

5 Best Practices for Developing a STEAM Curriculum



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Executive Summary

Introducing STEAM curriculum into the classroom is an enriching and engaging way to get students excited about the myriad intersections between STEAM subjects. It is also an essential tool in preparing students for a future work environment where collaboration, creativity, and innovative thinking will be as critical as their abilities in science, math, and engineering.

Because STEAM curriculum is still in the early stages of adoption, for many educators, knowing where and how to start introducing STEAM-based learning into the classroom can feel daunting. This paper outlines best practices that make it simple and affordable for educators, administrators, and districts to successfully bring STEAM tools into the classroom and integrate those tools with current curriculum.

Preparing for a STEAM Future

Success in the 21st-century workforce will require a combination of scientific and mathematical concepts along with creative innovation. To help prepare students, there is a growing movement to integrate STEAM-based learning (Science, Technology, Engineering, Art, and Mathematics) into today's K-12 classrooms.

“We realized that language arts, social studies, and visual arts are crucial and can’t be taught in isolation from science and technology,” says Sarah Elliott, EdD, adjunct professor of STEAM at Concordia University-Portland.

STEAM curriculum incorporates a project-based learning framework that teaches students how to ask questions, collaborate, experiment, and create in an enriching and engaging hands-on learning environment. STEAM encourages problem-solving and increases critical thinking while blurring the boundaries between science and art. It's a holistic approach to learning that exercises both sides of the brain.

It is also precisely the type of curriculum students need to prepare for the future of work, which will demand the ability to work collaboratively to solve global challenges and real-world problems. According to the Georgetown Public Policy Institute, STEAM is one of the fastest-growing occupational fields in the United States. By 2020, the number of STEAM jobs is expected to grow 26 percent since 2010. And, these jobs will also pay well—with nearly half paying more than \$58,000 annually.

Moving From Interest to Implementation

While some schools have begun to incorporate a STEAM curriculum into their classrooms, many more are just getting started. But the best path forward isn't always clear. Currently, many STEAM initiatives are still taking place at the grassroots level within individual teachers' classrooms or as after school programs. This situation leaves educators interested in pursuing a more STEAM-based curriculum, grappling with challenges like:

- No roadmap for how to best implement STEAM into current classroom curriculum
- Limited budgets

- Difficulty getting buy-in
- Need for professional development to learn new technologies and how to integrate them with current curriculums

While there is no one right way to overcome these challenges, and the approach to STEAM varies from school to school and district to district depending on specific goals, there are best practices educators and administrators can follow to make a STEAM implementation smoother and more successful.

Augment Your Students' Learning Experience

Virtual and augmented reality solutions are being used in classrooms to expose students to new worlds and scientific explorations. VR headsets and AR devices are affordable and easy-to-use and can allow students to visit world heritage sites, experiment with chemistry in a safe environment, explore space, and more.

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VEATIVE



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- Dive into the bloodstream, lungs, and small intestine with 360 VR video lessons
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octagon studio



Octagon

- Multidimensional flashcards that are powered by augmented reality technology
- Broadens knowledge through fun by allowing students to see interactive animals and dinosaurs come to life

5 Best Practices for Adding STEAM to Your Current Curriculum

1. Start Small and Simple

Rather than taking on a big multi-week or multi-disciplinary project, it's best to start with a small and simple project. By starting with a single project, in a single grade or classroom, with a single technology, and with a single STEAM discipline—such as science or art—you can test out what works and what doesn't before you begin to scale it across your curriculum or to other classrooms and grades.

Initial projects should also not be overly complicated, lasting only a week or two, and they can even be part of traditional teaching instruction. For instance, you can use drones to run science experiments as part of a lesson plan on physics, such as observing how a drone performs with different weights attached to it, or to have students take aerial photographs for a mapping project.

Using a single, simple technology like drones also keeps the project affordable, eliminates the need for IT's involvement, and doesn't require much of a learning curve to use the technology since most teachers and students will have some familiarity with drones.

Pilot programs, when offered by a vendor, are also a great way to figure out what products will best meet your STEAM goals. For instance, Sony KOOV offers a pilot program where schools can receive a certain number of kits to test out in classrooms. While not all manufacturers offer pilot programs, it is certainly a great way to start getting STEAM products into a school.

At Connection, we have used pilot programs on several occasions to see which products are a good fit for the school. For example, if a school likes specific features of a product, but doesn't like other features, we can then point them to a different product that will better meet their needs.

2. Get Buy-in

Small, classroom-focused initiatives can succeed without broader administrative support for STEAM, but the level of buy-in from other teachers and administrators will determine how much or how little you can expand your STEAM curriculum, and whether you can create continuity from grade to grade.

By starting small and simple, as discussed above, you can showcase the benefits of STEAM to other teachers and administrators in a low-cost environment. This approach will make it easier to get your program off the ground while allowing stakeholders to see how the STEAM curriculum enriches student learning.

Running a test program can also help increase buy-in. For instance, Connection worked with one school district, who hosted a robotics summer camp to gauge the level of interest in robotics among their student population. Using MakeBlock mbots, a programmable robot for beginners, students in the camp assembled robots from scratch using a screwdriver and following step-by-step instructions. Watching the students progress with building their robots and their excitement learning about a variety of robotic machinery and the fundamentals of block-based programming while developing logical thinking and design skills made clear the value of further investing in STEAM tools.

Similarly, we have seen schools and districts that have strong buy-in for STEAM can go further with their programs. Some are already investing in "Makerspaces," where students can work on STEAM projects independently or as a group. These are lab-like spaces that come equipped with a variety of STEAM technologies and devices such as:

- 3D printers
- Laser cutters
- Robotics kits
- Electronic invention kits
- Coding kits
- Video and animation software
- Computers
- Craft supplies

61% of educators say they are either currently implementing or plan to grow STEAM implementation during the next school year.

3. Invest in Professional Development

Incorporating STEAM into the classroom is not as simple as bringing in new technologies or designing a hands-on science project—it's about mixing the left brain and the right brain and making disciplines like science, math, and engineering more creative and visual using project-based learning. For many teachers, this is a big leap in how they've traditionally approached teaching. Less tech-savvy teachers may also need training on STEAM tools so that they know how to use a specific device, why to use it, when to use it, and where it fits into the classroom curriculum.

To help support professional development, select products and tools that come with professional development and curriculum suggestions or work with a vendor who can offer this support through their partners. For example, TechTerra Education offers virtual online trainings for educators working with K-12 students on specific STEM tools to help them gain mastery over the tool and to be able to comfortably and competently incorporate the technology into their curriculum.

There are also professional development trainings available that focus on project-based learning or how to design and create Makerspaces. These trainings are structured to allow educators to work in a hands-on environment with trainers to fully understand curriculum development, how to use the tools, and the incorporation of the “Stations of STEAM” into the learning environment.

4. Create a Task Force

Collaboration is a crucial part of what students learn when working on STEAM projects. It is also essential to allow STEAM programs to flourish and to avoid gaps in curriculum as students transition from one grade or school to another.

While schools and districts may choose to integrate STEAM across all their schools and classes, others may choose to infuse the arts into STEM subjects more organically. With either approach, success will depend on having all stakeholders at the table and in agreement on what they want to accomplish, why, and by when.

“The schools that have had the most success have created a team or task force,” notes Jo Ann Dempsey, Business Development Manager at Connection. “They have started with an initiative, determined what they wanted to achieve, and then thought through the process so that they have a road map to help them get there.”

5. Be Creative with Funding

Finding funding for STEAM initiatives is one of the biggest hurdles for educators. However, there are many different avenues you can pursue to fund STEAM initiatives—especially if you're willing to be creative and resourceful.

Your local PTO and PTA organizations are an excellent place to start, as they may be able to support a specific activity or help raise funds for supplies. Reaching out to community partners, foundations, and businesses can also yield additional funding. Almost 75 percent of STEAM educators reported that they collaborate with business or industry partners. Most had guest speakers present on science and STEAM careers, but many also received grants, donations, or sponsorships based on their collaborations with their business or industry partners.

For schools with limited budgets, we have suggested establishing a cart-based STEAM program to stretch resources further. One school we recently worked with, who had limited funding, purchased a variety of STEAM products for multiple grades. The teachers could sign the cart out for a period of time during the day to use in their classrooms. This approach allowed the school to let many more students participate in STEAM-based learning initiatives than if the products had been assigned to an individual class.

Some schools are even using STEAM products to fund their STEAM curriculum. In one school Connection has worked with, they purchased an Inventables X Carve—a 3D carving machine. The school not only integrated the X Carve into its curriculum to teach manufacturing, it also developed a program where students can make items with the 3D printer and then sell the items as a fundraiser to offset the ongoing cost of 3D printing supplies.

Go Full STEAM Ahead

There are many ways to incorporate STEAM technology into the classroom that are budget-friendly and enrich student learning. While starting a new curriculum is never easy, ensuring you are engaging with all stakeholders and getting buy-in will help make the path forward smoother and more successful.

Additionally, finding a partner who will work with you to support your STEAM curriculum can make a big difference in making it simple to get started. Look for a trusted partner with a wide selection of products and experience working with schools and districts to integrate these tools into the classroom. This will ensure that you get knowledgeable guidance on what products will work best for your students and goals, help you find solutions that fit within your budget, and provide you with the professional development support you need to effectively integrate STEAM into your current curriculum.

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For highlights of the STEAM products we offer, view our [STEAM catalog](#).

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Cart-Based Programs Create a Budget-Friendly Approach to STEAM

Whether you're just getting started with STEAM or have a limited budget to work with, mobile carts are a great way to make your investment in STEAM products reach as many students as possible.

Here are some product suggestions for building grade-appropriate STEAM carts:

PreK to Grade K:

- **Cubetto**—A friendly wooden robot that teaches students the basics of computer programming with a coding language students can touch and manipulate.
- **Matatalab**—A screenless, word-free educational game that helps students develop cognitive abilities, imagination, and coding skills by using coding blocks to control a robot.

Grades 1-2:

- **Octagon Studio**—4D and AR flashcards bring core learning objectives to life and include animal, dinosaur, and occupation themes.
- **Space**—Take students on a journey to explore our solar system, satellites, rovers, space object, and space missions.
- **Humanoid**—Students learn human anatomy with interactive depictions, including muscular, skeletal, respiratory, nervous, digestive, integumentary and urinary, endocrine, and immune.

Grades 3-5:

- **Codey Rocky**—Students learn about programming while they play and create using mBlock, a software that supports both block-based and Python programming.
- **Curiscope Virtuali-Tee**—Students can explore the human circulatory, respiratory, and digestive systems with fully immersive 360-video using augmented reality and 3D.
- **Sony KOOV**—Provides a comprehensive solution with everything needed to start building robots and learning to code.

Grades 6-8:

- **3D Magic Pen**—Students create hand-drawn, three-dimensional objects, expanding their imaginations while learning about construction. Great as stand-alone product or with 3D printers.
- **Zu3D Stop Motion Animation Kit**—Students use teamwork, problem-solving, and imagination to create engaging stop-motion animations in language arts, history, science, and more.
- **Cubelets**—Students do not need to know how to code or wire to construct robots with these snap-together robot blocks, which teach the basics of building robots.

Grades 9-12:

- **ChronoQuest**—Students use AR to travel through time to learn about and add to history's past. With one timeline, teachers can create limitless quests in Humanities, Science, Civics, Technology, Art, and more.
- **MakeBlock Airblock**—Students can explore aviation, engineering, and real-world programming with the easiest and most exciting modular drone that can be turned into a hovercraft, car, and more.
- **MakeBlock Ultimate 2.0**—The Ultimate 2.0 is an advanced programmable robot kit and is perfect for students who are robot enthusiasts.