UNITED STATES DEPARTMENT OF EDUCATION

WASHINGTON, DC 20202

April 17, 2017

Resources for STEM Education

Ensuring that all students have access to science, technology, engineering, and mathematics (STEM)[1] education is fundamental to the U.S. Department of Education's (Department) goal of providing equitable educational opportunities so that all students are prepared to succeed in college, careers, and life.

To further the goal of high-quality STEM education for all, Federal agencies, State educational agencies (SEAs), local educational agencies (LEAs), and private sector partners are encouraged to coordinate their efforts and to use modern research-based methods.

The purpose of this resource document is to help SEAs, LEAs, and their partners better understand how to use Federal funds to support innovative, equity-focused pre-kindergarten through grade 12 (Pre-K–12) STEM education strategies.

In order to help SEAs, LEAs, and their partners identify potential ways to use Federal formula grant funds to support STEM education, this resource document provides examples of how funds from Title I, Title II, Title III, and Title IV of the Elementary and Secondary Education Act (ESEA), as amended by the Every Student Succeeds Act (ESSA); the Individuals with Disabilities Education Act (IDEA); and the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins) can support efforts to improve Pre-K–12 instruction and student outcomes in STEM fields.[2]

These examples fall into the following categories:

1. Increase students' equitable access to STEM courses and experiences, including out-of- school programs,[3] STEM-themed schools, and career pathways;
2. Support educators' knowledge and expertise in STEM disciplines through recruitment, preparation, support, and retention strategies; and
3. Increase student access to materials and equipment needed to support inquiry-based pedagogy and active learning.[4]

Enhancing the impact of STEM education programs and maximizing the impact of available Federal resources necessitate leveraging various sources of support. For example, an SEA or

[1] For the purposes of this resource document, consistent with the Elementary and Secondary Education Act, as amended by the Every Student Succeeds Act (ESSA), all references to STEM include computer science.

[2] Although the examples provided in this resource document are limited to the ESEA, as amended by the ESSA; Perkins; and IDEA, funds from other formula and competitive grant programs administered by the Department may also be able to be used to support STEM learning.

[3] The phrase "out-of-school programs" refers to expanded learning time, before- and after-school programs, and summer learning opportunities.

[4] Active learning is a process whereby students engage in activities such as reading, writing, discussion, prototyping, or problem-solving that promote analysis, synthesis, and evaluation of course content.

LEA might use Title I or Title IV funds to purchase or reconfigure STEM materials, devices, or STEM-focused digital learning resources[5] or spaces; Title II funds to train educators to teach new STEM concepts and approaches, including those in computer science; Title III funds to provide access to STEM resources specifically developed for English learners; and Perkins funds to develop a comprehensive STEM pathway program. In addition, under Title IV, Part B of the ESEA, an SEA may continue to provide students at 21st Century Community Learning Centers program sites with the opportunity to engage in authentic STEM content that aligns to their school day and to focus on hands-on, active STEM-rich experiences. An SEA or LEA could also apply for discretionary grants in grant competitions that support STEM education. All uses of Federal resources must comply with applicable laws and requirements for each funding source.

We hope the examples and other information provided in this resource document will be helpful in your efforts to provide access to high-quality STEM programs and resources as well as improve learning and achievement for all students.

Examples of leveraging ESEA, IDEA, and Perkins Funds for STEM education

The pace of technological and scientific change continues to accelerate, and students beginning elementary school will graduate into an innovation economy with new technologies, scientific advances, and job opportunities that did not exist a decade ago. To best prepare for this future, all students will benefit from a solid foundation in the STEM fields. The Department encourages educators at every level to pursue innovative strategies and active teaching methods in STEM, while working to ensure equitable educational opportunities across STEM disciplines. To help catalyze such innovation, this resource document provides examples that illustrate how grantees may use funds made available under the ESEA, as amended by the ESSA, IDEA, and Perkins.

The use of funds under any grant program must be an allowable use of funds that is consistent with programmatic and fiscal requirements of the program. The examples below highlight ways in which a grantee might be able to use Federal funds (depending on availability) for STEM education for the 2017–2018 school year and beyond to:

1. Increase students' equitable access to STEM courses and experiences, including out-of-school programs, STEM-themed schools, and career pathways;
2. Support educators' knowledge and expertise in STEM disciplines through recruitment, preparation, support, and retention strategies; and
3. Increase student access to materials and equipment needed to support inquiry-based pedagogy and active learning.

Except as otherwise noted, statutory references in the examples below are to the ESEA, as amended by the ESSA.

Increase students' equitable access to STEM courses and experiences, including out-of-school programs, STEM-themed schools, and career pathways: STEM learning occurs across a variety of places and times. In 2014, the National Research Council convened experts from the formal, informal, and out-of-school learning communities to explore how these three contexts

[5] Schools operating a Title I schoolwide program under the ESEA may use Title I, Part A funds to acquire devices, including tablets, laptops, and other devices, as part of a comprehensive plan to upgrade the educational program of a school, consistent with the school's comprehensive needs assessment.

could improve STEM learning for all students[6]. A 2013 report found that by the time a student from a low-income family reaches 6th grade, he or she will typically have had 6,000 fewer hours of out-of-school or summer enrichment activities than a more economically advantaged peer[7].

To help address this critical gap, schools, SEAs, and LEAs may use Federal funds to support increased access to STEM opportunities both during the school day and out-of-school-time.

1. **Increasing access to rigorous STEM coursework for all students**: Depending on the student population served, program funds (see potential options below) may be used to support dual or concurrent enrollment programs, early college high school models, or other methods to increase access to rigorous STEM coursework to enhance career and college readiness. Schools and LEAs may utilize Federal funds to support STEM coursework for:
    a. Students who are members of underrepresented groups in STEM (ESEA section 4107);
    b. Students attending a Title I school operating a schoolwide program, consistent with the school's comprehensive needs assessment (ESEA section 1114);
    c. Students identified as failing, or most at risk of failing, to meet the challenging State academic standards who are attending a Title I school operating a targeted assistance program (ESEA section 1115).
    d. Supplemental English language acquisition activities in STEM courses for English learners and supplemental early college high school or dual or concurrent enrollment programs or courses designed to support English learners' success in postsecondary education (ESEA section 3115); and
    e. Serving IDEA-eligible students with disabilities who require college coursework in order to receive a free appropriate public education, or who need additional services and supports in STEM courses to access the general education curriculum (IDEA section 602, section 611, section 612, section 613, and section 614).
2. **Increasing access to out-of-school and expanded learning time in STEM:**
    a. SEAs and their subgrantees (e.g., LEAs, community-based organizations, and other public and private entities) may use funds from the Department's 21st Century Community Learning Centers program to provide high-quality STEM and computer science programs and "maker"[8] activities to students in out-of-school learning settings and as part of expanded learning programs that meet certain conditions. Eligible entities may also use funds to carry out programs that foster innovation in learning by supporting nontraditional STEM education teaching methods that may

[6] National Research Council. (2014). *STEM Learning Is Everywhere: Summary of a Convocation on Building Learning Systems.* S. Olson and J. Labov, Rapporteurs. Planning Committee on STEM Learning Is Everywhere: Engaging Schools and Empowering Teachers to Integrate Formal, Informal, and Afterschool Education to Enhance Teaching and Learning in Grades K-8, Teacher Advisory Council, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. National Research Council. (2015). *Identifying and Supporting Productive STEM Programs in Out-of-School Settings.* Committee on Successful Out-of-School STEM Learning. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

[7] The 6,000 Hour Learning Gap Infographic by ExpandED Schools www.expandedschools.org/sites/default/files/tasc_6000-hours-infographic.pdf

[8] "Making" involves higher-order reasoning and problem-solving skills as well as individual and collaborative project-based learning; the "maker mindset" actively fosters dispositions and skills which have inherent value, such as curiosity, collaborative problem-solving, and self-efficacy. By helping students experience hands-on science, technology, engineering, and math (STEM) learning and real-world problem solving, making can spark deep interest and develop the necessary passion for students to excel in the 21st century.

emphasize hands-on, experiential learning. (ESEA section 4201, section 4204, and section 4205);

b. Title I schools operating a targeted assistance program may use Title I, Part A funds to support students identified as failing, or most at risk of failing, to meet challenging State academic standards through expanded learning time, before- and after-school programs and summer programs and opportunities (ESEA section 1115); and

c. Eligible entities may use Title IV, Part A funds to support the participation of low-income students in nonprofit competitions related to STEM subjects (ESEA section 4107).

3. **Increasing access to career-based experiential learning:**
   a. Perkins funds may be used to support collaborations with technology industries to offer voluntary internships, apprenticeships, and mentoring programs that improve the mathematics and science knowledge of students (Perkins section 135). Funds reserved for State leadership activities may also be used to support, develop, improve, or expand the use of technology through collaborations with technology industries to offer voluntary internships and mentoring programs (Perkins section 124).
   b. Title I, Part A funds may be used to support programs that coordinate and integrate academic and career and technical education content through coordinated instructional strategies that incorporate experiential learning opportunities and promote skills attainment important to in-demand occupations or industries and work-based learning opportunities that provide students in-depth interaction with industry professionals (ESEA section 1112).

4. **Increasing access to STEM-focused schools and pathways:**
   a. Eligible LEAs could utilize Title IV, Part A funds to support the creation and enhancement of STEM-focused specialty schools (ESEA section 4107);[9]
   b. Eligible LEAs could utilize Title IV, Part A funds to integrate other academic subjects such as the arts, history, and writing, into STEM subject programs to increase participation in STEM subjects, improve attainment of skills related to STEM, and promote well-rounded education (ESEA section 4107);
   c. Eligible LEAs or consortia of LEAs could use STEM-focused instructional activities under the Magnet School Assistance Program (ESEA section 4401 and section 4407) to establish theme-based magnet schools that attract students of diverse backgrounds; and
   d. Public charter schools could support STEM initiatives using funds received under the Charter Schools Program (ESEA section 4302).

5. **Increasing access to STEM focused field-based or service learning experiences:**
   a. Eligible entities could use funds to provide hands-on and active learning and exposure to STEM subjects, such as science fairs, citizen science projects, student entrepreneurship, and integrated "maker" activities and "maker faires"[10], and to support the use of field-based or service learning to enhance students' understanding of the STEM subjects (ESEA section 4107); and
   b. Title I schools operating a schoolwide program may use Title I, Part A funds to

[9] Section 4102(8) of the ESEA defines a STEM-focused specialty school to mean "a school, or dedicated program within a school, that engages students in rigorous, relevant, and integrated learning experiences focused on science, technology, engineering, and mathematics, including computer science, which include authentic schoolwide research."
[10] "Maker Faires" are events that celebrate arts, crafts, engineering, science projects and the do-it-yourself mindset. They provide a showcase for invention, innovation, creativity and resourcefulness that is engaging and educational.

support activities such as field trips to increase access to real-world, hands-on STEM experiences, activities, and applications, including experiences that expand student knowledge of the impact of STEM in the world, or the history of the range of backgrounds of people in STEM. Such uses must be consistent with applicable SEA or LEA policies, Federal requirements for uses of funds, and a school's comprehensive needs assessment (ESEA section 1114).

Support educators' knowledge and expertise in STEM disciplines through recruitment, preparation, support and retention strategies: To help envision ways Federal resources may be utilized to support the continuum of STEM educator development, the Department invites SEAs, LEAs, and their partners to consider the following:

1. **Recruiting and preparing novice STEM educators, including those from groups historically underrepresented in STEM.** Some examples include:
    a. Utilize Title II, Part A funds to provide stipends to attract STEM educators to the profession (ESEA sections 2103 ;);
    b. Utilize Title II, Part A funds to recruit qualified individuals with STEM content knowledge from other fields to become teachers, including professionals from other occupations, former military personnel, and recent graduates with records of academic distinction (ESEA section 2103); and
    c. Eligible LEAs, SEAs, the Bureau of Indian Education (BIE) or non-profits or for-profits in partnership with LEAs, SEAs or BIE could improve the processes for recruiting and retaining STEM teachers and school leaders in high need schools through the Teacher and School Leader Incentive Program ((ESEA sections 2211-13 section 2212).
2. **Developing effective STEM pedagogy to improve teaching and learning, including active learning methods.** Some examples include:
    a. Utilize Title II, Part A funds to provide professional learning opportunities to educators.
    Examples include sustained relevant professional development opportunities offered by informal science institutions (such as science museums, "maker" spaces, Federal labs, or nonprofits) (ESEA section 2103);
    b. Utilize Title II, Part A funds to support educators as they implement new courses, such as computer science and engineering (ESEA section 2103);
    c. Utilize Title II, Part A funds to support educators to effectively teach students with disabilities in STEM subjects (ESEA section 2103);
    d. Utilize Title II, Part A and Title III, Part A funds to provide supplemental support to educators to effectively teach English learners and immigrant youth in STEM subjects (ESEA section 3115 and section 2103);
    e. Utilize Title II, Part A funds to support elementary STEM teachers, including preschool educators, to incorporate STEM learning experiences into their classrooms and to utilize effective STEM pedagogy in their teaching (ESEA section 2103);
    f. Utilize Title II funds or Title IV, Part A funds to train or provide professional development to educators on incorporating technology into effective STEM instruction through personalized learning or blended learning (ESEA section 2113 and section 4109); and
    g. Utilize Title IV, Part A funds to facilitate collaboration among school, after-school program, and informal program personnel to improve the integration of programming

and instruction in STEM subjects (ESEA section 4107); and

h. Use funds reserved by the State for leadership activities to offer internships that provide valuable work experience, which may include internship programs that provide relevant business experience, for secondary and postsecondary teachers, faculty, administrators, and career guidance and academic counselors who are involved in integrated career and technical education programs (Perkins section 124 and section 135).

3. **Supporting leadership pathways for STEM educators.** Some examples include:
   a. Hire STEM-coaches: LEAs may use Title II Part A funds to hire STEM coaches to help grantees tailor professional learning to the needs of individual educators. For example, coaches might help educators bolster their STEM content knowledge or expand STEM pedagogy to include problem- or project-based active learning or "maker" techniques (ESEA section 2103); and
   b. Provide differential or incentive pay for educators in high-need subject areas, such as STEM, to serve in high-need schools, or to reward the work of teachers and leaders who have demonstrated effectiveness in improving student outcomes in STEM areas (ESEA section 2103 and through the ESEA section 2212).
   c. Eligible SEAs or non-profits in partnerships with SEAs could support the development of a statewide STEM Master Teacher Corps or support the implementation, replication, or expansion of effective STEM professional development programs in schools across the State through collaboration with school administrators, principals and STEM educators through the STEM Master Teacher Corps program (ESEA section 2245).
   d. Support STEM teaching pathways for native-born, foreign-born, and foreign-trained STEM professionals to meet the shortages of STEM teachers and address teacher diversity goals.

Increase student access to materials and equipment needed to support inquiry-based pedagogy and active learning: Supporting students in STEM learning can require additional resources and technologies; the Department invites SEAs, LEAs, and other grantees to consider the following:

1. **Devices**: Federal funds may be used by grantees to purchase devices for students to access materials and general instruction and to collaborate with peers and educators and to support STEM learning.
   a. **Provide Students with Mobile Learning Devices to support STEM learning:**
      i. Schools operating a Title I schoolwide program may use Title I, Part A funds to acquire devices, including tablets, laptops, and other devices, as part of a comprehensive plan to upgrade the educational program of a school, consistent with the school's comprehensive needs assessment (ESEA section 1114); and
      ii. LEAs that receive an allocation under Title IV, Part A could purchase devices, equipment and software applications to address readiness shortfalls consistent with the LEA's needs assessment and approved subgrant application, subject to certain limitations (ESEA section 4109)[11].

[11] LEAs may use Title IV, Part A funds to build technological capacity and infrastructure by purchasing devices, equipment, and software applications to address readiness shortfalls. Districts may not use more than 15% of the funds

b. **Provide Students with Disabilities with Assistive Technology Devices:** SEAs may use IDEA, Part B section 611 funds they retain for authorized State-level activities, other than administration, to improve the use of technology in the classroom for students with disabilities, in order to enhance their learning.[12] LEAs may use their IDEA, Part B funds to enable students with disabilities to participate in STEM courses, if a student's individualized education program specifies that the student requires an assistive technology device or service (IDEA sections 602, 611, 612, 613, and 614).

2. **Labs and specialized learning spaces**: Title I funds may be used by schools operating a Title I schoolwide program to update existing STEM-related labs and lab materials, or other specialized learning spaces, to support inquiry-based STEM or "maker" activities, as part of a comprehensive plan to upgrade the educational program of a school, consistent with the school's comprehensive needs assessment (ESEA section 1114).

3. **Supporting English Learners:** LEAs may use Title III, Part A funds to improve instruction for English learners by acquiring supplementary digital learning resources and software that will support English learners' acquisition of English proficiency and STEM content proficiency, including materials in languages other than English (ESEA section 3115).

4. **Use Technology to Connect Educators with STEM Professionals:** Consistent with their subgrant applications, LEAs may use their Title IV, Part A funds to purchase software and devices that are an essential component of their plans to create and provide digital professional learning communities with practicing scientists or engineers if consistent with their needs assessment, approved subgrant application and other limitations[13]. These activities may be especially helpful in rural schools and communities[14] (ESEA section 4109).

These are just a few examples of allowable uses of Federal funds that might support the development, implementation, and expansion of STEM approaches to help improve student achievement. To identify further opportunities, please review the statutes, regulations, and guidance for each Federal program or contact your Department program officer. Additional guidance documents for the ESEA, as amended by the ESSA, are available at http://www.ed.gov/essa and additional STEM resources are available at https://innovation.ed.gov/stem.

---

provided under section 4109(a) for this purpose. ESEA, secs. 4109(a)(2); 4109(b) Please see the non- regulatory guidance on Title IV, Part A for more information: https://www2.ed.gov/policy/elsec/leg/essa/essassaegrantguid10212016.pdf

[12] These improvements should include technology with universal design principles and assistive technology devices, to maximize accessibility to the general education curriculum for students with disabilities. Note that public schools must provide accessible technology to students with disabilities, as required by Section 504 of the Rehabilitation Act of 1973 and Title II of the Americans with Disabilities Act of 1990. Under these laws, public schools are also required to make STEM courses available to students with disabilities, if those courses are available to other students. These requirements apply regardless of whether IDEA funds are used to provide the accessible technology.

[13] See footnote 11

[14] Note that rural LEAs that receive funds under the Rural Education Achievement Program (Title V, Part B) may use these funds for the same purposes as Title I, Part A; Title II, Part A; Title III; and Title IV, Part A funds, among other uses. See ESEA section 5212(a) for allowable uses under the Small, Rural School Achievement Program and ESEA section 5222(a) for allowable uses under the Rural and Low-Income School Program.