Creating a Culture for STE(A)M

Georgia Department of Education
Federal Programs/Curriculum & Instruction

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Objective(s)

• Share the "Why" of STEM / STEAM and share examples of engaging learning experiences created by implementation.

• Share ways that Title IV A funds can support your goals to create or expand STEM / STEAM opportunities for your teachers and students.
System of Continuous Improvement
Why STEM and STEAM?

What are you here to learn more about?
Why STEM and STEAM?

• STEM careers will grow by 77,000 new jobs between now and 2026.
• Biggest areas of growth: software developers, nurses, computer customer support, emergency medical technicians.
• More than half of the job growth in GA between now and 2026 will be in the healthcare and film industry.
• GA Long Term Workforce Trends Report
Why STEM and STEAM?

• Not just about STEM / STEAM jobs, but the STEM and STEAM in the jobs.
  • Collaboration
  • Problem-solving
  • Innovation / Risk Taking
  • Independent Work / Thinking

• Example: Less data processing & more decision making with data (Great Forbes article!)
Fine Arts and the Georgia Economy

• The Creative industries in Georgia represent a combined $37 billion in revenue, including 200,000 employed with $12.1 billion in earnings, and $62.5 billion in total economic impact.

• The creative industries represent 5% of all employment and 4% of all business revenue in the state.

• The Creative Industries are surpassing Agriculture as a CASH CROP of Georgia.
How are we building learning opportunities that support STEM / STEAM thinking with our content standards?

How are we creating professional learning opportunities that support this type of planning and thinking for our teachers and leaders?
Title IV A and STEM / STEAM?

(C) programming and activities to improve instruction and student engagement in science, technology, engineering, and mathematics, including computer science, (referred to in this section as “STEM subjects”) such as—

(i) increasing access for students through grade 12 who are members of groups underrepresented in such subject fields, such as female students, minority students, English learners, children with disabilities, and economically disadvantaged students, to high-quality courses;

(ii) supporting the participation of low-income students in nonprofit competitions related to STEM subjects (such as robotics, science research, invention, mathematics, computer science, and technology competitions);
Title IV A and STEM / STEAM?

(iii) providing hands-on learning and exposure to science, technology, engineering, and mathematics and supporting the use of field-based or service learning to enhance the students’ understanding of the STEM subjects;

(iv) supporting the creation and enhancement of STEM-focused specialty schools;

(v) facilitating collaboration among school, afterschool program, and informal program personnel to improve the integration of programming and instruction in the identified subjects; and

(vi) integrating other academic subjects, including the arts, into STEM subject programs to increase participation in STEM subjects, improve attainment of skills related to STEM subjects, and promote well-rounded education;
Characteristics of STEM Education
Characteristics of STE(A)M Education: Pedagogy not Product

**PROJECT AND PROBLEM-BASED LEARNING**
Students must be able to apply content from multiple disciplines to answer complex questions and develop solutions to real world problems. Teacher takes on the role of facilitator in the classroom.

**INTEGRATED MATH, SCIENCE, CTAE, AND FOR STEAM, FINE ARTS INSTRUCTION**
Students are able to analyze and articulate interdisciplinary connections that exist within math, science, CTAE, and fine arts content.

**STRONG BUSINESS, COLLEGE, COMMUNITY PARTNERS**
Partners are involved in development of curriculum and assist with making connections between classroom teaching and learning and business and industry applications.

**STUDENTS CONDUCT INVESTIGATIVE RESEARCH**
Students identify and support claims related to a complex question or real-world problem by supplying relevant data as evidence.

**COLLABORATIVE PLANNING TIME**
Time must be allocated for teachers to work collaboratively to plan purposeful, meaningful, and intentional interdisciplinary lessons.
Thinking and Planning is Rooted in a Process

Stanford d.school Design Thinking Process

- **Empathize**
  - Interviews
  - Shadowing
  - Seek to understand
  - Non-judgmental

- **Define**
  - Personas
  - Role objectives
  - Decisions
  - Challenges
  - Pain Points

- **Ideate**
  - Interviews
  - Shadowing
  - Seek to understand
  - Non-judgmental
  - Share ideas
  - All ideas worthy
  - Diverge/Converge
  - "Yes and" thinking
  - Prioritize
  - Mockups
  - Storyboards
  - Keep it simple
  - Fail fast
  - Iterate quickly

- **Prototype**
  - Understand impediments
  - What works?
  - Role play
  - Iterate quickly

- **Test**
  - Ask: Identify the need and constraints
  - Research: the problem
  - Improve: Redesign as needed
  - Test: and evaluate prototype
  - Create: Build a prototype
  - Plan: Select a promising solution
  - Imagine: Develop possible solutions
Engineering Design Process

8 steps to make any design project a success

1. ASK QUESTIONS
   - Who?  
   - What?  
   - Why?  
   - How?

   - Who is the target audience?  
   - Consider their interests, needs, and what inspires them.
   - What is your main goal?  
   - Why are you doing it?
   - Think about your desired outcome and what you want to achieve.
   - How can you measure success?  
   - Think about the tools you use to measure the results.

2. BRAINSTORM
   - doodle, investigate, creativity, research, write, spark, flow inspiration

3. DESIGN CONCEPT
   - Repeat steps 1 to 5 until launch

4. FEEDBACK

5. REVISIONS

6. REPEAT

7. LAUNCH
   - Take the final design to completion

8. COMMUNICATE
   - Think about what you learned and apply it to the next project!
**Let’s plan…**

- **S3E1.** Obtain, evaluate, and communicate information about the physical attributes of rocks and soils.
  a. Ask questions and analyze data to classify rocks by their physical attributes (color, texture, luster, and hardness) using simple tests. (Clarification statement: Mohs scale should be studied at this level. Cleavage, streak and the classification of rocks as sedimentary, igneous, and metamorphic are studied in sixth grade.)
  b. Plan and carry out investigations to describe properties (color, texture, capacity to retain water, and ability to support growth of plants) of soils and soil types (sand, clay, loam).
  c. Make observations of the local environment to construct an explanation of how water and/or wind have made changes to soil and/or rocks over time. (Clarification statement: Examples could include ripples in dirt on a playground and a hole formed under gutters.)

**Ask:**
- Why is grass not growing on the playground?

**Observe aerial photos of playground.**
- Tour campus to investigate types of soil. Collect soils in groups.
- Plant seeds.

**Plans:**
- Student will create a diagram or map of the playground.
  To include:
  - Locations of soil
  - Types of soils
  - Types of grass
  - Other natural resources (e.g., building materials)

**Ask:**
- How do plants grow using fractions? (Clarification statement: Use fractions to show the amount of sunlight, rain, etc.)

**Student will create a diagram of plant growth on a line plot.**
What do STE(A)M Learning Experiences look like?

- Projects / problems are rooted in standards-based education
  - Not all standards will fit with your overarching project
  - Teach with inquiry perspective
- Community creates authentic learning experiences
- Built upon relevance / interest
**Project-Based Learning**

Overarching grade-level or schoolwide focus

Students solve a real-world problem

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**Day-to-Day Interdisciplinary Instruction**

Typical instruction integrates, at the minimum, science and math - for STEAM, arts as well

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**Driven by grade-level Georgia Standards of Excellence**

Learning targets are identified

Documented in STEM or STEAM Journal

Students document data collection

Students use school/program identified thinking process
How can we slow down the erosion on the HMES nature trail and creek?

Science
- Erosion
- Weathering

Technology
- Sketch to design solution
- 3D Printer to design prototype

Engineering
- Design objects to slow down erosion

Math
- Research and graph rainfall data in 5 states. Analyze data and discuss effects on soil erosion. Compare data from multiple states.

Art, Music, Drama
- Andrew Goldsworthy inspired art to show erosion/weathering.
- Color contrast organic shapes, geometric shapes.
How can we educate our community about healthy food? 2nd

Tower gardens
- Create a Google Site (unpublished)
- Student made video
- Flipgrid
- Chatterpix
- Digital thermometer

- Collect, analyze, graph data
- Measurement, time (MDI)
- Add and subtract mentally
- Compare numbers
- Add and subtract within 10

- Changes in environment
- Patterns of sunlight
- States of matter
- Force of motion (wind)

- Life cycles of plants/fish
- Plant life cycle
- Develop a model of a life cycle
- Create a way to track shadows (sunlight)
STE(A)M Journal: The House for Student Thinking

• "Journal of Messy"
• Process-Based Thinking
• Interdisciplinary Connections
• Reflection
• Investigative Research and Data
The problem involves understanding the changes in a population over generations, specifically looking at two varieties: Variety A and Variety B. The graph illustrates the percentage of each variety present over time, with Variety A showing a steady increase and Variety B remaining constant.

1. What does the graph illustrate?
2. Which variety will contribute significantly to the future of the species gene pool?
3. What does the line for Variety A represent? B?
4. In what generations does the graph reach its highest and lowest points for Variety A and B?

The problem context involves a scenario where a species starts with a single population. Over generations, differences in traits emerge, with Variety A increasing in number and Variety B remaining stable. The graph helps visualize these changes, indicating the evolutionary trends of the species.
How can Title IV A help you create these learning experiences?

The Student Support & Academic Enrichment (SSAE) program provides LEAs the flexibility to tailor investments based on the needs of their unique student populations for a variety of activities with the intent and purpose of improving student outcomes and/or addressing the opportunities gaps identified through the needs assessment.
Well-rounded Education

• Enriched curriculum and education experiences.

• Exploration and connection between students and subjects, curiosities and skills.

• Promote a diverse set of learning experiences across a variety of courses.
Effective Use of Technology

Supporting professional learning STEM/STEAM.

Provide funding for teachers to participate in virtual, blended, or face-to-face courses and workshops.

Intended to increase educator’s capacity to offer high-quality STEM courses, such as computer science, engineering, game design and/or other STEM-related courses.

Opportunities to learn how to embed STEM elements, such as engineering design principles, computational thinking, and app design within other learning experiences can also be included.
Allowable Activities: Is this in your CLIP?

✓ Is the proposed activities part of the locally developed plan based on results of the need assessment?

✓ Is the proposed activity consistent with the purposes of one of the three focus areas?

✓ Is the proposed activity reasonable and necessary for the performance of the grant?

✓ Is the proposed activity supplemental?
Examples (Needs-based and Supplemental)

• Salaries
• **Substitutes**
• Stipends
• **Professional Training/Development**
• Conferences
• Travel
• **Contracted services**
• Resource materials
• Software
• Instructional/STE(A)M Coaches
• Field trips

• Transportation
• Supplies
• Train the trainer
• **Guest speakers**
• Duel Enrollment Activities
• AP testing for low income students
• **Direct serve professional services**
Using Title IV A for STE(A)M Professional Development

- School Visits
- Teacher Academies
- State of Georgia STEM/STEAM Leadership Cohort
- STEM/STEAM Georgia Forum held in Athens, GA (October)
- Registration coming soon: [http://www.stemgeorgia.org/professional-development/](http://www.stemgeorgia.org/professional-development/)
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Stay connected to STE(A)M

• To join our listserv to receive email notices and updates from the GADOE STEM/STEAM program, please send an email with no message to the email address listed below.

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• STEM Georgia Online: [http://stemgeorgia.org](http://stemgeorgia.org)
  Enables users to find STEM resources, materials, links to STEM schools, grants, competitions, lesson plans, and more.

• Follow us on Twitter: [http://twitter.com/stemgeorgia](http://twitter.com/stemgeorgia)
  @stemgeorgia enables users to receive tweets about STEM updates, grants, scholarships, workshops, information, articles, resources, and more.
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