology

### Participants

Our Noyce grant includes three different cohorts: pre-service teachers, first-year teachers and second-year teachers (we call them all scholars). All of the participants are/were educated through [blinded university]'s degree program in Education that yields a Master's degree as well as state teaching certification. Participants have Bachelor's degrees in STEM fields. They entered this program usually as career changers or they decided to become teachers after receiving their Bachelor's degree and feeling like they needed to make a difference in society. They all were required to student teach in Title I middle schools in the [blinded city] metropolitan area in either mathematics or science. While there are 23 total scholars, 12 participated in the focus groups; 33% of the second year teachers participated, 54% of the first year teachers participated and 57% of the student teachers participated.

### Data Collection and Analysis

Data were collected in November of 2020 in two separate focus groups facilitated by a neutral evaluator. Each session was 60 minutes in length and the facilitator followed a structured set of eight open-ended questions focusing on successes, challenges and availability of resources to meet the challenges. Responses were audio recorded and translated into de-identified written scripts made available to the researchers.

The first focus group consisted of all current classroom teachers and the second focus group focused on pre-service teachers. Scholars were asked to reflect on their experiences teaching children in their schools through in-person instruction, virtual instruction, or a combination of both. All of our Noyce scholars are collectively considered a case in this study. The study was approved through IRB and consent was received from participants. Data were analyzed holistically with a focus on understanding the scholars' perceptions regarding teaching and learning through remote learning models during the COVID-19 pandemic.

## Findings

### In-service Scholars

In terms of the successes, the scholars saw benefits in a reduction of behavior issues, the ability for students to address self-care (bathroom breaks, lunch and/or snack breaks), no commuting time, and increased time to help students through afterschool tutoring. In terms of behavior issues, a scholar said, "For the students who are participating, I think they're doing well and excelling, I do like teaching online. I don't really like being a student online, but I enjoy teaching online a lot." In terms of tutoring, a scholar said, "Instead of driving in traffic for an hour, I have students in tutoring for an hour doing problems on the whiteboard. So, there's a lot of good things happening." Scholars are also developing blended learning skills. They are using online tools like Nearpod, Digital Interactive reader, Peardeck, Phet, Quizziz and other tools that support learning; "The kids love Quizziz. The ones who are often disengaged get really into it."

In terms of challenges, scholars observed that not all students were participating online at the same level. One stated, "Most of my students don't really participate or turn things in" while another said, "I know we're leaving lots of [students] behind ... I still feel bad about that." They also observed that school leaders failed to adjust standardized testing requirements. Rather, schools are still oriented toward testing; "The emphasis on the testing and the scores and the mastery of the standards; all of these things that we've already seen before the pandemic were not serving all students. It's been so disappointing to see at least in my district, and I guess in others, that so much is business as usual this year." There also appears to be a lack of focus on students' mental health: "I...feel that at this time, we should be looking out for them. At this time especially, we should be looking at the emotional piece." Another scholar commented, "We have record anxiety among our children, and we are still doing this."

### Pre-service Scholars

In terms of successes, scholars point to hard working teachers (mentors) who are guiding them throughout this remote learning process. One scholar stated, "One thing I like about my internship right now is my teacher gets everyone to get to know each other. She does a daily poll...and they get talking and they start chatting in the main chat." Another stated, "I really enjoy my mentor teacher. She keeps trying new things every single time...What's going to work, what's not, what can I repeat for next semester?"

In terms of challenges, they experienced delay times and inconsistent internship placements that have caused stress. There have also been challenges in connecting with students. "When we first started, [school administrators] were hesitant to allow breakout rooms because they didn't want kids unsupervised one-on-one. Now, they're more accepting of [breakout rooms]. Without the breakout rooms, we had a lot of unsubmitted work." Another commented, "Most of the students don't have their cameras on...I haven't actually seen their faces." There have also been challenges with students' family demands. "The biggest struggle I am having online is babies. I have so many eighth graders who are taking care of little siblings." Another commented, "I think they don't require [students to have cameras on] because they don't want to be responsible for seeing things...like teachers seeing things they don't want to see like...students taking care of kids." And finally, these scholars are challenged by students not participating and not turning in their work. "The challenges for the most part are students not participating. They just submit the attendance and just stay online, and they probably walk away from the screen. As much as we message them or call them, they don't respond."

## Discussion

While the scholars experienced some struggles, it is important to note that there were also successes during this unforeseen remote learning transition. Of particular note was the overall success of some students in the virtual environment; while others were disengaged. The same thing could be said for in-person teaching; however, some of the strategies used in live classrooms, such as proximity of teacher and peers, access to materials and visual scanning of the classroom were more challenging in the virtual environment. A teacher's ability to gage the energy level of the classroom was inhibited by lack of cameras being on and inability to control for interruptions that naturally occur in the home setting. In-person learning allows a teacher to intervene immediately when students are off-task.

Teacher preparation and induction of individuals with a STEM bachelor's degree and background is typically focused on preparation to teach content knowledge, learning pedagogical content knowledge, and learning to manage the classroom behaviors of students in the context of observations and then student teaching under the guidance of a mentor teacher. What made the current Noyce scholars' experiences unique is the unanticipated online learning environment due to the COVID-19 pandemic. In addition to grappling with questions such as, "What should I do to help my students understand this science or mathematics concept? What are my students already aware of about these concepts? What will likely be difficult for them? What is the best way to assess my students' learning?" scholars also dealt with questions such as, "What can I do to motivate student learning in an online setting when social distancing is the norm? How do I ensure students are engaged in exploring the topic(s) under consideration when they are by themselves in small groups in breakout rooms? How do I monitor student behavior, motivate them to learn, connect with their peers and me in meaningful ways, and keep them focused on learning tasks?" Scholars also experienced first-hand, in an unexpected manner, issues related to students' socio-economic status and its impact on learning—students needing to care for younger siblings while attempting to attend an online video session and take part in a learning experiencing for school.

While these challenges about learning to teach and managing classroom behaviors are always in the forefront when it comes to teacher preparation, navigating the unexpected socially distant learning environment emerged as a significant finding. Skillful and experienced mentor teachers and university supervisors with decades of teaching experience were able to help demonstrate and guide the scholars learning to learn how to be a teacher during the unexpected impact of the pandemic.

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