

# Policy Considerations for STEAM Education

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Education in science, technology, engineering and mathematics has captured the attention of state policymakers who are concerned about preparing students for an evolving workforce.<sup>1</sup> By 2030, Institute for the Future estimates that 85 percent of the jobs that today's K-12 learners will be doing haven't been invented — demanding a workforce that is creative and prepared to respond innovatively to real-world problems.<sup>2</sup> Including the arts in STEM learning can further enhance teaching and student achievement, and build upon existing approaches to STEM that encourage students to apply creativity to solving real-world problems. As a response to changing workforce demands, policymakers across the country are increasing their focus on the role of the arts in STEM and exploring opportunities to create and implement STEAM (science, technology, engineering, arts and mathematics) programs. This report highlights state policies and practices that can help states to increase student access to STEAM education.

For this report, STEAM education is defined as an approach to teaching in which students demonstrate innovative and critical thinking and creative problem-solving at the intersection of these disciplines. STEAM education uses [arts integration](#) as an instructional approach — and for experiential and inquiry-based learning — and provides multiple access points for students to engage in the creative process and meet objectives in all subject areas.<sup>3</sup>

STEAM education improves student achievement and fosters opportunities to apply creativity and innovation to solving real-world problems.

States recognize access and achievement in STEAM at the school and individual level and have increased opportunities for STEAM through federal and state funding.

Leadership efforts — including statewide task forces, committees and designated leadership positions at the state level — help advance STEAM education efforts.

This approach represents a shift to an emerging ideal of education that values the process of learning in addition to the results. In STEAM education, students ask questions, experiment, improvise, innovate and solve real-world problems. Student learning experiences involve two or more standards from STEAM subjects, and the product of learning typically leverages the art form itself.<sup>4</sup>

Six core STEAM education practices include:

- 1| Leveraging concepts in one or more STEM disciplines to create meaningful artwork.
- 2| Focusing on outcomes that have a personal and/or aesthetic meaning.
- 3| Conducting open exploration in the context of both science and art.
- 4| Designing with intention.
- 5| Iterating through several drafts, prototypes or models.
- 6| Communicating about the process and outcome.<sup>5</sup>

Though STEAM education is an innovative model, it is not a new practice; for more than 25 years, the National Science Foundation (NSF) has funded educational projects that integrate the arts and sciences.<sup>6</sup> Research

demonstrates that students who participate in STEAM learning experience higher achievement than their peers, high levels of learning retention and increased enjoyment in learning.<sup>7</sup>

### **The following policy components and practices support STEAM education:**

#### **1| Access**

- School certification.
- Diploma endorsement.

#### **2| Finance**

- Federal funds under the Every Student Succeeds Act (ESSA).
- State funds.

#### **3| Statewide Coordination**

- Leadership.
- Implementation continuum.

These components and practices do not represent a complete set of policies; but provide examples of support that states have implemented through statute, regulation, budgets or other formal guidance. While no standard/universal approach exists for implementation, states may consider the following examples to accomplish the goals of each policy element.

## **STEAM in Action: Painting With Chemistry**

Supported by the NSF, Colors of Nature is a collaboration between the University of Alaska Fairbanks, the National Optical Astronomy Observatory (Tucson, Ariz.) and the University of Washington (Bothell, Wash.). The project aims to increase STEM learning and interest through art, build capacity through professional development, advance research and inspire underrepresented students to pursue STEM careers. In a lesson titled Painting With Chemistry, students use red cabbage to investigate how chemical reactions affect color. From discussions of acids and bases, experimentation and pattern observation, students design a color palette and create paintings.

# Access

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## School Certification

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**Georgia** and **Ohio** expanded their systems for STEM school certification to include the arts — recognizing schools and programs for their commitment to STEAM education. The rubric that states use to evaluate schools for certification articulates a standard of quality for programs to maintain and, in the case of **Ohio**, qualify for STEAM funding.

While **Georgia** and **Ohio** established different processes for STEAM certification, both states include similar considerations in the application, such as:

- Goals for student participation, including access for nontraditional students.
- A rigorous, integrated and project-based curriculum.
- Plans for or evidence of public/private partnerships.
- An overview of school leadership and plans for teacher professional learning and collaboration.
- Curriculum guidance.
- Examples of accountability and plans for sustainability (in-kind, financial support).

**Ohio** offers guidance to schools based on a [Quality Model for STEM and STEAM Schools](#), and the [Ohio STEM Learning Network](#) offers technical assistance to schools interested in the designation process. Similarly, **Georgia** [offers guidance](#) to schools seeking certification, provides them with a self-assessment tool and requires a visit prior to submitting an application.

The **Ohio** designation process is guided by state statute that designates STEAM as a type of STEM school and authorizes the STEM committee within the department of education to review proposals.<sup>8</sup> Unlike **Ohio**, **Georgia**'s certification process is not included in statute but is instead authorized by the state department of education.<sup>9</sup>

## Diploma Endorsement

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Diploma endorsements or seals recognize individual high school students who surpass standard graduation requirements. While some state diploma endorsements recognize advanced academic achievement generally, other states require students to demonstrate advanced achievement in a particular area, including STEAM coursework.

Although several states have established requirements for students to earn a STEM diploma (**Idaho**) or STEM endorsement to the standard diploma (**Colorado, Hawaii, Michigan, Ohio, Texas, Virginia**), **Nevada** is the only state that offers a STEAM endorsement to the diploma. **Nevada** statute requires the superintendent of public instruction to establish a State Seal of STEAM awarded to students who achieve a 3.25 GPA (3.85 weighted); earning three credits in science, four credits in mathematics, one credit in computer science, engineering or related subjects; one credit in fine arts; and either receiving qualifying scores on specified exams or earning a B or higher in a dual enrollment math and/or science course.<sup>10</sup>

## Finance

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Limited funding for STEAM education can create barriers that hamper program offerings, student participation, staffing, professional development, resources or access to after-school programs. States have taken innovative approaches to fund programs through a variety of federal and state sources to help address these issues.

### Federal Funds Under ESSA

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**TITLE II, PART A:** Title II funds support educators' professional learning opportunities to help ensure that all students have access to educators who can help them meet the state's academic standards. The broad language in ESSA allows states to use Title II funding for programs for arts educators and to provide non-arts educators with arts-based techniques to improve effectiveness.<sup>11</sup>

**TITLE IV, PART A:** This funding provides districts with the opportunity to support greater access to a well-rounded education, a safe and healthy learning environment, and a personalized learning experience through the effective use of technology. Districts must complete a needs assessment to identify gaps in these areas and submit an application explaining how the district will address them. In this application, districts can

include STEAM programming as a strategy to address these gaps.<sup>12</sup>

**TITLE IV, PART B:** This competitive grant funds the development of 21st Century Community Learning Centers that provide academic enrichment opportunities outside of the school day, particularly for students who attend high-poverty and low-performing schools. Districts can use this funding for after-school STEAM activities.<sup>13</sup> [The Alaska Department of Education & Early Development](#) currently funds two district 21st CCLC programs in Anchorage and Fairbanks, with [plans to provide](#) additional activities in coming grant years.

### State Funds

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States have identified creative ways to fund STEAM education through formula funding, career and technical education (CTE) funds, state grants and specific line items in their education budgets.

#### FORMULA FUNDING

States generally fund public education through two basic models: 1) providing a school district with a set amount of funding per pupil (commonly called foundation funding) or 2) funding a number of positions (teachers, principals, counselors, etc.) per school.<sup>14</sup> **Ohio** funds STEAM schools through the foundation funding formula for education, the same formula as [community schools](#).<sup>15</sup> **Ohio** statute designates STEAM as a type of STEM school, and the STEM committee of the state department of education oversees school [financial reporting requirements](#).<sup>16</sup>

### Arts Opportunities Under ESSA



For more on how states and districts can engage the arts under ESSA, refer to this [Special Report](#).

## CTE FUNDS

Since 2013, states have experienced [significant legislative activity](#) related to CTE in efforts to align high school and postsecondary programs to meet workforce demand.<sup>17</sup> **Ohio** supplements STEAM foundation funding with CTE funds. By law, the state requires that districts spend 75 percent of the funds on program implementation, including curriculum development or purchase; instructional resources and supplies; work-based learning experiences; professional development; and other costs directly associated with CTE programs, including the development of new programs.<sup>18</sup>

## STATE GRANTS

States may establish grant programs that permit funds to be applied toward STEAM implementation. In 2018, the **Georgia** Department of Education launched the [Partnership for Rural Growth](#) to expand available STEAM resources to public school districts in rural **Georgia**, including grants to

fund coordinator positions to help expand the quantity and quality of course offerings.<sup>19</sup>

Alternatively, states may dedicate a portion of STEM funds to STEAM activities. Since fiscal year 2013, the **Iowa** Governor's [STEM Advisory Council](#) has been supported by a legislative appropriation. While STEAM education is not a stand-alone line item in the advisory council's finances, advisory council funds have supported programs as part of broader advisory council expenditures, including:

- [STEM Scale-Up](#), which receives about \$3 million annually to support a menu of vetted programs (including STEAM offerings) for pre-kindergarten through 12th-grade learners both during and outside the school day.
- [STEM BEST](#), which provides start-up funds for local educator/business partnerships approved through a rigorous application process and rubric.

## STEAM in Action: Using ESSA Funding

The Anchorage School District received \$500,000 to fund after-school programs at four school sites over a five-year period. The **Alaska** Botanical Garden partners with the school sites to offer STEAM activities and academic enrichment aligned with school-day curricula.

The Fairbanks North Star Borough School District received close to \$500,000 to fund programs at three school sites over a five-year period. The program offers STEAM-focused enrichment opportunities, with the goal of improving academic performance, motivation, behavior, class participation and credits earned for high school participants.

# Statewide Coordination

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## Leadership

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Leaders at the state, district and local levels have contributed to the implementation of STEAM-related policies across the country. [Seventeen legislators](#) supported **Nevada** S.B. 241 to establish the **Nevada** STEAM graduation endorsement, which the **Nevada** Legislature [unanimously approved](#). In **Ohio**, the state superintendent, the chancellor of the **Ohio** Board of Regents, the director of the **Ohio** Development Services Agency and four members of the public appointed by the governor support STEAM education through the [STEM Committee of the Department of Education](#).<sup>20</sup> District and school leaders, such as the [STEAM program specialists](#) at the **Georgia** Department of Education and program specialists for [STEAM schools](#), offer guidance on implementation and sustainability, as well as curriculum and lesson assistance.<sup>21</sup>

States have also established new leadership entities to inform STEAM education. In **Georgia**, former Gov. Nathan Deal established the [Arts Learning Task Force](#) by executive order. The task force was charged with setting recommendations for improving educational achievement of students through arts education and arts integration.<sup>22</sup> The task force recommendations included STEAM education as a priority and prompted increased coordination between the fine arts program specialist and STEM coordinator at the **Georgia** Department of Education.<sup>23</sup> This resulted in the creation of the statewide STEAM program specialist,

and many **Georgia** districts and schools have established similar leadership positions.<sup>24</sup>

The **Rhode Island** [STEAM Now Coalition](#) is an alliance of over 300 representatives from education, business and industry, community-based groups, nonprofit organizations, funding agencies and government offices.<sup>25</sup> The coalition makes policy recommendations to help increase the number of students who participate in programming and pursue degrees and careers in STEAM fields.<sup>26</sup> In an effort to further its objectives, the coalition is working toward formalizing the Governor's STEAM Council.<sup>27</sup>

## Implementation Continuum

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The **South Carolina** Department of Education developed a STEAM Implementation Continuum, in partnership with the Center on Standards and Assessment Implementation. The purpose of the continuum is to provide statewide guidance and consistency for STEAM education in [elementary](#), [middle](#) and [high school](#). Similarly, the **Georgia** Department of Education developed STEM and STEAM implementation continua for [elementary](#), [middle](#) and [high school](#), as well as a [self-assessment and reflection tool](#) based on criteria within the continuum. Both tools establish a common language and allow educators to assess the progress and quality of STEAM implementation, or both tools can be used to plan quality implementation of programming.<sup>28</sup>

## The implementation continua for **Georgia** and **South Carolina** include the following elements:

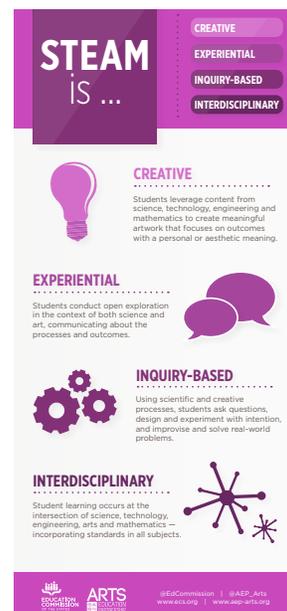
- 1| STEAM vision, culture and outreach.
- 2| Program development (rigor through the arts, project- and process-based thinking).
- 3| STEAM connections with business and community.
- 4| Teacher planning and professional growth.
- 5| Connections with postsecondary education.
- 6| Recognizing STEAM accomplishments and innovations.
- 7| Program evaluation and sustainability.<sup>29</sup>

The continua include elements related to policy implementation, such as resource allocation and funding, academic standards, work-based experiences, professional learning and recognizing achievement in STEAM education at the school and individual level.<sup>30</sup>

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## About the Arts Education Partnership



AEP at Education Commission of the States is a national coalition of more than 100 education, arts, cultural, government, business and philanthropic organizations that was created in 1995 by the National Endowment for the Arts and the U.S. Department of Education.

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