



Fostering Equitable and Engaging STE(A)M Programming

INFORMATION SHEET

Purpose

This resource highlights areas within the Title IV, Part A statute that discuss science, technology, engineering, arts, and mathematics (STE(A)M) learning and participation. Though the statute references “STEM” (Sec. 4107(a)(3)(C)), it also underscores arts education and integration (Sec. 4107(a)(3)(C)(vi)); thus, the acronym STE(A)M will be used throughout this publication to reflect a more comprehensive approach to STEM education. This resource also shares indicators and examples of effective STE(A)M programming with an emphasis on equity.

Introduction

There is no one-size-fits-all guide to effective science, technology, engineering, arts, and mathematics (STE(A)M) programming; however, there are indicators that can be used to measure whether schools or districts are on track to meeting related needs of students and educators. This resource focuses on two indicators: [\(1\) engagement in activities that are “real, active, and local”](#)¹ and [\(2\) integration of STE\(A\)M across subjects](#). These relevant, interactive, and integrative approaches are viewed² and practiced³ by STE(A)M educators as a part of effective programming, and they can support student outcomes, such as attitudes toward STE(A)M⁴ and engagement and persistence in related fields.⁵ Additionally, STE(A)M approaches can help students to develop life skills³ that can be applied more broadly, such as creativity, critical thinking, and problem-solving.⁶

Emphasis on equitable access to STE(A)M throughout this resource reflects Title IV, Part A (Title IV-A) priorities to support a well-rounded education for all students (Sec. 4107(a)(3)(C))

and expand access for racial, ethnic, and gender groups that are underrepresented (Sec. 4107(a)(3)(C)(i)). The indicator summaries describe how incorporating these practices can help with student learning and provide related examples. In addition, this information sheet provides [sample questions](#) and additional [resources](#) for State coordinators (SCs) to utilize when working with local education agencies (LEAs) on STE(A)M programming. With this information, SCs can set the stage for LEA and school leaders to articulate expectations and support educators to take on new approaches that promote STE(A)M-focused educational activities.



Figure A: Characteristics of Engaging and Successful STE(A)M Activities



Real

Student activities are applicable to students' everyday lives and address real-world problems



Active

Students “learn through doing”; activities are designed to be hands-on or to solve a specific problem.



Local

Student learning is supported by and addresses issues within the students' surrounding community.

Effective STE(A)M Programming Indicator #1: Engage in Activities That Are Real, Active, and Local

Title IV-A encourages hands-on STE(A)M learning, such as experiences provided by field-based or service learning (Sec. 4107(a)(3)(C)(iii)). Title IV-A priorities around hands-on learning are consistent with best practices in STE(A)M education highlighting the benefit of activities that are real, active, and local (see [Figure A](#)).

Interacting with real-world problems in this way can help students engage in meaningful learning, develop their STE(A)M identity (i.e., see themselves as someone who belongs and can be successful in STE(A)M courses and professions), and experience greater access and equity (see “[Equity Spotlight](#)”). Making connections to students' everyday lives and with community partners has the potential to affect student achievement, their preferences for participating in more STE(A)M courses, and their college and career choices. The next sections discuss how activities and community partnerships

might be structured to support real, active, and local learning.

Connect to the Everyday Lives of Students

Making connections to everyday life can help students move beyond simply *learning* content to *applying* learned content. It helps students see how they are already using STE(A)M thinking processes and problem-solving in their daily lives.

Examples of connecting learning to students' everyday lives include

- Designing architectural models of city parks that are engaging for children and youth of all ages.
- Using different shapes to create favorite animals.
- Conducting science experiments and lab assignments focused on biological health and disease prevention.



- Planning, developing, and tending a school garden.
- Using technology to create and record music for school events.
- Collecting water samples from the community to detect unhealthy chemical levels.

Another way to reflect the everyday lives of students as part of STE(A)M programming is to plan activities that use readily available resources within students' surrounding environments (e.g., rubber bands, paper rolls, spices). This practice alleviates issues of access to resources and materials that may be limited, costly, or otherwise inaccessible, particularly for students who already experience disparities in access to STE(A)M learning opportunities. Connecting STE(A)M to students' everyday lives might also include planning activities that address community challenges (e.g., water pollution) or social justice issues (e.g., racial violence). These opportunities will help students apply STE(A)M learning in particularly meaningful ways, such as through learning how to measure, improve, or express their perspectives on these issues.

Equity Spotlight

Title IV-A recognizes STE(A)M as a way to support a *well-rounded education* for all students (Sec. 4107(a)(3)(C)), while also recognizing the need to *expand access* to STE(A)M opportunities. Title IV-A specifically addresses the need for increased access for groups underrepresented in related courses, activities, and fields, including “female students, minority students, English learners, children with disabilities, and economically disadvantaged students” (Sec. 4107(a)(3)(C)(i)). In terms of minority persons or persons of color, research has shown that black, Latinx, and American Indian and Alaskan Native persons are underrepresented in the STE(A)M workforce.¹ Here are some ways that SCs can support LEAs around equitable STE(A)M programming:

- Collect and review student data to understand differences in participation and achievement.
- Remove cost barriers to completion of accelerated learning exams (Sec. 4107(a)(3)(D)(i)) or participation in STE(A)M competitions (Sec. 4107(a)(3)(C)(ii)) for students whose families have low income.
- Engage a diverse group of stakeholders (e.g., teachers, parents and caregivers, students, community members), especially those from underrepresented groups, as part of STE(A)M program planning and improvement.
- Recruit and retain a racially/ethnically and linguistically diverse STE(A)M-qualified workforce.
- Arrange professional development opportunities related to culturally responsive approaches tailored specifically to STE(A)M courses and activities.

Partner With the Community

Partnerships and collaborations with outside organizations are encouraged under Title IV-A (Sec. 4107(a)(2)). Community partnerships can help LEAs and schools expand access to resources and learning opportunities, expose students to experts from diverse professional and demographic backgrounds, and potentially strengthen STE(A)M instruction. Coupled with relevant and interactive approaches to STE(A)M learning, communities can also serve as classrooms, creating a “STEAM Ecosystem,” where multisector partners share and execute a common vision of STE(A)M education. It is important to note that “communities” can also extend beyond an LEA’s physical or geographic community. Virtual communities can serve as partners, such as local or nationwide museums hosting virtual field trips, local businesses conducting virtual job tours, or global classrooms connecting local educators and students with educators and students abroad. Engagement with local and virtual or remote communities bolster messaging, awareness, and effectiveness of STE(A)M initiatives.



as they work to effectively address Title IV-A priority areas in their state. See “SC STE(A)M Programming Questions to Consider” for a list of questions to use when providing technical assistance or reviewing LEA applications related to relevant and interactive STE(A)M programming.

Effective STE(A)M Programming Indicator #2: Integrate STE(A)M Across Subjects

Title IV-A highlights integration of STE(A)M with other academic subjects to promote increased educational participation and skill attainment (Sec. 4107(a)(3)(C)(vi)). Title IV-A also highlights collaboration among educators as a way to better facilitate subject integration (Sec. 4107(a)(3)(C)(v)). SCs can play a role in encouraging and supporting LEAs to help school staff build STE(A)M into subjects such as language arts, social studies, physical education, or electives. Title IV-A resources can support professional development, planning time, or coaching to help educators collaborate, learn how to apply STE(A)M learning across contexts, and identify where there is flexibility to implement STE(A)M instruction. This benefits students as they utilize and strengthen skills across multiple areas and draw on creative and analytic strengths. An integrated approach promotes a practical synthesis of STE(A)M and other content areas and can be especially useful when it is challenging to find dedicated time for STE(A)M activities.

Some real-world examples of community partnerships for STE(A)M learning include

- Partnering with a university to support training of K-12 educators around STE(A)M lesson delivery.⁷
- Connecting with local business to access needed resources.⁸
- Collaborating with an arts organization to offer professional development on integrating drawing and science.⁹
- Partnering with a student-driven community farm focused on sustainable agriculture.¹⁰
- Engaging in a community development project to build tiny homes for unhoused youth.¹¹

These examples are just a few of the many different relevant and interactive STE(A)M programming options LEAs may be proposing or executing. SCs can look for and support this type of programming

Examples of integrated STE(A)M learning activities could include

- Playing music or sharing arts representing historical eras or themes from literature being studied.
- Using binary code to create bracelets with students' names.
- Programming graphics to accompany a dance production.
- Exposing students to an array of scientific, technical, or artistic terminology in their vocabulary studies.
- Programming a robot to interact with student-created drawings.
- Making connections between tessellations and angles and features observed in art.
- Examining the influence of technology on society and history.

Integration of STE(A)M with other subjects can bolster student interest and engagement, help students make connections between STE(A)M and everyday life, and support their creative thinking and problem-solving.

Plan Ahead

Thoughtful planning on the part of LEAs and school administrators helps equip schools and educators to execute integrated STE(A)M programming and activities. As a first step, SCs might consider asking LEAs to build STE(A)M into their needs assessment process to better understand both challenges and existing assets around STE(A)M education. Needs assessment activities can also examine the availability of related supports (e.g., skilled personnel, student learning materials, equipment and supplies, school facilities like labs or performance space, community-based resources). Needs assessments inform LEAs' prioritization of goals and selection of curricula and activities to support subject integration.

As a next step, LEAs can engage in planning to address issues around resources (e.g., funding), accessibility (e.g., access to advanced courses that may be more likely to take an integrative approach, course costs), and inclusivity (e.g., accessible equipment, equitable enrollment for different student subgroups). To ensure buy-in and that STE(A)M programming meets the needs of students, families, and educators, including a range of stakeholders in planning is key.

Examples of stakeholder engagement can include

- Consulting with stakeholders that represent different staff roles, student and family groups, and STE(A)M-focused community partners to inform planning and identify potential partnerships.
- Speaking with students and families about their awareness, engagement, and interest in courses and activities and the types of STE(A)M learning they would like as part of curricula and activities.
- Holding listening sessions with educators to hear their desires and concerns around STE(A)M program plans, integrated instruction, and learning and to better understand needed supports.
- Engaging with community partners to develop agreements that help integrate local STE(A)M related issues into the curriculum.

Prioritize Professional Development

Professional development is essential for developing the capacity and confidence of STE(A)M educators, especially given that staff in these roles may not have formal training in STE(A)M subjects or interdisciplinary teaching and learning. Title IV-A recognizes the need to support educators in STE(A)M teaching and programming, such as through partnerships with organizations, to learn how to effectively harness technology (Sec. 4109(a)(5)).

Professional development support can include

- Planning time for educators to develop and reflect on integrated STE(A)M learning.
- Communities of practice (e.g., in-person or Web-based learning communities) involving multiple participants (e.g., teachers, after-school program personnel, community organizations) to discuss and share STE(A)M activities.
- Community partnerships that bring in experts to strengthen educator capacity on STE(A)M subjects as well as integrated approaches.

- Engaging educators in helping to plan or reassess professional development needs and goals, including developing school- or LEA-level mentorship opportunities when feasible.

The approaches to planning and professional development in this section are just some ways that LEAs may foster integrated STE(AM) programming. SCs can encourage and help LEAs think through the specifics of how related programming will be executed. See [“SC STE\(A\)M Programming Questions to Consider”](#) below for a list of optional guiding questions to use when providing technical assistance or reviewing LEA applications related to integrated STE(A)M programming.

SC STE(A)M Programming Questions to Consider

When working with LEAs on STE(A)M programming, here are some things to ask or look out for.

To promote “real, active, and local” STE(A)M activities, how will the LEA

- Align activities with student interests and lived experience?
- Engage students in active learning?
- Identify community partners?
- Detail the nature and goals of community partnerships?
- Leverage the local community context to bolster learning?

For integrating STE(A)M with other subject areas, how will the LEA

- Support subject integration?
- Support educator collaboration?
- Support educators in strengthening integrative approaches?
- Measure effectiveness of subject integration in improving student outcomes?

For ensuring equitable access and approaches to STE(A)M learning activities, how will the LEA

- Ensure that students and families from groups traditionally underrepresented in STE(A)M are aware of and supported in accessing STE(A)M related opportunities?
- Identify what disparities might exist in who participates in STE(A)M courses and activities?
- Engage students and families from underrepresented groups in planning STE(A)M programming, lessons, and activities?
- Support educators in meeting the needs and leveraging the strengths of diverse learners through culturally responsive approaches?



Conclusion

STE(A)M education presents enriching learning opportunities for students and helps meet the Title IV-A goal of providing a well-rounded education. When accessible to all students, STE(A)M education can help with student engagement, foster a better understanding of how different disciplines and areas of study can be interrelated, and expose students to different STE(A)M fields and career options as they move into the workforce. As LEAs work to develop and strengthen STE(A)M programming, SCs can offer guidance on relevant, integrated, and equitable indicators of effective STE(A)M programming.

STE(A)M-Related Resources for SCs and LEAs

This list offers a selection of resources, but is not intended to be exhaustive. Note that although STE(A)M is used throughout this resource, the below list uses STEM or STEAM to reflect terms used in the respective resources.

Source	Description
Assessing Needs and Goals	
Texas STEM Education Toolkit	This Website provides a suite of planning, implementation, and community engagement tools for PK-12 programs around the Texas STEM Framework .
Policy Considerations for STEAM Education	This report highlights state policies and practices that can support student access to STEAM education.
U.S. Department of Education, Science, Technology, Engineering, and Math, Including Computer Science	This Website shares information on Federal funding opportunities and strategies that support STEM education.
Equity	
Zero Barriers in STEM Education: Accessibility and Inclusion Workbook	This resource offers guidance around strategies and practices to remove barriers to STEM education and promote “diversity, equity, accessibility, and inclusion.”
Accessible Science Equipment	This resource shares examples of science equipment purchased by the University of Washington’s Disabilities, Opportunities, Internetworking, and Technology Center to promote engagement of students with disabilities.

Stakeholder Engagement

[Engaging Families in the STEM Ecosystem](#)

This Web page compiles research, tips, and stories on engaging families as part of STEM ecosystems. The parent [STEM Ecosystems Website](#) shares information about the broader global community of practice initiative to create STEM ecosystems of support in more than 100 communities across the world.

[Texas STEM Education Toolkit: Community Tools](#)

This Website is designed to offer tools to support school districts in engaging families in and raising community awareness of STEM efforts.

University Partnerships

[Science, Technology, Engineering, Art and Math \(STEAM\) Technical Assistance Center](#)

The STEAM Technical Assistance Center is a joint project among the West Virginia Department of Education, West Virginia University, and the West Virginia Public Education Collaborative. The center serves teachers and students in middle and high schools across the state.

[STEMx Network](#)

The STEMx network advocates for the advancement of STEM education. Led by West Virginia University, the network comprises over 21 state STEM networks.

[Florida Local Alliance for Math Literacy and Equity \(FLAME\)](#)

FLAME is a university-community-school alliance uniting Florida International University, local school districts, and community partners to unite voices invested in the advancement of STEM education.

Local Partnerships

[STEM Library Lab](#)

The STEM Library Lab offers an equipment lending co-op and professional development to member teachers and schools in the New Orleans, Louisiana, area.

[Partnering With Community Organizations to Support Science Learning: Research-Based Tips for Forming Partnerships](#)

This article offers research-based tips for developing community partnerships to support science learning, including considering potential partners, specifying partnership activities, and ensuring a good fit.

Professional Development

[Texas Education Agency's STEM Walk-Through Observation Tool](#)

This tool is an implementation resource that can be used for observing, coaching, and providing feedback to educators in delivery of STEM activities and lessons, and assessing overall program progress.

[Professional Development Session Resources](#)

This Website shares open education resources, such as slides, notes, and facilitator guides, to support the professional development of STEM educators.

Integrating STE(A)M Across Subjects

[Texas Education Agency's Integration Strategies](#)

This resource offers definitions for varying levels of STEM integration. An accompanying [graphic organizer](#) is designed to help educators plan for STEM integration.

[STEAM and the Role of the Arts in STEM](#)

This resource, developed by the State Education Agency Directors of Art Education, discusses how students and educators can be supported and empowered through the integration of the arts into STEM.

[Breaking Down STEAM for Young Children](#)

This article is the first in a four-part series that shares guidance around integrating STEAM in early childhood settings through projects, problems, and play.

Endnotes

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³ Kasza, P., & Slater, T. F. (2017). A survey of best practices and key learning objectives for successful secondary school STEM Academy settings. *Contemporary Issues in Education Research (CIER)*, 10(1), 53-66. <https://doi.org/10.19030/cier.v10i1.9880>

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⁶ STE(A)M Truck. (2020, August 3). The history and importance of STEAM education. <https://www.steamtruck.org/blog/steam-education-history-importance>

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¹⁰ Eastern Rhode Island Conservation District. (n.d.). *Portsmouth AgInnovation Farm*. (<https://www.easternriconservation.org/aginnovation-farm>)

¹¹ Rethink Together. (2022, January 13). *What is STEAM education?* <https://xqsuperschool.org/rethinktogether/what-is-steam-education/>



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