



Implementation Checklist

STEAM

You for Youth



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Implementation Checklist

Use this checklist to record ideas and track your STEAM planning process as you complete the tasks listed below.

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Task 1: Consider STEAM Education Variations and Characteristics

STEAM is “an educational approach to learning that uses science, technology, engineering, the arts, and mathematics as access points for guiding student inquiry, dialogue, and critical thinking,” according to Susan Riley, an arts integration specialist.

Some STEAM activities include all five of the STEAM disciplines — the S, T, E, A and M. But not always. When you’re on a STEAM mission, there will be times when you’ll use just one discipline, like the “A,” and other times when you’ll use all five, or something in between.

Review the following STEAM “serving options” and select which ones you wish to try:

Single Discipline

- **Why this option?** Good for introducing staff and students to the STEAM approach through a single discipline as a starting point.
- **Example:** Logo Design – Design and draw a logo that represents a group or program. (ARTS)

Multiple disciplines

- **Why this option?** Good for helping students see connections between disciplines.
- **Example:** 3D Model – Draw and design a miniature roller coaster. Build a 3D model of a polynomial graph. Determine x-axis points, write/solve the function, etc. (ENGINEERING, ARTS, MATH)

All five disciplines

- **Why this option?** Good for solving a real-world problem by integrating all five disciplines.
- **Example:** Real-World Solution – Think about a specific location in your community (like a playground or empty city lot) that’s underused, unsustainable or needs improvement. Identify the problem or challenge, and design a new prototype for the location. (ALL FIVE)

When you start to develop a STEAM activity, keep these four characteristics of STEAM in mind:

- Creative** (tackles a real-world challenge or creates something that has value or meaning)
- Interdisciplinary** (includes content and skills from more than one field of knowledge)
- Experiential** (provides opportunities for active exploration)
- Inquiry based** (follows the design thinking process)

Resources

Use Y4Y’s free online **STEAM** course for ideas and inspiration to help you implement STEAM in Nita M. Lowey 21st Century Community Learning Centers (21st CCLC) Grant Programs.

Use these tools to prepare your staff for STEAM:

- **STEAM Activity Example**
- **STEAM at a Glance**
- **Four Characteristics of STEAM: Project Planning Worksheet**

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Task 2: Activate the Power of Design Thinking and Makerspaces

Design thinking is essential to implementing a STEAM program. The design thinking process is a problem-solving approach. It's similar to the engineering design process, and it's also a lot like the creative process used in the arts. Students can use design thinking to develop a product that solves a real-world problem, or to create something that people value and find meaningful. Students are encouraged to be innovative and to “think outside the box.” Review the following five-step design thinking process and consider how you'll include these steps in your STEAM program:

- Empathize** (Research your users' needs.)
- Define** (State the needs of your users.)
- Ideate** (Challenge your assumptions and document ideas.)
- Prototype** (Create solutions.)
- Test** (Try out solutions.)

Tip: To challenge assumptions during the “Ideate” step, introduce students to the “5 whys” technique by having them repeat the question “Why” at least five times to make sure they have the right target (problem) before they focus on solutions.

An appropriate physical environment is also essential to implementing a STEAM program. One way to support STEAM learning is to set up a makerspace. A makerspace is a collaborative environment designed to allow students to make, create, learn, invent and share. It's a place that inspires students to be creative when completing a project or activity. In a makerspace, the “makers” are the students, and the act they perform is “making.” Here are some characteristics of a makerspace:

- Is **flexible**
- Supports **differentiated learning**
- Provides a **variety** of materials and options
- Supports **self-directed** learning
- Fosters **innovation across disciplines**
- Provides a **noncompetitive, fun environment**

Activities that happen in a makerspace typically require some common household items and art supplies. They may also include other specialized tools and materials. What to include will depend on your activity and what's available. Every makerspace will be unique and have different materials students can use to invent, explore and create. Use this checklist to select some of the materials you want to include in your makerspace:

- Popsicle sticks
- Duct tape
- Batteries
- Toothpicks
- Pipe cleaners
- Beads

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- Marbles
- Coding software/applications
- 3D printers
- Soldering tools
- Electronics
- Robot building materials
- Circuits and electrical components
- Woodworking materials
- Other: _____
- Other: _____
- Other: _____

You'll also want to think about how you'll manage your makerspace. Review these suggestions and select those that you need to work on to ensure that your makerspace is a success:

- Set norms
- Set safety procedures
- Schedule reflection sessions
- Other: _____
- Other: _____
- Other: _____

Resources

Use these Y4Y tools as you plan to implement design thinking and makerspaces:

- **Activity Center Planner**
- **Design Thinking Framework: Project Planning Template**
- **Design Thinking Task Tracker for Students**
- **The Five Whys Questioning Technique**





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Task 3: Plan to Mitigate Risks

Good planning can help you avoid mistakes and ensure a safe and successful learning experience. Project managers call this kind of planning “risk mitigation.” For STEAM, there are two primary areas where risk mitigation is important: people and logistics.

First, you’ll need to select and prepare the people who’ll lead, facilitate or support STEAM projects and activities in your program. One of the greatest risks you can encounter is not having a “STEAM team” that includes staff who are qualified and prepared to implement STEAM. Think about your current staff’s knowledge of STEAM, and consider what kind of support they might need in addition to the professional development topics suggested below under “logistics.”

Another potential risk to success is failing to enlist partners who can help you and your staff “fill in the gaps” in terms of STEAM knowledge and resources. Here are some people and organizations you might want to consider as partners. Select those you want to include on your team to help you plan, implementation and assess successful STEAM activities:

- School-day teacher
- Engineer
- Graphic designer
- Science museums
- Colleges and universities
- Local businesses
- Professional associations
- Health professionals
- Interest groups
- Online resources
- Other: _____

Second, you’ll need to plan for logistics to reduce the risks of planning activities that will fail due to insufficient funds, time, resources or staff preparation. Review the four logistical areas below and discuss them with your program team:

- Budget**
 - How much professional learning will need to be provided?
 - How many hours per week are we offering the activity?
 - What supplies and materials might we need?
 - Are there any packaged curricula that we want to add?
 - Are there any vendors that will be engaged that need to be paid?
- Schedule**
 - Consider scheduling STEAM every other day for a full semester or every day for six weeks to ensure that students have the time needed to fully engage in design thinking and makerspace activities.



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Materials

- Think about simple everyday materials you have available.
- Consider asking families and/or local businesses to donate materials (e.g., empty plastic bottles, rubber bands, cardboard boxes, art supplies).

Professional development

- **Connecting STEAM to Real-World Challenges** will help students see the relevance of STEAM disciplines to their personal lives, their community and the world.
- **Applying Design Thinking** will help your team see design thinking as a nonlinear process and a mindset for solving problems and creating something that has value or meaning.
- **Creating a Makerspace** will help your team understand what a makerspace looks like and how you can use it to implement the STEAM approach to learning.

Tip: Download Y4Y's free, customizable training materials for the three professional development topics listed above. If your staff isn't familiar with the STEAM approach to learning, you might also have them complete the Introduction section of Y4Y's free online STEAM course They'll catch the vision for STEAM, gain an understanding of the basics, and see how STEAM connects to a broad range of career pathways. Anyone who registers on Y4Y and completes the Introduction section gets a Y4Y certificate of completion!

Resources

Use these Y4Y courses to help you put together a program team and identify and maintain partnerships:

- **Continuous Education**
- **Strategic Partnerships**

Use these Y4Y tools to help you plan for recruiting partners, mapping community assets, and managing your budget and schedule:

- **Creating a Program Elevator Speech**
- **Mapping Community Assets**
- **Sample 21st CCLC Budget Worksheet**
- **STEAM Example Activity Schedule**



Implementation Checklist

Task 4: Choose Your Mission and Implement Your STEAM Activity

Whether you’re implementing STEAM with elementary, middle or high school students, you’ll want to incorporate the five components of the design thinking process: empathize, define, ideate, prototype and test. Assemble your STEAM team and discuss the topics and projects you wish to explore. Record your team’s ideas below.

- Choose a topic and empathize** (Conduct research to develop a deep understanding of the challenge and audience.)

- Define** (Clearly define and articulate the problem to be solved.)

- Ideate** (Brainstorm creative ideas, then narrow them down to a few ideas to test.)

- Prototype** (Build a real-life representation or prototype to test part or all of the solution.)

- Test** (Engage in short-cycle testing on the prototype, and make use testing results, feedback and research to improve the product.)

Don’t forget to take time to reflect! Thinking about the activity you created above, identify how STEAM was addressed. Remember that you may choose to address anywhere from one to all five of the STEAM components.

- Science





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Technology

Engineering

Arts

Mathematics

Ask yourself these facilitation questions:

Will students be working in a makerspace?

Are there career pathways that can be explored?

Resources

Use these tools to help you implement STEAM projects and activities:

- **Building a Ski Jump**
- **Busting Myths About STEAM Careers: Discussion Starter**
- **Everyday STEAM: Strategies for Your Staff**
- **Science and Mathematics Vocabulary Builder**
- **Selecting Student Roles for Group Work**
- **Student Portfolio Planning and Review Checklist**
- **Student Self-Monitoring Checklist for Project Work**
- **Virtual Learning STEAM Project Planning Worksheet**

Also, see the next page for tips on conducting STEAM activities virtually.

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Tips for Using the STEAM Approach Virtually

To engage students:

- Invite community members to a virtual meeting with students so they can survey them.
- Invite a community expert to join a virtual meeting where students can ask questions.
- Watch videos to get students ready and excited for the activity.
- Provide students with reusable “science bags” that include items they could use in a makerspace.
- Host a virtual classroom with specific activities each week.

To engage families:

If you’re working with a virtual program space and you want students to have a maker experience, there are some things you’ll want to think about before you get started. Review these tips with your team:

- Get students’ families on board.
 - Get families excited about setting up a makerspace in their home.
 - Send emails or mail flyers with information on makerspaces and how families can create one themselves.
- Provide families with an orientation.
 - Encourage them to be open about using different tools.
 - Teach them about new tools that they and their child can use.
 - Show them what you do, and explain that they can do it too.
 - Answer their questions.
 - Encourage them to be creative.
 - Provide a list of household items they could use in their space.
 - Offer activity ideas and resources.

To create a virtual makerspace:

- Rethink the definition of a “tool” in a makerspace.
 - Explore the use of virtual tools, such as online software tools designed for making, animation and the arts, like JavaScript, or graphic design software.
 - Many free tools are available online. If you can’t locate a free version of a tool you want for your virtual makerspace, check with the school and local organizations to see if they can help.
 - If you decide to purchase a virtual tool for your makerspace, and it’s within your budget, (1) check to see if there’s a discount for educators, (2) make sure the purchase or license permits multiple users, and (3) make sure it’s compatible with the laptop, tablet or other device where the tool will be downloaded and used. *Before you make a purchase, you might want to check with the school or district technology specialist for guidance on these matters, as well as any security requirements.*



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Task 5: Ensure a Smooth Link to Program Goals by Implementing With Fidelity

For your activities to have an impact on student growth, the activities must be implemented with fidelity. Fidelity of implementation is the degree to which an intervention or program is delivered as intended or designed. Be sure to consider each of the four measures of fidelity:

- Adherence:** How well did you stick to the plan?
- Dosage:** Did students engage in the project to the degree that was intended?
- Engagement:** Were students managing their own learning?
- Delivery:** Did the facilitator guide the learning, acting as a navigator, rather than direct the project like a captain giving orders?

Resources

See Y4Y's **Implementing Your Program With Fidelity** Click & Go for a mini-lesson, along with podcasts, FAQs, tools and resources.



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Task 6: Assess, Reflect and Celebrate

Assess. Remember to assess the learning and provide opportunities for your students and staff to reflect. Consider these four tools and think about which ones you might use to assess student learning:

- Portfolios
- Journals
- Rubrics
- Surveys

Reflect. Reflection opportunities should be built into any STEAM project or activity — and reflection happens naturally in any good makerspace. It’s rewarding and critical to students’ overall learning experience to have them think back on the activity as a whole after it’s over. This provides students an easy pathway for connecting their learning from the school day to out-of-school time, and to real life. Even if a student or group of students struggled, reflection and discussion can help them see that struggle as “worth it” due to its impact and the lessons learned. Begin by asking students to complete their own self-evaluation. This can be done by having students self-rate on an activity rubric or by having them use a standard self-evaluation sheet. Then provide students with options for how they’d like to reflect on and share their personal growth. Consider these options:

- | | |
|---|---|
| <input type="checkbox"/> Mapping | <input type="checkbox"/> Creative projects |
| <input type="checkbox"/> Videos | <input type="checkbox"/> Blog |
| <input type="checkbox"/> Letters to leaders | <input type="checkbox"/> Reflective reading |

Celebrate. When your students are finished with any activity, give them an opportunity to show off the work they’ve done and the new things they’ve learned. For example, students might present the prototypes they built to mentors and peers, or post photos and testimonies in a newsletter or social media platform. Think back to the activity your team created in Task 4 and record some celebration ideas:

How will your students celebrate the completion of their STEAM project?

Resources

Use these tools to help you assess, reflect and celebrate:

- **Assessment and Reflection: Project Planning Worksheet**
- **STEAM Approach Self-Check for Staff**
- **Student Portfolio Planning and Review Checklist**
- **Tips and Tricks to Plan a Successful Culminating Event**

Congratulations on completing this checklist. You’re ready to open up an exciting new world of possibilities for your 21st CCLC staff and students!

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