STEM EDUCATION

Selected Federal Initiatives, Challenges, and Approaches to Supporting Rural Populations

Report to Congressional Committees

July 2025
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July 2025

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Why GAO Did This Study

STEM education helps prepare K-12 students for careers in STEM fields to enhance innovation and global competitiveness. About 10 million K-12 students were enrolled in public schools in rural areas in 2022, the most current year of data available.

The August 2022 Research and Development, Competition, and Innovation Act includes a provision for GAO to examine issues related to rural STEM education. This report describes (1) selected federal agencies' initiatives that support rural K-12 STEM education, (2) challenges selected recipients of federal funds and other stakeholders have reported related to supporting rural K-12 STEM education, and (3) approaches selected recipients of federal funds have found to be effective for supporting rural K-12 STEM education.

To conduct this work, GAO examined federal initiatives that support rural K-12 STEM education at four agencies— the Department of Agriculture, Department of Education, National Aeronautics and Space Administration, and National Science Foundation. GAO selected these agencies in part based on the number of K-12 STEM education initiatives they administered and their STEM education funding levels as of fiscal year 2022, the most recent year for which data were available when selected. GAO also visited rural school districts in four states—Alabama, Maine, Nevada, and South Dakota—selected to include a variety of geographic regions and rural district characteristics. GAO also interviewed stakeholders from national organizations and local employers in the four states and reviewed relevant federal laws and regulations.

What GAO Found

All four federal agencies GAO selected for review generally reported supporting K-12 science, technology, engineering, and mathematics (STEM) education for rural populations as part of broader initiatives that served numerous populations. Agency officials provided examples of how these initiatives have supported rural STEM education in various ways. For example, some initiatives have supported recruiting and training STEM educators. Other initiatives have focused on enhancing STEM learning and career exploration for students in rural schools, such as through educational field trips and hands-on activities.

School and district officials GAO visited in Alabama, Maine, Nevada, and South Dakota said that staffing challenges and limited access to STEM learning opportunities and materials were barriers to providing K-12 STEM education in rural areas. For example, officials from one district in rural Alabama said their district had no certified math teachers to serve their 300 students in grades seven through 12 in the 2023-24 school year. Stakeholders also said the cost and logistics of traveling long distances in remote rural areas limited opportunities for certain field trips or learning activities. Rural districts GAO visited varied in terms of remoteness and size and experienced these challenges differently.

Remoteness and Transportation Costs Can Limit Access to Learning Opportunities

Source: GAO site visit to rural South Dakota. | GAO-25-107371

School and district officials in the four states GAO visited said that improving access to STEM learning materials and showing students how STEM topics related to their lives were among the ways they effectively supported rural K-12 STEM education. In many cases, their efforts were made possible by partnering with groups such as university research centers, nonprofit organizations, and local employers. To improve access to STEM materials, rural stakeholders highlighted strategies such as using federal funds to purchase equipment and sharing materials across rural districts. For example, a federally-funded research institute in Nevada maintains a robotics lending library and ships STEM materials to teachers in rural schools throughout the state. Stakeholders also consistently highlighted the value of connecting STEM activities to students' local environments, like projects related to beekeeping and growing vegetables in South Dakota, to spark students' interest in STEM.

Contents

Abbreviations

- Education: U.S. Department of Education
- ESEA: Elementary and Secondary Education Act of 1965, as Amended
- NASA: National Aeronautics and Space Administration
- National Academies: National Academies of Sciences, Engineering, and Medicine
- NSF: U.S. National Science Foundation
- STEM: science, technology, engineering, and mathematics
- USDA: U.S. Department of Agriculture

July 15, 2025

Congressional Committees

The federal government invested approximately $7.3 billion in science, technology, engineering, and mathematics (STEM) education initiatives—including K-12 initiatives—in fiscal year 2023, the most recent data available from the Office of Science and Technology Policy.[1] STEM education initiatives help prepare students for careers in STEM fields and are intended to drive innovation and enhance the nation's global competitiveness. As the number of STEM jobs in the U.S. is projected to grow over the coming decade, some stakeholders have raised questions about whether students in rural areas are being fully prepared for STEM careers.[2]

Roughly 10 million K-12 students were enrolled in public schools in rural areas in fall 2022—one in five public school students nationwide.[3] Rural school districts may possess different assets than their urban or suburban counterparts. Likewise, rural school districts may face unique challenges due to their remoteness and sometimes small population size.

The Research and Development, Competition, and Innovation Act was enacted in August 2022 as part of what is commonly referred to as the CHIPS and Science Act of 2022. It includes a provision for GAO to examine issues related to STEM education in rural areas.[4] This report examines (1) initiatives selected federal agencies have carried out in support of K-12 STEM education in rural areas, (2) challenges selected recipients of federal funds and other stakeholders have reported related to supporting K-12 STEM education in rural areas, and (3) approaches selected recipients of federal funds, federal agencies, and other stakeholders have found to be effective for supporting K-12 STEM education in rural areas.

We examined federal funding opportunities and other initiatives that support K-12 STEM education in rural areas at four agencies—the U.S. Department of Education, National Aeronautics and Space Administration (NASA), U.S. National Science Foundation (NSF), and U.S. Department of Agriculture (USDA). We selected

[1]This figure includes all STEM education initiatives, not just K-12 initiatives. White House Office of Science and Technology Policy, *2024 Report on the Committee on Science, Technology, Engineering, and Mathematics (CoSTEM) And CoSTEM-Related Agency Actions* (Washington, D.C.: Jan. 2025). We use the term "initiative" throughout this report to refer to agencies' STEM grants, programs, projects, and other initiatives. Federal funding accounted for about 13 percent of the total public investment in K-12 education in fiscal year 2023, with state and local sources covering the rest, according to a report published by the U.S. Department of Education. Department of Education, National Center for Education Statistics, *Revenues and Expenditures for Public Elementary and Secondary Education: School Year 2022–23 (Fiscal Year 2023): First Look*, NCES 2025-302 (Washington, D.C.: April 2025).

[2]See U.S. Bureau of Labor Statistics Employment Projections program, "Employment in STEM occupations," 2023 and projected 2033, accessed March 27, 2025, https://www.bls.gov/emp/tables/stem-employment.htm. According to the bureau, STEM occupations include computer and mathematical, architecture and engineering, and life and physical science occupations, and the bureau notes that the STEM definition it uses is one of many possible definitions of STEM.

[3]U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics, 2023*, "Table 214.40. Public elementary and secondary school enrollment, number of schools, and other selected characteristics, by locale: Fall 2012, fall 2021, and fall 2022," accessed March 4, 2025. The fall 2022 data was the most recent data available at the time of our analysis.

[4]Pub. L. No. 117-167, div. B, tit. V, § 10515, 136 Stat. 1366, 1619 (2022).

agencies from among those that administered a relatively large number of K-12 STEM education initiatives that might focus on rural populations and that had relatively high funding levels for STEM education as of fiscal year 2022, the most recent year for which data were available when selected.[5] We also selected agencies to obtain a variety in agency missions and based on stakeholder recommendations. We interviewed officials from the selected agencies and asked them to identify and provide information for up to five agency initiatives that most directly support K-12 STEM education in rural areas as of fall 2024.

To understand some of the challenges and effective approaches for supporting K-12 STEM education in rural areas, we interviewed officials at selected federal agencies and visited rural school districts and schools in four states: Alabama, Maine, Nevada, and South Dakota.[6] We selected states to obtain geographic diversity and a range in the percentage of K-12 students enrolled in rural schools and based on stakeholder recommendations. Three states had a relatively high percentage of students enrolled in rural schools (ranging from 39 to 54 percent) and one state had a low percentage (8 percent), according to 2022 Education data.

We selected school districts and schools to visit within these four states through recommendations from states' educational agencies and other stakeholders such as nonprofit organizations or postsecondary institutions. We also used publicly available data on rural school districts that received rural grant funds from Education.[7] We visited or spoke with officials from at least three schools or districts in each of the four selected states. The districts we visited varied in terms of median household income, racial distribution, and remoteness (i.e., distance from the closest urban area). Our selections of states, districts, and schools are nongeneralizable.

We interviewed a variety of stakeholders on the site visits, including teachers, school and district officials, and local nonprofit and business representatives. We asked stakeholders about strategies they had used to support K-12 STEM education in their rural context, approaches they had found to be effective and why, challenges they had faced, and any efforts they or others had made to address those challenges.

We also interviewed stakeholders from three national organizations knowledgeable about K-12 STEM education issues in rural areas and reviewed relevant reports, federal laws and regulations, and agency documents on K-12 STEM education initiatives.

We conducted this performance audit from February 2024 to July 2025 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

[5]Specifically, we identified the five agencies with the largest number of K-12 STEM education initiatives that might focus on rural populations, according to information provided by the Office of Science and Technology Policy. We also identified the five agencies with the highest funding levels for STEM education as of fiscal year 2022.

[6]A few rural school districts and schools we visited were in locations classified as towns, as defined by the National Center for Education Statistics. However, all the school districts we visited included at least one rural school.

[7]The Rural Education Achievement Program, administered by Education, awards grants to rural school districts that serve small numbers of students or high concentrations of low-income students. We used publicly available data for this program to identify some school districts to visit in selected states.

Background

Federal Role in Supporting STEM Education

The federal government accounted for about 13 percent of the total public investment in K-12 education overall in fiscal year 2023, with state and local sources covering the rest, according to a report published by Education.[8] Multiple federal agencies administer grants, programs, projects, or other initiatives (referred to throughout this report inclusively as "initiatives") that support STEM education, including K-12. STEM education provides individuals with skills to perform a wide variety of jobs, including in fields such as agriculture, aquaculture, aviation, computer sciences, cybersecurity, engineering, and life and physical sciences. The Office of Science and Technology Policy has historically emphasized the importance of STEM education and skills for both college-educated STEM practitioners and those working in skilled trades that do not require a 4-year degree.

The Committee on STEM Education, which is under the National Science and Technology Council, is the interagency coordination body for STEM education in the federal government.[9] The committee issues a 5-year strategic plan for federal STEM education and publishes annual reports on coordinating federal STEM education efforts.[10] The committee also maintains an inventory of STEM education initiatives across federal agencies.[11] In addition, it reports information on the types of participants that initiatives serve and available evaluation reports, among other things.[12]

Additional Research on Rural STEM Education

The CHIPS and Science Act also included a provision for the National Academies of Sciences, Engineering, and Medicine (National Academies) to examine issues related to K-12 STEM education in rural areas.[13] The study, published in 2025, reported on the quality and quantity of federal programs supporting K-12 STEM

[8]Department of Education, *Revenues and Expenditures for Public Elementary and Secondary Education*.

[9]Pub. L. No. 111-358, § 101(a), 124 Stat. 3982, 3984 (2011) (codified at 42 U.S.C. § 6621(a)). The America COMPETES Reauthorization Act of 2010 required the Director of the Office of Science and Technology Policy to establish under the National Science and Technology Council, a committee to coordinate federal programs and activities in support of STEM education.

[10]The most recent strategic plan was issued in November 2024. Committee on Science, Technology, Engineering, and Mathematics Education, *Federal Strategic Plan for Advancing STEM Education and Cultivating STEM Talent* (Nov. 2024).

[11]The committee is required to maintain this inventory under the America COMPETES Reauthorization Act of 2010. Pub. L. No. 111-358, § 101(b)(6), 124 Stat. 3982, 3985 (2011) (codified at 42 U.S.C. § 6621(b)(6)).

[12]For fiscal year 2023, 18 federal agencies reported over 300 STEM education initiatives (including K-12 and postsecondary education). See Office of Science and Technology Policy, *2024 Report on the Committee on Science, Technology, Engineering, and Mathematics (CoSTEM) And CoSTEM-Related Agency Actions* (Washington, D.C.: Jan. 2025). In 2018, we reported on STEM education and the extent to which the STEM education portfolio has been assessed. See GAO, *Science, Technology, Engineering, and Mathematics Education: Actions Needed to Better Assess the Federal Investment*, GAO-18-290 (Washington, D.C.: Mar. 23, 2018). GAO made three recommendations to the Committee on STEM Education to (1) review performance assessments of federal STEM education programs and take appropriate steps to enhance the effectiveness of the portfolio; (2) improve public awareness of information on programs' performance assessments; and (3) report required information on the participation rates of persons from rural areas, among other participant groups, for federal STEM education programs that collect this information. The Committee on STEM Education agreed with GAO's recommendations, and as of January 2023, these recommendations had been implemented.

[13]Pub. L. No. 117-167, div. B, tit. V, § 10514, 136 Stat. 1366, 1618-19 (2022).

education in rural areas. It also assessed the assets rural areas have and the challenges they face in providing quality STEM education.[14]

In addition, the CHIPS and Science Act included a provision for NSF to report on its efforts to promote rural K-12 STEM education.[15] The NSF report was published in May 2024 and includes suggestions for increasing rural students' participation in STEM.[16]

We refer to the findings from these studies throughout our report as they relate to our work.

Variation Among Rural Communities

Rural communities differ from each other in terms of remoteness; geography; socioeconomic makeup; their local STEM-related industries; and other characteristics. Therefore, rural communities vary in their K-12 STEM education needs and experiences.

In addition, according to the National Academies, federal agencies define "rural" in a variety of ways. For example, various federal definitions of rural are based on population, distance from urban areas, or broadband availability. These varying definitions of what is considered rural—as well as differing thresholds for classifying communities, schools, or districts as rural—can affect rural schools' or districts' eligibility for federal funding and other initiatives at different agencies.[17]

Selected Federal Agencies Reported Supporting Rural Populations as Part of Broader K-12 STEM Education Initiatives

Selected federal agencies—Education, NASA, NSF, and USDA—generally reported supporting K-12 STEM education for rural populations as part of broader initiatives. For example:

- NASA officials reported that the agency generally tried to connect its STEM education resources to K-12 students and educators from a broad range of populations—including rural, urban, and suburban.

[14]See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education and Workforce Development in Rural Areas* (Washington, DC: The National Academies Press, 2025).

[15]Pub. L. No. 117-167, div. B, tit. V, § 10512(g), 136 Stat. 1366, 1616-17 (2022).

[16]For the published report, see National Science Foundation, *Making Visible the Invisible: STEM Talent of Rural America* (May 24, 2024).

[17]To provide a more consistent and complete picture of rural K-12 STEM education, the National Academies made several recommendations related to developing and using a common definition of "rural" across federal agencies. See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas*, Chapter 8: Conclusions, Recommendations, and Research Agenda.

- NSF officials said that the agency funded several initiatives that can support rural K-12 STEM education, and that NSF generally served rural populations as part of broader K-12 STEM education efforts.[18]

[18]NSF previously funded STEM education initiatives that focused specifically on certain rural populations as part of its Rural Systemic Initiative. NSF officials said the agency moved away from that approach a couple of decades ago, and rural initiatives were incorporated into existing or new initiatives. For more information on the Rural Systemic Initiative, see National Science Foundation, *Making Visible the Invisible: STEM Talent of Rural America* (May 24, 2024).

Additional Initiatives at Selected Agencies That Support Rural K-12 STEM Education

In addition to the initiatives that selected agencies identified as most directly supporting rural K-12 science, technology, engineering, and mathematics (STEM) education, officials reported on other efforts and resources that support rural STEM. For example:

- The Department of Education's Comprehensive Centers Program has supported technical assistance for rural grantees. For example, it supported the development of a community of practice for rural educators in Arizona, California, Nevada, and Utah beginning in 2020. This community of practice is intended to foster peer-to-peer learning and information sharing on how to use federal and state funds to support rural K-12 STEM education.
- In 2024, the National Science Foundation established the National STEM Teacher Corps Pilot Program to support regional networks in recognizing outstanding STEM teachers and elevating the profession, including in rural areas. It also hired a staff person in 2024 to coordinate STEM outreach and engagement activities, including for rural populations, and promote partnerships with universities and industries.
- The Department of Agriculture established a group to develop new STEM training materials for K-12 teachers and make them accessible online for rural populations.

Source: GAO review of written responses from selected federal agencies. | GAO-25-107371

Almost all the initiatives that agency officials identified in fall 2024 as most directly supporting rural K-12 STEM education support activities beyond STEM education or populations beyond those in rural areas (see table 1). As of fall 2024, officials underscored their agencies' role in serving all populations, including various underserved and underrepresented populations such as rural students, as outlined in their missions or strategic plans. Similarly, the National Academies reported that federal support for K-12 STEM education is broad in scope, and few federal programs that support STEM education prioritize rural populations.[19]

[19]National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas*, Chapter 3: Education Policy, Funding, and Programs in Rural Areas.

Table 1: Initiatives Identified by Selected Federal Agencies That Most Directly Support K-12 STEM Education for Rural Populations, as of Fall 2024

Department of Agriculture	Department of Education	National Aeronautics and Space Administration	National Science Foundation
• Secondary Education, Two-Year Postsecondary Education, and Agriculture in the K-12 Classroom Challenge Grants Program • Agriculture in the Classroom Program • Women and Minorities in Science, Technology, Engineering, and Mathematics Fields Program • Food and Agricultural Non-formal Education Program • Capacity Extension Programs	• Title I, Part A of the Elementary and Secondary Education Act of 1965, as amended (ESEA) (Improving Basic Programs Operated by Local Education Agencies) • Title II, Part A of the ESEA (Supporting Effective Instruction) • Title IV, Part F, Subpart 1 of the ESEA (Education Innovation and Research) • Title IV, Part A of the ESEA (Student Support and Academic Enrichment Grants) • Title IV, Part B of the ESEA (Nita M. Lowey 21st Century Community Learning Centers)	• Science Activation • Teams Engaging Affiliated Museums and Informal Institutions	• Robert Noyce Teacher Scholarship Program • Innovative Technology Experiences for Students and Teachers • Advancing Informal STEM Learning • Discovery Research PreK-12 • Computer Science for All

Source: Agencies (logos) and GAO review of written responses from selected federal agencies. | GAO-25-107371

Note: GAO asked selected agencies to identify up to five initiatives that most directly supported rural K-12 science, technology, engineering, and mathematics (STEM) education.

Although the initiatives selected agencies identified support a range of activities and populations, officials provided some examples of how federal funds have been used to support rural K-12 STEM education, specifically. Uses included recruiting and training rural STEM educators and enhancing STEM learning and career exploration activities for students in rural schools, as well as other activities that supported rural STEM.

Recruiting and training rural STEM educators. Officials from selected agencies provided examples of specific initiatives that had supported recruitment, training, or other activities for rural STEM educators.

- Computer Science for All, an NSF initiative, funded a multi-year project beginning in 2020 to provide curricula and resources to educators in rural areas who lack formal computer science training. The project's goal was to train about 20 of these educators in a rural district to teach computer science to about 500 rural elementary school students.
- The Robert Noyce Teacher Scholarship Program, also administered by NSF, supports recruiting, preparing, and retaining K-12 math and science teachers in high-need school districts. The initiative funded a multi-year project beginning in 2021 in Kansas and Missouri to help recruit and train about 24 certified high school STEM teachers in two school districts. Project funds have been used to explore challenges faced by STEM teachers in rural areas and factors affecting teacher retention. Funds have also been used to support scholarships, mentorships, and field-based learning experiences for participating teachers.
- Funds from NASA's Science Activation initiative have been used to host a series of webinars for rural educators to highlight STEM opportunities and resources, including a webinar in 2021 on how to engage girls in rural areas in STEM.

- USDA funded a 2-year project beginning in 2023 to support training for rural educators in Oregon.[20] The project's goal was to train about 60 K-12 educators across the state to teach agriculture topics and increase teachers' and students' awareness of agriculture-related careers.

Enhancing STEM learning and career exploration activities for rural students. Officials at selected agencies also provided examples of initiatives that have supported hands-on STEM educational activities and skills development, STEM literacy efforts, STEM career exploration and other activities for rural students.

- NSF's Innovative Technology Experiences for Students and Teachers initiative funded a multi-year project beginning in 2021 that supports hands-on learning experiences for rural high school students in Alabama. Participating students gain cybersecurity skills by developing and testing a secured mobile phone application, according to the project's description. The same NSF initiative also funded a project beginning in 2023 that provides opportunities for rural middle school students in Maine to strengthen their research and data collection skills by studying a local bird species native to their region.
- A NASA grant for local community hubs provided funding in 2022 that supported a program for rural and tribal communities in Montana on how remote sensing technology could be used to detect wildfires. Over 2,000 students participated in the program during field trips to the museum that hosted the program or at annual tribal powwows.[21]
- The USDA-funded project in Oregon that provided teacher training (discussed above) also provided hands-on learning activities and field trips to local farms for students in grades four through 12 in rural areas of Oregon. These activities and experiences supported lessons about different agricultural and food science careers, according to the project's annual report.

Other activities that support rural STEM. In addition, officials at selected agencies provided examples of initiatives that have supported rural STEM education in other ways, such as through research on instructional practices and needs or by paying for STEM equipment for rural K-12 classrooms.

- NSF's Discovery Research K-12 initiative funded a project beginning in 2023 to survey rural middle school educators nationwide. The project's goal is to understand current trends in instructional practices and curricula, resources that support math education in rural communities, and the challenges that rural math educators face.
- Education officials said that some of the broad grant programs that Education administers provide funding for STEM materials or designing STEM spaces. For example, officials said ESEA Title I, Part A funds can be used to purchase tablets and laptops that support STEM learning activities, and Student Support and Academic Enrichment (ESEA Title IV, Part A) funds can be used to purchase or reconfigure STEM-focused digital learning resources or spaces.[22]

[20]Funds were awarded through the Secondary Education, Two-Year Postsecondary Education, and Agriculture in the K-12 Classroom Challenge Grants Program.

[21]Funds were awarded through NASA's Teams Engaging Affiliated Museums and Informal Institutions.

[22]As reauthorized and amended in 2015 by the Every Student Succeeds Act, Title I of the Elementary and Secondary Education Act of 1965, (referred to throughout as ESEA), seeks to provide all children significant opportunity to receive a fair, equitable, and high-quality education, and to close educational achievement gaps. The purpose of Title IV of the act is, in part, to increase the capacity of states, local educational agencies, schools, and local communities to improve the academic achievement and digital literacy of all students through the use of technology. Pub. L. No. 89-10, 79 Stat. 27, as amended by Pub. L. No. 114-95, 129 Stat. 1802 (2015).

NSF Funding for Rural K-12 STEM Education

For the five science, technology, engineering, and mathematics (STEM) initiatives that NSF identified, officials estimated that funding amounts supporting K-12 STEM education for rural populations, specifically, ranged from slightly less than 10 percent to just over 25 percent of overall funding for each respective initiative in fiscal year 2023. NSF officials estimated funding amounts by searching the agency's active awards for key words such as "rural" and the rural classification of grantees.

Source: GAO review of written responses from the National Science Foundation (NSF). | GAO-25-107371

Because the initiatives that selected agencies identified support a broad range of populations and purposes, information was not readily available on how much funding went toward rural K-12 STEM education efforts, specifically. In some cases, agency officials were able to approximate the amount of funding from certain initiatives that went toward supporting rural K-12 STEM education (see sidebar). In other cases, federal funding supports a wide range of activities and may pass through states to school districts to support teachers and school leaders. This can make it challenging to track specific funding amounts by different uses. For example, for Education's ESEA Title II, Part A grant, one of the initiatives agency officials identified as most directly supporting rural K-12 STEM education, 53 percent of rural districts reported using funds to improve teachers' content knowledge in STEM or computer science. However, specific amounts spent are unknown.[23]

Selected agencies also cited difficulties measuring rural K-12 STEM education outcomes. For example, an Education official said causal studies that demonstrate the effects of programs on rural K-12 populations could be challenging, especially if the number of participating students was small. NSF reported that its programs were usually evaluated as a whole, and program outcomes were generally not disaggregated by geography or topic. USDA officials reported that the agency had not carried out any formal evaluations or studies of the programs they identified but said that funding recipients were required to provide information on project activities, audiences served, and project outcomes.[24]

In its recent report, the National Academies recommended that agencies that fund STEM education programs examine and document what makes a program or approach successful for rural populations or in rural settings, specifically.[25]

[23]U.S. Department of Education, State and District Use of Title II, Part A Funds in 2022-2023 (May 2024). The purpose of ESEA Title II, Part A is in part to provide grants to state educational agencies and subgrants to local educational agencies to increase student achievement, improve the quality and effectiveness of teachers, principals, and other school leaders, and increase the number of teachers, principals, and other school leaders who are effective in improving student academic achievement in schools. 20 U.S.C. § 6601.

[24]A public database, the Data Gateway, includes summary information for USDA projects that have received funding from the National Institute of Food and Agriculture. See https://www.nifa.usda.gov/data/data-gateway.

[25]See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas*, Chapter 8: Conclusions, Recommendations, and Research Agenda.

Stakeholders Cited Limited Staffing and Student Access to Learning Opportunities and Materials as Challenges for Rural K-12 STEM Education

School and district officials in our four selected states said that staffing challenges and students' limited access to STEM learning opportunities and materials made providing K-12 STEM education in rural areas challenging. A combination of factors such as remoteness, small student populations, and limited state and local financial support contributed to the challenges that some rural districts faced. However, rural districts we visited varied and experienced these challenges differently. For example, not all rural districts we visited were remote, and some districts were less populous than others.

Some Challenges Extend Beyond Rural Areas and STEM Education

Some of the challenges discussed in this section are not unique to rural areas but may be intensified by certain rural characteristics like remoteness. Also, in addition to challenges related to providing K-12 science, technology, engineering, and mathematics (STEM) education, school district officials identified broader challenges to rural K-12 education, such as student housing insecurity and the lingering effects of the COVID-19 pandemic on education. GAO has previously reported on learning loss due to the pandemic.

Source: GAO site visits to rural school districts and GAO-22-105816. | GAO-25-107371

Staffing Challenges

Officials from rural school districts we visited in all four selected states reported facing significant staffing challenges, such as a shortage of certified K-12 STEM teachers.[26] For example, officials from one school district in rural Alabama said their district had no certified math teachers to serve their 300 students in grades seven through 12 in the 2023-24 school year. According to these officials, the district had since been able to hire two new certified math teachers but still faced challenges recruiting teachers. Another Alabama stakeholder said one rural school that lacked a science teacher for grades six through 12 had been inviting guest speakers from a museum and a university and using virtual approaches to help fill in the instructional gaps.

Teacher shortages can have a variety of negative effects on students, according to stakeholders. Officials in one Nevada district we visited described how a vacancy at a single grade level could limit students' long-term STEM learning opportunities. For example, they said the junior high school had no algebra teacher for a time, which made it difficult for students to advance to calculus before graduating high school. The National Academies study provides several examples of how student learning may be affected by teacher shortages.

[26]We reported in 2022 that public K-12 teacher shortages were more prevalent in specific geographic areas, including rural areas, and specific subject matters, including science. We recommended that Education develop a more comprehensive strategy to raise public awareness about the value of teachers, and that Education collect and share resources to help schools and districts address specific recruitment and retention challenges. As of May 2025, both recommendations remained open. See GAO, *K-12 Education: Education Should Assess Its Efforts to Address Teacher Shortages*, GAO-23-105180 (Washington, D.C.: Oct. 27, 2022).

For example, teacher shortages can limit the range of STEM courses available to students and thus reduce students' interest in or preparation for STEM-related careers.[27]

State Effort to Address STEM Teacher Recruitment and Retention in Alabama

Alabama created the Teacher Excellence and Accountability for Mathematics and Science Salary Schedule Program in 2021 to help address science, technology, engineering, and mathematics (STEM) teacher shortages. The program provides participating teachers with a higher salary for teaching approved math and science classes in grades six through 12. They can further earn a salary supplement if they teach in hard-to-staff schools, including some rural schools. Officials from the Alabama state educational agency told GAO that in the 2023-24 school year, more than 4,000 teachers participated in the program.

Officials from two rural Alabama districts GAO visited emphasized the importance of the program. For example, a teacher GAO spoke with in a rural school told GAO that were it not for the program, he might have had to leave teaching for a higher-paying career.

Source: GAO site visits to rural Alabama school districts and Alabama state educational agency officials. | GAO-25-107371

A variety of factors may contribute to STEM teacher shortages in rural areas. We reported in 2022 that factors contributing to nationwide teacher shortages included low salary and a perceived lack of support from the school district and community.[28] In addition, stakeholders in three of our four selected states said recruiting and retaining teachers in rural areas was difficult due to limited budgets and the inability to pay potential teachers higher salaries to compensate for the challenges of living in remote areas. For example, Alabama state educational agency officials identified low pay as a primary barrier to recruiting STEM teachers to rural areas and told us the state had taken steps to address this challenge (see sidebar). In addition, a superintendent in Nevada said it was difficult to attract teachers to the region in part because the school district covered over 9,000 square miles yet had very few medical facilities. Similarly, a teacher in a rural Maine school district said it was difficult to convince prospective teachers and their families to move to the area because there was no movie theater or shopping nearby.

When rural schools have difficulty filling STEM teacher positions or have too few students to warrant hiring additional educators in a subject, teachers may have to cover multiple STEM topics and grade levels, sometimes outside their area of expertise. For example, one rural South Dakota school we visited had one teacher who covered all science subjects for grades five through 12, including earth science, physics, biology, anatomy, and others. Similarly, a teacher in Alabama told us his class preparation was more time-consuming and complicated at the rural school where he taught five different science subjects than at his previous post in an urban school, where he taught a single subject.

[27]See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas,* Chapter 3: Education Policy, Funding, and Programs in Rural Areas and Chapter 6: Educator Recruitment, Retention, and Professional Learning.

[28]See GAO-23-105180.

Federal Agency Efforts to Support Rural STEM Teachers

Officials from selected federal agencies recognized that rural school districts often face challenges related to supporting teachers' science, technology, engineering, and mathematics (STEM) professional development, and in some cases their agencies had taken steps to address them. For example, National Aeronautics and Space Administration (NASA) officials said the agency had developed STEM lessons and activities that included supplemental videos to assist teachers. These materials were meant to help boost teachers' understanding of STEM topics. NASA officials said these resources could be particularly helpful to the many STEM teachers in rural areas who were not teaching within their area of expertise.

Source: GAO review of written responses from selected federal agencies. | GAO-25-107371

In addition, some teachers said STEM educators may feel underprepared to effectively use STEM materials in their instruction or to teach STEM courses at all. For example, teachers in Maine recounted instances when they had received robots or virtual reality headsets for their classrooms, but the equipment sat unused in closets because nobody at the school was trained in how to use them. Teachers further noted that educators teaching outside their areas of expertise sometimes lacked the confidence to teach STEM subjects. For example, a teacher in rural Maine with a background in English said he was asked to teach technology because of staffing changes. Other teachers we spoke with in Maine said that elementary school teachers with backgrounds in reading and language arts might need additional training to boost their confidence in teaching science and math.

However, in three of the four states we visited, teachers reported limited opportunities for STEM-related professional development.[29] For example, teachers in more remote rural schools said that professional development opportunities were often offered in larger cities that were far away, requiring them to find the time and money to travel to attend.

In addition, stakeholders in three of the four states we visited described challenges related to being the only STEM subject teacher in their rural school or district, including limiting their networks of support. One teacher in rural Maine referred to such teachers as "island" teachers because they are often isolated from other STEM teachers and resources. Island teachers may have a harder time finding mentors or partner teachers to learn from or share ideas with, according to the teachers we spoke with.

Limited Access to STEM Learning Opportunities and Materials

Rural school and district officials in all four states we visited said their students had limited access to STEM learning opportunities—including field trips and career exploration activities—and STEM materials. Multiple factors contribute to these access challenges, such as the cost and logistics of traveling long distances in remote rural areas or providing materials to schools and districts with small student populations. In addition, the National Academies study includes several examples of funding challenges that rural school districts may face. For example, some rural districts with more limited tax bases do not have sufficient funds to purchase certain STEM materials or update STEM facilities.[30] Officials from one rural Nevada district we visited said their limited tax base prevented them from updating their school's STEM facilities.

[29]We have ongoing work that examines how Education supports the provision of effective professional development to K-12 teachers.

[30]See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas,* Chapter 7: STEM Education and Workforce Development Infrastructure and Materials.

Stakeholder Efforts to Address Rural Transportation Challenges

Stakeholders in Maine and South Dakota said that bus driver shortages could limit students' access to various learning activities and led some science, technology, engineering, and mathematics (STEM) teachers to take on additional responsibilities beyond classroom instruction. For example, at a rural South Dakota school, the district's sole science teacher for grades five through 12 had a commercial driver's license that allowed him to drive a school bus route. He was thus also able to transport students on STEM field trips. Teachers at a rural Maine school said they used U.S. Department of Education funds to purchase vans, which do not require a commercial driver's license to drive. Teachers at the school are now able to take small groups of students to STEM learning opportunities when licensed bus drivers are not available.

A STEM teacher in rural South Dakota uses his commercial driver's license to transport students to the school's beehives.

Source: GAO site visits to rural Maine and South Dakota school districts. | GAO-25-107371

Long distances to STEM activities. Stakeholders in all four states we visited said they faced difficulties helping students access distant STEM learning activities through field trips or participation in STEM competitions. Schools in remote rural areas may be many hours' drive from the nearest city, museums, or other schools. For example, officials from one school district we visited in rural Nevada said long distances made it difficult to take students to STEM activities like robotics competitions. The district was almost 300 miles from the nearest major city in the state, making any day trips difficult.

Rural school districts may also have difficulty covering transportation costs for long-distance field trips or finding buses and drivers to take students to STEM opportunities, according to stakeholders.[31] A rural high school science teacher in Alabama told us that he wanted to take his students on a field trip to the Georgia Aquarium (about 120 miles away), as first-hand experiences engage students more and get them excited about STEM. However, the school had not been able to fund the trip.

Few local connections to STEM careers. Stakeholders also said it could be difficult for rural schools to connect students to STEM career opportunities and STEM professionals. Rural districts in more remote areas may not have many local professionals nearby who work in STEM fields. For example, a high school science teacher in rural Nevada said she wanted to bring in a guest speaker for her forensics class but could not because the only forensics labs in the state were in Reno and Las Vegas, which were too far away to arrange a visit. Her students thus could not benefit from this opportunity to learn about a STEM career path first-hand.

[31]The National Academies found that transportation was a major concern for rural school districts, particularly those that cover larger geographic areas. See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas,* Chapter 3: Education Policy, Funding, and Programs in Rural Areas.

State educational agency officials in Alabama likewise said that rural students in their state often lack the exposure to STEM careers that could spark students' interest at an early age. They said more access to STEM professionals could help rural K-12 students envision themselves in different types of STEM careers.

Limited Broadband Access in Rural Areas

Rural students may not be able to access online learning opportunities if they lack reliable broadband internet access in school or at home. GAO has previously reported on some of the challenges with broadband coverage in rural areas. Officials from three of the four selected agencies stated that rural areas might have limited access to reliable broadband. Officials from selected schools and districts generally reported that their school buildings had reliable broadband internet; however, some said students and teachers might have limited internet connectivity at home.

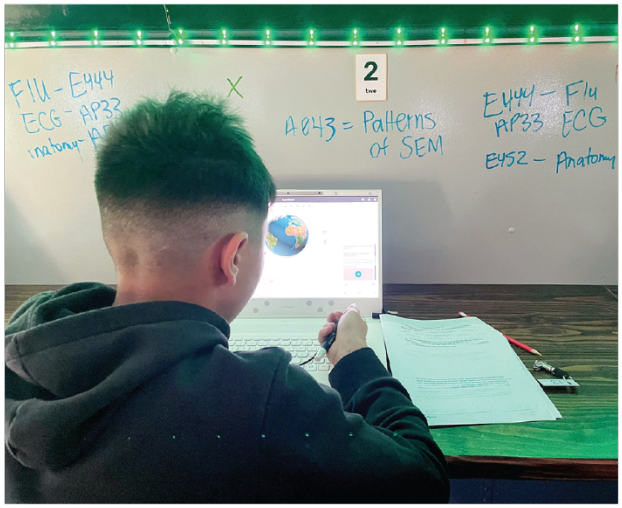
Source: GAO review of written responses and interviews with officials from selected federal agencies, GAO site visits to rural school districts, and GAO-22-104611. | GAO-25-107371

Limited access to STEM materials and facilities. Selected agency officials reported that rural districts may face challenges acquiring or affording STEM equipment or facilities. For example, NSF officials told us that compared to urban school districts, rural districts may have more outdated facilities. NASA officials also said that many rural schools lack cutting edge classroom and lab equipment.

Rural school district officials in all four states we visited likewise reported challenges securing STEM equipment or facilities. In some cases, this was because rural districts with smaller student populations had trouble securing STEM materials because they had trouble taking advantage of economies of scale. For example, a rural district official in Nevada told us the district had to spend more than necessary on STEM materials. The official said her small rural district needed 20 licenses for a computer science and STEM software program but had to pay for 100 because the company selling them based its minimum purchase on the needs of more populous districts. Officials from a rural district in Alabama we visited said the district had just enough funds to put a single specialized STEM computer in each of its schools. This would have allowed only one or two students in each school to use the software at a time. The district developed an alternative approach to share this limited number of computers and increase student access (see text box).

Stakeholder Effort to Address Limited Access to STEM Materials

One rural district in Alabama developed a mobile science, technology, engineering, and mathematics (STEM) bus to increase students' access to STEM equipment. The district had sufficient funds to put a single specialized STEM computer in each of its schools, which would have allowed only one or two students at a time in each school to use the software. Instead, the district had its technical education students retrofit a school bus that the school already owned with all these STEM computers. The bus travels from school to school so that entire classes can learn using the specialized software together.



Source: GAO site visit to rural Alabama school district. | GAO-25-107371

Federal Agency Efforts to Address Challenges Faced by Rural Applicants

Officials at selected federal agencies recognized that rural schools and districts sometimes faced challenges applying for federal grants due to limited staff grant writing capacity or a lack of experience with the federal grant process. Officials from all four selected agencies said their agencies had taken steps to help rural applicants learn to prepare and submit federal grant proposals.

- The Department of Education developed an internal resource explaining to agency staff how to address some of the unique needs of potential applicants from rural areas and provide technical assistance to rural organizations with limited resources. Education officials also said their competitive grants sometimes included a competitive preference for rural areas to ensure rural applicants are not at a disadvantage.
- NASA, NSF, and USDA officials reported providing various forms of technical assistance to rural applicants, including webinars, videos, reference guides, and grant writing courses.

Source: GAO review of written responses and interviews with officials from National Aeronautics and Space Administration (NASA), U.S. National Science Foundation (NSF), U.S. Department of Agriculture (USDA), and U.S. Department of Education. | GAO-25-107371

Some federal grants can provide funds to help rural schools and districts pay for field trips and career exploration activities or secure modern STEM equipment like robotics kits. However, stakeholders told us that rural schools and districts may face challenges in applying for federal funding. For example, one high school principal in rural Maine told us that her small rural school had no grant writer and no assistant principal who could focus on developing expertise in securing federal funding. In addition, stakeholders in two of the four states we visited told us they thought that small, rural school districts could be at a disadvantage in competing for federal grants. This was sometimes because they did not serve enough students to be competitive with larger schools or districts—even though they served a large percentage of their local community. Officials from selected federal agencies we interviewed acknowledged that rural schools and districts sometimes faced challenges applying for federal grants and provided some examples of efforts to address them (see sidebar).

Improving Access to Materials and Connecting STEM to Students' Lives Were Among the Ways Stakeholders Supported Rural K-12 STEM Education

School and district officials in selected states said that improving access to STEM learning materials, showing students how STEM topics relate to their lives, and providing STEM-related professional development for teachers were effective ways to support K-12 STEM education in rural areas. In many cases, the approaches officials told us about were made possible by partnerships with groups such as university research centers, nonprofit organizations, and local employers.

Various stakeholders said that these kinds of partnerships help rural schools and districts overcome some of the challenges they face in supporting K-12 STEM education. For example, partner groups may have greater capacity for grant writing and managing federal funds than a rural school or district. Partner groups may also be able to procure materials or provide a greater range of learning opportunities at scale due to the participation of multiple schools. By partnering with these groups, rural schools and districts can access STEM education resources for students and teachers without having to identify and apply for funding sources directly.

Improving Access to STEM Materials

To improve access to STEM learning materials, stakeholders highlighted strategies such as using federal funds to purchase equipment and sharing materials across rural districts to achieve economies of scale. For example, a teacher in one rural South Dakota school district we visited used USDA Specialty Crop Block Grant funds to place educational beehives and vegetable grow carts in dozens of school districts throughout the state (see text box). These materials have provided students with hands-on STEM learning experiences in agricultural science topics. He said one teacher cried when she received her vegetable grow cart, as she could finally teach her students to grow their own food, despite having a classroom with no windows. Another rural South Dakota district we visited used Education ESEA Title I funds and funding from a private foundation to develop two STEM labs for its K-12 students. These labs are equipped with STEM materials and learning kits, and students take dedicated STEM courses in addition to their math and science courses.

Examples of STEM Learning Materials Purchased with Federal Funds by Districts in South Dakota

Rural school districts GAO visited in South Dakota used federal funds to procure science, technology, engineering, and mathematics (STEM) materials to enhance students' learning.

Above: Students from a rural school in South Dakota visit the school hives, originally purchased with U.S. Department of Agriculture funds, to learn about beekeeping and bee life cycles.

Right: Vegetable grow carts, also funded through a U.S. Department of Agriculture grant, enable students to gain practical botany and agricultural science skills.

Above: Middle school students in rural South Dakota use everyday materials to complete a building design challenge in a STEM lab supported in part by federal funds.

Source: GAO site visits to rural South Dakota school districts. | GAO-25-107371

Stakeholders in selected states also provided examples of increased access to STEM materials through the use of shared mobile or shippable resources (see text box). These resources can help rural schools overcome challenges related to remoteness, high transportation costs, and limited funds for STEM materials.

- A research institute in Nevada that receives funds from Education, NASA, and NSF maintains a robotics lending library and pays to ship STEM instructional units to and from teachers in rural schools throughout the state. Teachers order specific units, and the institute ships the curriculum and materials to the school. After completing the units with their students, the teachers return the items for use by other districts.
- In Maine, a nonprofit developed a mobile biology laboratory to increase access to STEM learning materials in rural areas in the state. The nonprofit used federal, state, and private funding to outfit a large trailer with science lab equipment. The trailer travels to rural (and other) school districts throughout Maine and provides middle school students with hands-on laboratory experiences as they learn about topics such as water quality and safety.

Examples of Mobile and Shippable STEM Learning Materials in Maine and Nevada

Mobile and shippable science, technology, engineering, and mathematics (STEM) learning materials allow students from multiple rural school districts to access materials.

In Maine, a mobile biology laboratory travels between school districts to provide hands-on learning in biology.

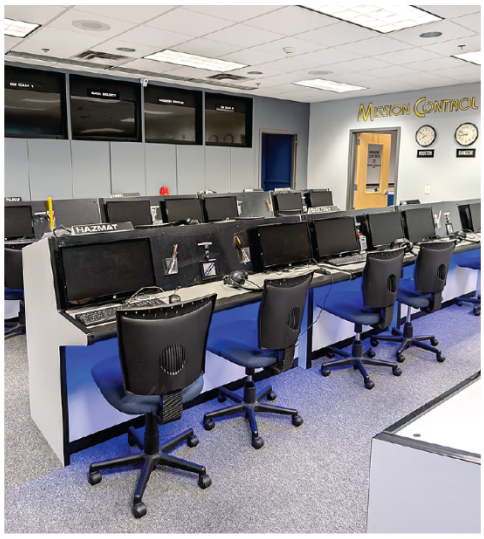
In Nevada, a research institute lends science units to teachers throughout the state, which are then returned to be shipped to other school districts.

Source: GAO site visit to Maine (mobile laboratory photo) and research institute in Nevada (science unit photo). | GAO-25-107371

Virtual resources can also increase rural students' and teachers' access to STEM learning opportunities. For example, a nonprofit learning center in Maine that received funding from NASA provided virtual space mission simulations for rural schools that could not transport their students to the learning center for in-person activities (see text box). Through the simulations, students learned about different STEM careers and worked in groups to analyze data. Staff from the learning center told us they had used NASA funds to provide virtual missions for 58 rural communities beginning in 2022, serving nearly a thousand students.

A Learning Center in Maine Provides In-Person and Virtual Space Simulations for Students

A Maine learning center offers in-person and virtual mission control and space lab programming where students work together to solve real-world problems.



Source: GAO site visit to Maine. | GAO-25-107371

Connecting STEM to Students' Lives

Learning experiences that connect STEM topics to students' lives outside the classroom are an effective way to increase student engagement in STEM, according to stakeholders. Stakeholders highlighted approaches that connected learning to students' current and future lives—through providing place-based learning activities and exposing students to the range of potential STEM career options open to them and the skills needed to work in those jobs.[32]

Place-based learning. Stakeholders consistently highlighted how place-based learning activities can spark students' interest in STEM. Place-based learning connects education, including STEM topics, to students' local environments—such as forests, lakes, or farmland—and to real-world problems that their communities are facing. For example, a teacher we spoke with in Maine said he had his students collect water samples from local wells to test for arsenic and then communicate results to the property owners. Supported in part by federal funding, this experience taught students about chemical testing and ecology and showed them how these sciences were relevant in their everyday lives.[33] Additionally, in one district we visited in Nevada, an agriculture teacher told us how he taught students about the local sagebrush ecosystem, which is home to much of the state's plant- and wildlife. The school partnered with the Nevada Department of Wildlife to grow sagebrush to plant in desert sage areas that had suffered from wildfires (see text box). By restoring the sagebrush in these areas, students provided ground cover and food so that animals such as sage grouse and deer can return.

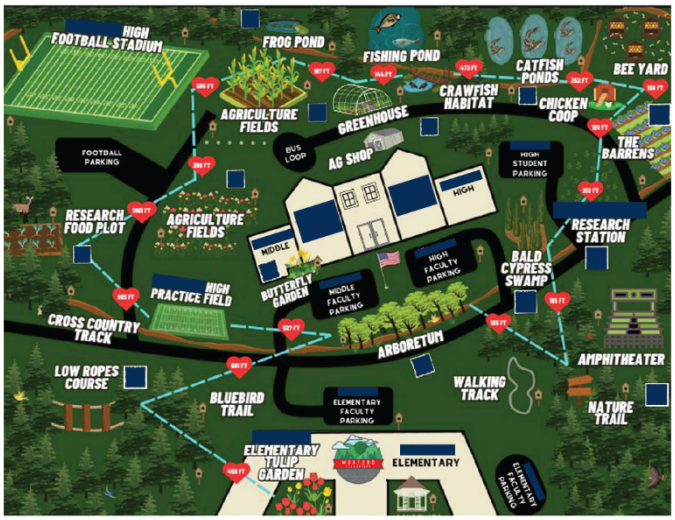
[32]The National Academies also found that students from rural school districts benefit from place-based learning and from STEM education that is tied to career opportunities. They found that place-based learning, for example, simultaneously increases STEM academic achievement while strengthening students' connections to their rural areas. See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas,* Chapter 5: Effective STEM Learning Experiences and Pathways.

[33]The teacher told us funding came from the National Institutes of Health.

Examples of Place-Based STEM Learning Activities in Nevada and Alabama

Rural school districts GAO visited often provided students with opportunities for place-based science, technology, engineering, and mathematics (STEM) learning.

An agriculture teacher in Nevada shows students how to prepare sagebrush to be planted in areas affected by wildfires.



A rural Alabama school campus includes ponds, gardens, agriculture fields, and a greenhouse where students engage in place-based learning activities related to STEM.

Source: GAO site visits to rural Nevada and Alabama school districts (information and photo) and rural Alabama school district (map). | GAO-25-107371

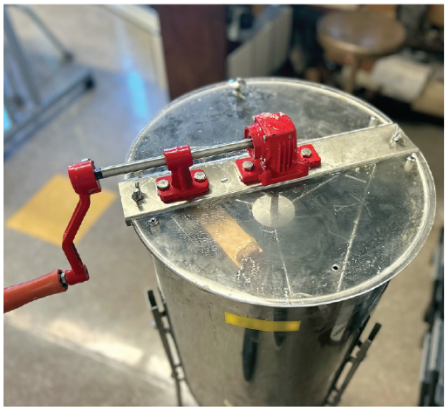
The South Dakota science teacher who developed an educational beehive program said he did so to help students see the connection between their science classes and their local environment (see text box). The teacher incorporated hands-on activities—such as collecting the honeycomb frames and extracting raw honey from the comb—and agriculture, biology, and math lessons into the beekeeping program. The school district also served raw honey from its own hives on the lunch line each day, enabling students to connect what they had learned about beekeeping to what they saw on their lunch tray. Moreover, the teacher has partnered with a local honey processing plant, a major employer in the county. Students have toured the plant to learn about commercial beekeeping and honey production in their region.

An Educational Beehive Program in South Dakota Connects STEM Learning Activities to Students' Local Environment

A South Dakota beehive program teaches students about commercial beekeeping and connects students' science, technology, engineering, and mathematics (STEM) learning to a significant agricultural industry in the state.

A science teacher in rural South Dakota leads a field trip to the school's beehives and has students participate in hands-on activities such as collecting the honeycomb frames while learning about the lifecycle of bees and crop pollination.

A student observes piles of processed beeswax on a visit to a local commercial honey plant, learning how STEM concepts are applied at a major local employer.



In the classroom, students cut honeycomb from the frames and use this centrifuge to extract the raw honey, learning about centrifugal force and other scientific concepts in the process.

Source: GAO site visit to rural South Dakota school district. | GAO-25-107371

Stakeholders in Maine provided additional examples of how partnerships with nonprofits or other organizations increased opportunities for place-based learning for rural students in the state.

- One rural Maine school we visited has partnered with multiple local environmental nonprofits to provide students with opportunities to engage in STEM learning outside of the classroom. These opportunities included studying trees in the forest, hatching salmon eggs and releasing the fish at a fishery, and contributing to salt marsh and river restoration projects. Teachers at this school said they had seen even

their lower-achieving students become passionate about these projects and more enthusiastic about their science coursework.

- Another teacher in Maine said her school partners with the Wabanaki Tribe to incorporate cultural topics into natural science classes. For example, students learn how ash trees have historically been used by Wabanaki people to make baskets but are now threatened by an invasive species in forests across Maine.
- A research and education institute in Maine partners with school districts throughout the state to provide field trip and educational opportunities to K-12 students. The institute tailors its STEM programming for rural students around topics relevant to their communities, such as using NASA satellite data to track changes in habitats for marine species local to Maine.

STEM career exposure and preparation. Another way to connect STEM education to students' lives and interests is to teach them about the range of STEM careers they could pursue, according to stakeholders. For example, one rural South Dakota district we visited invites local STEM professionals like optometrists and USDA Farm Service Agency employees to talk to students about pursuing STEM careers in their own hometown. Their local hospital also offers day camps where students can learn about different health science careers. Some rural school districts in Nevada partner with a major mining company in the region to teach students about potential STEM-related careers in fields like geology and environmental engineering.

School district officials in all four states we visited also emphasized the importance of teaching students both the technical and soft skills they said STEM employers often look for. Some school districts we visited highlighted their career and technical education programs in preparing students for STEM-related careers. For example, high school students in one rural Nevada district we visited can learn marketable STEM skills and earn at least eight professional certifications that prepare them to work as electricians or motor technicians, according to the career and technical education teacher. Some school districts we visited also developed students' technical skills in cybersecurity or other high-tech subjects to prepare rural students for high-demand technical jobs.

- A rural Alabama school we visited used federal funding to develop a cybersecurity course.[34] High school students in this course bested some collegiate and even professional cybersecurity teams in a national cybersecurity competition.
- At a rural school in Maine that we visited, the physical science teacher said his students had sent nanosatellites into space to collect data through a project supported in part with NASA funds. One of the students who participated is now studying satellite technology in college, according to the teacher.
- A South Dakota district we visited that developed STEM labs for its students coordinated with local employers to identify the skills students needed to be successful in local STEM jobs. The district developed its STEM lab curriculum to teach those skills. For example, the superintendent told us that elementary school students were learning the foundations of coding.

We also heard from school district officials and some industry partners that STEM-related employers value soft skills like teamwork, problem-solving, and perseverance. They said these skills will continue to be relevant even as technology changes. Rural districts we visited often emphasized the importance of students working in teams to solve problems (see text box).

[34]Officials told us funding came from the National Institute of Standards and Technology.

Examples of Students Applying STEM Technical and Soft Skills in Alabama and South Dakota

Stakeholders in all four selected states said that science, technology, engineering, and mathematics (STEM) employers valued both hard and soft skills. Rural school districts GAO visited provided students with opportunities to learn hard skills like electrical wiring and develop soft skills like teamwork.

Career and technical education students at one rural Alabama district learn STEM skills by building tiny houses and completing the framing, wiring, plumbing, and more. The district auctions completed tiny houses off to the community and uses the proceeds to fund the next year's tiny house.

Elementary school students in South Dakota learn collaboration and problem-solving in their school's STEM lab.

Source: GAO site visits to rural Alabama and South Dakota school districts. | GAO-25-107371

Providing Professional Development to Teachers

Stakeholders in all four states we visited noted that quality professional development could effectively support rural K-12 STEM education by improving educators' ability to teach STEM subjects and make STEM topics more real for students.[35]

Some teachers in rural schools we visited said STEM professional development helped boost their confidence to teach STEM subjects they were unfamiliar with.

- For example, one teacher in a rural Maine district said the professional development she received from an NSF-funded university research center in the state provided her with the confidence to teach computer science although her background was in biology and life sciences. The training also allowed her to sponsor

[35]The National Academies also described benefits of STEM-related professional development for teachers in rural areas, such as facilitating collaboration between otherwise-isolated teachers. See National Academies of Sciences, Engineering, and Medicine, *K-12 STEM Education in Rural Areas,* Chapter 6: Educator Recruitment, Retention, and Professional Learning.

the school's robotics club. Another teacher who provides training through the same research center said that he had taught middle school teachers who were not science majors how to teach physics.

- Sustained one-on-one coaching can also help teachers gain confidence in teaching STEM subjects such as math, according to stakeholders. Rural school districts in Alabama and Nevada hired math coaches who work with individual teachers for several months to train them in effective math instruction. One math coach we spoke with said that a teacher she coached went from saying she dreaded teaching math to calling it her favorite subject to teach.

Some rural teachers noted that it was helpful when professional development was offered in their own communities. One research institute in Nevada provides teacher professional development through workshop series in several rural communities around the state. Teachers who participated told us they appreciated receiving this high-quality STEM training without having to travel away from their local districts.

Other rural teachers said they benefitted most from professional development opportunities that allowed them to travel and gave them real-world exposure to STEM in action (see text box). For example, we spoke with some teachers in South Dakota who had received federal funding to join scientific expeditions at sea.[36] One teacher who benefitted from this funding described how her experiences with this real-world professional development and the materials she brought back allowed her to make ocean science real for her students. She said many of these students were low-income and had never seen the ocean or left South Dakota. This teacher, who said she tells her students she also grew up low-income but has now had the chance to travel to the ocean, serves as a living example to her students of what they can achieve.

[36]Teachers told us funding came from the National Oceanic and Atmospheric Administration.

South Dakota Beekeeping and STEM: Providing Professional Development

The South Dakota science teacher who runs the educational beehive program for students also provides professional development to K-12 teachers and helps build professional networks across the state. He trains teachers in beekeeping practices and how to incorporate lessons into their science, technology, engineering, and mathematics (STEM) classes. Moreover, he has taken over 20 teachers on professional development trips to Mississippi and California to learn about commercial beekeeping and visit the orchards where the bees from a local South Dakota honey company spend the winter pollinating crops. The teachers who receive this training can in turn provide hands-on life sciences enrichment to their K-12 students.

Rural South Dakota teachers receive training in beekeeping practices on a professional development trip to Mississippi.

Source: GAO site visit to rural South Dakota school district (information) and rural South Dakota school district (photo). | GAO-25-107371

Training that builds professional networks helps support K-12 STEM teachers as well, according to stakeholders. A research institute in Maine provides professional development opportunities for educators, such as a NASA-funded partnership that sponsors regional networks of educators to learn from each other and collaborate to develop learning experiences for K-12 students. Teachers who participated in these networks told us the groups help address the challenges of being the only STEM teacher in a rural district.

Agency Comments

We provided a draft of this report to Education, NASA, NSF, and USDA for review and comment. Education and USDA did not have any comments on the report. NASA and NSF provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Director of the NSF, the NASA Administrator, the Secretary of Agriculture, the Secretary of Education, and other interested parties. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

If you or your staff have any questions about this report, please contact me at emreyarrasm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix I.

//SIGNED//

Melissa Emrey-Arras
Director, Education, Workforce, and Income Security

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Appendix I: GAO Contact and Staff Acknowledgments

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Staff Acknowledgments

In addition to the contact named above, Michael Kniss (Assistant Director), Meredith Moore (Analyst-in-Charge), Camisha Fagan, Will Mayer, Dedrick Moulton, and Zoe Ziliak Michel made key contributions to this report. Also contributing to this report were James Bennett, Charlotte Cable, Jean McSween, Susan Murphy, Aaron Olszewski, Cathy Roark, Almeta Spencer, Britney Tsao, and Lisa Van Arsdale.

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