How to Start a STEM/Makerspace Program at Your School

A MakerState Guide
## Table of Contents

- Why Every School Should Have a Makerspace
- The Four Critical Career Skills that Your Children Need in the Future
- How to Get Started: Make Your Own Experience First
- How Can I Tell If It’s a Good STEM/Maker Program?
- How to Launch or Level-Up a STEM/Maker Program in Your In-School, After-School, or Community-Based Program
- Resource Guide to Set Up Your Own STEM/Makerspace Program
- Starting a School-Based STEM Makerspace: How Four Parents Did It
- Top Ten Tips for Parents in Starting a STEM/Makerspace
- Why STEM Programs Are Needed for Our Kids
- Our Learning Standards: Fiero & Flow
- Books that guide MakerState in its approach to student-centered STEM learning
Why Every School Should Have a Makerspace

By now, many parents have heard of the Maker movement and believe that it’s a positive trend in education. However, most schools have been very slow to incorporate Maker programs into their curricula. In some cases, the recognition is there by active parents but they still feel overwhelmed and don’t know how to get things started.

This guide was created for parents and other stakeholders to help you bring Maker programs into your schools and communities. Here we will provide you with the information, strategies, and resources you need to state your case and tell personal stories of successful parents to help you complete your mission.

The future belongs to a different kind of person with a different kind of mind: artists, inventors, storytellers – creative and holistic ‘right-brain’ thinkers.

– Daniel Pink
The Four Critical Career Skills that Your Children Need in the Future

The Partnership for 21st Learning, founded in 2002, is a coalition bringing together the business community, education leaders, and policymakers to position 21st century readiness at the center of US K-12 education. Over the course of several years of research and collaboration, they created the Framework for 21st Century Learning which was formed to help educators identify and infuse these critical skills into their curriculum.

While there were many skills acknowledged as necessary and important, it was agreed that there were four very essential skills that needed to be highlighted from the projects. These are referred to as the 4Cs: Critical Thinking & Problem Solving, Communication, Collaboration, and Creativity and Innovation.

Until now, schools have focused on teaching the 3 R’s (reading, writing, and arithmetic) which largely prepared students for an economy based on manufacturing. This is no longer adequate as our ever-changing society requires skills beyond the 3 Rs. The 4 Cs for successful lives in the 21st Century:

Skill 1: Critical Thinking and Problem Solving

Students today must practice applying various methods of reasoning (logical-mathematical, visual-spatial, interpersonal, etc.) to solve problems for a future which we cannot predict and for challenges for which there may be no previous precedents. They must learn to identify causal factors, make connections, arguments, and draw conclusions that will produce solutions.
Skill 2: Communication

Communication is not just about talking, it’s about listening too. Can today’s students listen effectively enough to understand and work with the intentions of the speaker? Empathy is important here as is focus. Students must also learn to articulate their thoughts in written form but also via a variety of other media and be able to assess the impact of their message.

If you can’t explain it simply, you don’t understand it well enough.
— Albert Einstein

Skill 3: Collaboration

This is one of the C skills that is very dependent on other C skills, especially Communication. Students today must learn how to contribute to a group as a member of a group while maintaining their own identity, integrity, and intentions. Sensitivity to each member is key here while also carrying out one’s own individual responsibilities. Celebrating individual and team ideas, learning moments, and wins keeps great collaboration going.

Skill 4: Creativity and Innovation

This is yet another skill that is very tied with another C skill, Critical Thinking and Problem Solving. As innovation is often sparked by a need to solve a particular problem, students must learn to not only create new ideas but to see them through to development. Learning to be creative as a group is also a skill to develop for the future. A key process here is in testing our hypotheses and prototypes and making improvements based on performance and data gathered. This iterative process is really
the heart of innovation and invention. One of the great joys of makerspace learning is at the intersection of scientific testing and creative problem solving.

**Maker Programs Build Each C Skill**

The reasoning why maker programs are beneficial to students is simple: Making is learning and its strength draws from educational principles found in STEAM curricula (Science, Technology, Engineering, Art, and Math). If you make a light switch, you gain hands-on learning about how to create a circuit. If you make a derby race car, you learn about physics and mechanical engineering. If you make a robot respond to its environment, you learn how to code.

Think of completing each of those projects as a group and you will understand how maker programs are the best tool to develop the four C skills in students today. Without a doubt, as schools task students to make something together, to solve a problem together, to fail together, to succeed together, maker programs build a critical foundation of enabling skills as students complete each STEAM project. That foundation is actually a culture, more specifically, a student-centered way of being that empowers students across the curriculum and in life.

The 4 Cs cannot be accomplished without establishing the type of student-centered culture necessary for children to feel safe in owning their work while voicing their opinions within a group. It’s really important here to encourage decision-making and creativity that doesn’t necessarily lead to immediate success. Finding the will to progress forward toward new discoveries gives rewards for the imagination and the intellect. Persisting through difficulties and finding little wins along the way give us stories that to remember.

Maker programs create the kind of culture in which individual students can advance in a group environment because the assessment of learning will always be viewed from the eyes of each student. One of the best characteristics of Maker programs such as those at MakerState is the concept of students in Fiero or Flow. In the best Maker and STEAM programs, teachers look for kids to realize two states of being every day.

- Fiero: when you overcome a challenge and discover self-sufficiency
- Flow: when you’re in “the zone and find new passions, skills, and purpose
At MakerState, young engineers are encouraged to identify with these states of mind as they experiment, create, persevere, and invent.

Supporters of school and community maker programs understand that students are more likely to seek these types of transformative learning experiences as they take on more and more complex challenges. Fiero and Flow really are about an innate desire to learn. That’s a state of mind that is fostered in a makerspace environment with an intention that it carry through across all other classes in the curriculum, in future work experiences, and in our personal lives.

*I am convinced that the best learning takes place when the learner takes charge.*

-Seymour Papert
How to Get Started: Make Your Own Experience First

Many parents and teachers have come to us with the goal of starting or expanding a STEM and/or makerspace program in their child’s school. It’s important to feel comfortable and informed when you advocate for a program with your school. In keeping with the maker ethos of DIY and experienced-based learning, we believe that you can do a better job of sharing the value of maker/STEM education with anyone if you become involved too. Here are three simple ways you can do it:

1. Attend a Maker Faire:

   Maker Faire is hailed as “the Greatest Show (and Tell) on Earth—a family-friendly festival of invention, creativity and resourcefulness”. With over 130 annual, full and mini Maker Faires around the world each year, there’s a good chance there’s one you and your kids can attend (find a Maker Faire near you here). It’s an unforgettable experience.

   Ben and I attend World Maker Faire in New York City each Fall, hosted by the New York Hall of Science in Flushing, Queens. MakerState
is there each year too and we’re proud to have brought home blue and red ribbons from the Faire for our maker education initiatives. New York is one of two flagship Maker Faires, with the other in the Bay Area in May. These two-day events are spectacular and worthy of a weekend away.

2. Visit family maker events at your local children’s museum, library, or school:

“What we see in the Maker Movement, is that a relatively small amount of people can have a big impact." That’s Dale Dougherty, father of the Maker Movement (read more about his philosophy here in “The Maker Mindset”). Dougherty says “Making can be described as “project-based learning,” or “hands-on learning,” yet doing projects or working with your hands is only what making looks like, not what it is." That said, Dougherty points to one marker we think is a fantastic way to help parents discern a maker program from just a typical hands-on activity. Dougherty wrote, “it is the difference between a child who is directed to perform a task and one who is self-directed to figure out what to do." In short, the element of choice is part of being a maker. Those choices in exploration and creativity foster agency, self-direction, and new passions. So look for events, workshops, and classes that allow maximum opportunities for kids to choose what they create with as much support as possible to help them be successful.

3. Enroll your child in a maker program

Within the world of making, there are so many ways to get started. One option is to spend at a week in a maker summer day camp such as MakerState. We also love Brooklyn Robot Foundry, Camp Pixel from Pixel Academy, Camp Galileo, i2 Camp, Robofun, and IDtech. There are many more! We believe making is the future of education so you should be seeing many more such quality programs arise in your community. If you don’t have one but would like to start one, read on, or contact us at info@maker-state.com. If you are unable to enroll your child in one of these award-winning programs, let us know your ideas for starting a program and we can work with you each step of the way. MakerState is also an official provider of training courses for the New York City Department of Education’s Computer Science 4 All Initiative (“CS4all”), a 10-year “moon mission” to ensure every NYC public school student has access to computer science education by 2025.
See below for a list of questions parents can ask when choosing maker and STEAM programs based upon our principles of what makes maker/STEM learning at MakerState. It doesn’t matter if it’s a class on computer-aided design, Minecraft modding, tinkering, digital drawing, or robotics--it should have as many of the qualities described below as possible.
How Can I Tell If It’s a Good STEM/Maker Program?

Q: Is this a student-centered learning environment?
As a parent, you’ll want to hear that your child will have ample opportunities for decision-making and support for the development of her/his ideas. The specific structure of the program should include and demonstrate content learning in both process and product. What we’re describing here is an evolved, truly empowering academic experience: clearly articulated learning goals, student-driven protocols for learning through experience, diverse opportunity for experimentation, collaboration, testing, iteration, and innovation, and demonstrated new STEAM masteries as a result.

Q: Will my child have an opportunity to work with others? How do you help them with this?
It’s not enough to tell students to work together or even provide them with occasional “group work” projects. Working collaboratively is a skill that can be learned and used every day, across the curriculum. Good educators will support students by helping them develop skills in communication, flexibility, empathy,
and teamwork. Look for students having opportunities in consensus building, active listening, and gaining peer feedback. These are skills that will empower kids throughout their lives and they can be super-powered in them at very early ages!

**Q: How do you assess the quality of my child’s experience?**

A great maker program will have a structure already in place for assessment. Keep in mind that assessment is not just from a teacher’s perspective. Throughout the program period, you want your child to have opportunities for peer assessment and most importantly, self-assessment. We at MakerState emphasize protocols like “Think-Pair-Share” and playtesting as part of the Engineering Design Process. MakerState Reports are sent home to parents each day which feature the day’s “Challenge Prototype” build, the learning objectives of that project, and how learning can continue at home and in the community through discussion and experience.

**Q: Is it about the creative process or exhibition of learning?**

It should be both! There’s a false dichotomy in education circles that learning is either about “product” or “process”—experiential, maker education can and should be both. Maker and STEAM programs ensure resources and time to plan, prototype, build, test, and iterate as well as for the space to demonstrate and present one’s work in front of peers, parents, community, and user-groups. Being able to verbalize the journey to the completion of a project builds an ethos of craftsmanship, mastery, and purpose that enables students across the
Ron Berger, author of “Leaders of Their Own Learning: Transforming Schools Through Student-Engaged Assessment” said, “Anytime you make the work public, set the bar high, and are transparent about the steps to make a high-quality product, kids will deliver.” MakerState’s daily circle briefs, playtesting, and end-of-semester “Pop Up Makerspaces” allow students plenty of space and support for demonstrating their learning to real-world audiences. Look for similar elements in any good maker ed program.

Students who are challenged to iterate on their designs develop internal standards for craftsmanship, excellence, and mastery.
How to Launch or Level-Up a STEM/Maker Program in Your In-School, After-School, or Community-Based Program

If your child has experienced a high-quality, hands-on STEM/maker learning program, you will understand just how challenging it may appear to an educational administrator or teacher to choose such a diverse, deep, and impactful learning program or approach for their school. There is so much on the school agenda and so dependably these days, a central focus is on test performance and test preparation. Teachers and administrators almost always know the components of student-centered, 21st Century Learning but there are an increasing amount of local, state, and federal performance-standards that now compete for time and resources. MakerState provides support in implementing or expanding STEM/maker programs so that educators don’t have to make a choice between competing and important objectives. MakerState provides the support parents and teachers need to bring hands-on STEM learning to their classrooms and community.

In this guide, MakerState would like to offer parents and educators a solution to help schools easily launch or level-up a STEM/maker program, whether in-school, after-school or in the community. Here are three models for getting started:. Also below, you’ll find additional resources for more DIY approaches to creating a maker program in your school or community.
## Three Options from MakerState

<table>
<thead>
<tr>
<th>Club Makerspace</th>
<th>Partner Makerspace</th>
<th>Turnkey Makerspace</th>
</tr>
</thead>
<tbody>
<tr>
<td>* MOST POPULAR *&lt;br&gt; * YOU RUN THE PROGRAM *&lt;br&gt;Run your own makerspace club in-school, after-school, or out of your home, scout troop, or community/faith center. We’ll set you up with a great Challenge Curriculum and materials to you run your own awesome Maker Club! All you need is five or more interested kids/families and you are ready to start right away!</td>
<td>* FULL SUPPORT *&lt;br&gt; * YOUR INSTRUCTOR *&lt;br&gt;MakerState partners with you in setting up and running your own in-school or after-school STEM Makerspace. Let us know who your instructor is and we will provide them with Maker Fellow training, ongoing support, and our award-winning “Challenge” curriculum and materials to make the program happen for the semester. Also includes fundraising supports to help pay for your makerspace.</td>
<td>* LET US DO EVERYTHING *&lt;br&gt; * GET STARTED NOW *&lt;br&gt;MakerState provides everything you need for your makerspace: a trained Maker Fellow instructor, our award-winning “Challenge” curriculum, and all the the maker materials to support the program. Includes a student Exhibition &amp; Pop Up Makerspace for your students to show off their builds and lead other kids in making!</td>
</tr>
<tr>
<td>Features:&lt;br&gt;● A MakerState Challenge Curriculum in one of over 20 content areas including coding, robotics, game design, rocket science, digital arts, and more.&lt;br&gt;● Supporting materials for running your club for a semester&lt;br&gt;● An initial training in how to start and run your Club</td>
<td>Features:&lt;br&gt;● Access to a MakerState Challenge Curriculum in one or more subject areas including coding, robotics, game design, rocket science, digital arts, and more&lt;br&gt;● Supporting materials for running your club for a semester&lt;br&gt;● An initial training in how to start and run your Makerspace&lt;br&gt;● Support for establishment and operation of your makerspace&lt;br&gt;● Participation of one of your instructors in our Maker Fellowship, featuring initial content and classroom practice training as well as ongoing coaching throughout the semester&lt;br&gt;● A student exhibition and Pop-Up Makerspace student exhibition to introduce STEAM and making to the greater school community!&lt;br&gt;● Funding support to help pay for your makerspace (PTA Fundraiser Program, grant writing, DOE/city contracting support)</td>
<td>Features:&lt;br&gt;● A trained Maker Fellow instructor&lt;br&gt;● The MakerState Challenge Curriculum&lt;br&gt;● Everything you need to start and run your club for the semester&lt;br&gt;● Fundraising support to help pay for your makerspace (PTA Fundraiser Program, grant writing, DOE/city contracting support)</td>
</tr>
<tr>
<td>$1,000-$1,500</td>
<td>$3,000-$5,000</td>
<td>$4,000-$7,000</td>
</tr>
</tbody>
</table>
Resource Guide to Set Up Your Own STEM/Makerspace Program

Here’s a curated listing of some of the most effective resources for starting your own STEM/makerspace program:

**Maker Education Initiative** – This website is a great resource for you to find out existing schools and districts in the country that have successfully developed Maker programs. The Maker Education Initiative sprung from Dale Dougherty’s founding of the Maker Movement, Make Magazine, and Maker Faires—thanks Dale! So much accumulated learning here. They offer resources to others who would like to jump start their own Makerspace in their schools and communities including this 84-page comprehensive *Makerspace Playbook: School Edition*.

**New York Hall of Science Makerspace** – Run by our friend maker education guru, [David Wells](#) (right). Contains three zines to help you get started.

**Tinkering Studio at the Exploratorium** – The Tinkering Studio knows where it’s at with hands-on, maker learning. Check out their professional development to educators.

**Maker Resources for Educator from Intel Education** - This resource contains tutorials, project ideas, and guides for educators.

**Code.org** – Another amazing program. Offers free curricula in computer science for grades K-12. Get started with your own “Hour of Code” project. Like!

**How to Start a STEAM Program at Your School (littleBits Education)** - A guide to building a makerspace around one of our favorite maker-learning hardware sets. The indomitable littleBits.
MakerState CS4All Free Courses - MakerState is certified by the New York City Department of Education to provide computer science instruction education to teachers. We can help you set up your school-based makerspace now!
Starting a School-Based STEM Makerspace: How Four Parents Did It

Patrick Song - Afterschool Hero

One day, Partrick Song was walking down the block in his neighborhood and saw that a nearby church had their doors open. Peeking in, he saw children playing with robotic cars. They were programming them with computers to control responses and direction.

He recognized some of the signage. It was MakerState. He didn’t know much about the program but as an IT consulting firm CEO, he knew he was looking at a quality program taking place and sought a meeting with MakerState.

“I couldn’t believe what I was looking at really,” Song (with son, Xavier, at left) recounts. “This was cutting edge stuff, even for NYC.” Says Song: “I own an IT consulting firm and I know what makes a great programmer or engineer. And they’re doing this with six, seven, eight year olds.” So Song signed up his son. They both loved the fun building and coding experience.

The next move was clear says Song. He wanted maker ed in his son’s school. So he approached his son’s afterschool’s program director at PS 87 in New York City. After establishing the program’s need for STEM education, Song worked with the afterschool director to bring MakerState makerspace programs to his son’s school. This was his strategy:

“The absolute first step is to establish what programs are already available in the school in the first place,” said Song. The New York City father of two, recognized that the afterschool lacked resources and realized that his company could make contributions to the program. As his firm was a tech company, Song knew that he had about 12 laptops that he could give away. Song knew that the
director would have no doubt that he was very serious about bringing a Maker program into the afterschool program if he was willing to make donation or provide some volunteer help.

You Are Part of the Package

Offering valuable materials was a key tactic for Song but he says that it doesn’t always have to be supplies that you offer. “It could be parents agreeing to help out,” said Song. Song added that parents can offer to advertise the program and assist with outreach. Afterschool coordinators really just want to provide the most engaging and enriching programming for their programs. “MakerState was a no-brainer,” says Song.

Song counseled that to bring a maker program into the school day curriculum would require a different approach. As schools are strapped for resources, parent associations are working hard to fund anything from assistant teachers to music classes. Thus, Song says that getting involved with your child’s school parent association is critical. Song suggests that requesting a program like MakerState to come to your child’s school and doing a presentation or conducting a pop up makerspace event can show the parents and the school staff what a maker program can really do.

Lastly, Song noted that it’s helpful to have a discerning eye when examining maker programs. Already involved in technology professionally, he knew what to look for. Hands-on, real-world-connected, STEM-mastery-based creative projects. The bottom-line according to Song is to look for a quality program to bring to your school. “MakerState just gets it,” said Song. “Engage first, inspire kids’ creativity, and build toward mastery.”
Andrew Chu – Solving Social Problems with STEM/Maker Education

Andrew Chu moved into a neighborhood in which he planned for his child to attend a great public school with an excellent reputation. Everything was set until it was not. By the time Chu’s child was school-age, new rezoning laws required Chu’s children to go to another school just a few blocks away but lacking the attractive achievements for which he had moved to that address in the first place. The rezoning caused much controversy in Chu’s Manhattan neighborhood which was covered by many news outlets.

The young father of a preschooler fought it at first but then he changed his mind. Chu saw the rezoning as an opportunity to create change and help a struggling school reach new heights. If the school needed improvement, he would figure out just how to do it. Chu decided that bringing a maker program into the schools would give the vital boost the school needed to bring a community together and improve the school’s educational offerings at the same time.

“How do you get different members of the school community, different members of socio-economic backgrounds, different ethnicities, just different demographics all in a 10-square block radius to be a creative school where all types of communities interact positively?” Chu asked and then answered. “I think makerspaces are the key.”

Chu found that maker programs could be the answer to bringing a very divided school community together. “Giving these kids the opportunity to teach each other and at the end of the day, build things together,” Chu said. “That’s how you really to create connections and relationships.”

Chu reached out to MakerState, who was ready with a coding and physical computing program built around littleBits, Minecraft, and Scratch. They prototyped a program in the first year, made possible by a donation from MakerState. In the second year, Chu rallied the PTA to help bring a wider
program as part of the “Dream. Think. Do.” theme at the school that year. “It was a perfect fit,” said Chu. “We were looking for something extraordinary for our kids. MakerState helped us deliver on the promise.”

Don’t Leave Out Elected Officials

Chu had a bigger vision still. “Let’s get the teachers trained in what MakerState does,” said Chu. It was an obvious step, his fellow volunteers on the PTA agreed. Chu proposed it to PS 191’s principal, Lauren Keville who got on board quickly after having experienced success with the program. Then he approached City Councilwoman, Helen Rosenthal who provided funding for a pilot program within the same school year. Chu is now working on seeking government and other funding sources to fund a third year of the STEM/maker program—this time for a full year program, training teachers to continue the coding and maker learning. As the school extends to 8th grade, the plan to bring maker programs to middle school students who can then teach younger students in the elementary school is in the works.

Still, funding this initiative will not be easy. Funding for schools is dependent on enrollment in the school as well and Chu hopes maker programs will make the school become more attractive. “This is kind of a chicken-and-egg to put some things in motion so parents are willing to enroll their kids,” Chu explained. “Over time, the seats get filled. And the school becomes excellent.”

Lena Kempe – DIY Afterschool Maker

Kempe had wanted a maker program in her son’s charter school since she heard about coding and maker education in the news. She had found out that MakerState was willing to provide a program, however her school refused. The rule: Afterschool programming at her child’s school could not be offered by outside vendors. And while her son’s school had amazing performance on test scores, they weren’t offering STEM or maker programs during school or after.

Faced with a difficult situation, Kempe decided that the best course of action was to rent out a space and create her own afterschool program near her child’s school. There she would offer courses not given in her child’s school’s afterschool program.
The solution was simple. She partnered with MakerState to run the entire program. They rented the space and did the outreach to families. MakerState provided the materials and the trained Maker Fellow instructor. She was a successful executive. But running an afterschool program was not part of her skillset. And she didn’t have time in her busy schedule to coordinate it. For Kempe, partnering with MakerState and hosting the program nearby her child’s school turned out to be a great solution. After starting off with a robotics and coding program, Kempe’s afterschool also offered classes in Mandarin and chess. She continued to run this program until her child graduated from the school, with honors in writing, art, math, and of course, computer science.

Karen Cape – “Know Your Audience”

Want a STEAM/maker program at your school? First step is to secure a parent ally like Karen Cape. And if you are a parent who enjoys getting involved, follow Karen’s example to superpower your school with hands-on, STEAM learning.

Karen Cape never really considered herself a “parent leader” at PS 199. She hadn’t held an official position with the PTA but did help out on special projects where she could over the years. And she knew she wanted her little girl to have a shot at coding, rocket science, and engineering. At a thriving school such as PS 199, the possibilities for new and innovative programs seemed endless. Her experience volunteering in the school easily allowed her to build relationships and gain a deep understanding of her child’s school’s needs. After she found a promising STEAM program to bring to her child’s school, she began the process just as she had done all her other volunteer work at the school--with professionalism, enthusiasm, and confidence.

“You must know what the school has, what they want, and what they need.”
-Karen Cape, parent, changemaker, STEAM champion, P.S. 199, New York City

Get Involved for the Fun of It

Even though Cape has a full-time job, she still found ways to volunteer her time at the school. She always raised her hand to do all kinds of jobs because it made her feel good and her daughter was happy to see her contribute. There were many opportunities so she picked the ones she liked the most and they usually involved STEAM activities, the subject areas about which she’d always felt most passionate. As Cape came to know the school better and had more
ideas to improve programs, she learned that making change was very possible.

“I find that the more involved with the school you can be, the more helpful that it is to you when you want to do something special at the school,” Cape explained. By volunteering, parents can grasp what the school budget looks like as this budget will always be available to any parent at the school. By getting involved, parents can learn how much money is spent and earned and which programs have been successful in the past. Additionally, one can learn who the officers are, who handles which responsibilities i.e. Who updates the calendar, who issues the permits, etc.

To date, Cape has worked with MakerState to bring in rocketry, virtual reality, coding and game design, eco-engineering and more through special events and Pop Up Makerspaces at the school. And she helped bring MakerState to her community as the local STEM Summer Camp. She’s helped plan an in-school STEM elective offered by MakerState as an in-school elective for students in the upcoming academic year. “I'll be supporting this program at PS 199, even after we graduate,” said Cape. “It’s what kids need.”

Cape’s advice to parents wanting to do what she did is straightforward and simple: know your audience. “Parents often don’t know exactly how to describe the power of learning to code an Arduino,” said Cape. “They do know they want their children to navigate unknown futures and technologies safely, and with creativity and joy. So you just find a program at that point and get it going.”

Some schools are lucky enough to be strong in science and math. Others don’t have a dedicated science teacher or coding program. “We learned about what we most needed through hosting pop up makerspaces and special events. When we wanted to make it a permanent program,
MakerState made it easy,” said Cape. Above, Karen administers school awards at the PS 199 School Fair.

Be Creative, Be Professional

Cape also found that being creative was essential to getting things done. Cape knows that even in the best schools, sometimes there just isn’t enough funding. However, offering opportunities for her favorite maker program to interact with her large school community was an advantage she could offer. Cape found ways to attract partnerships by strategically offering partner exclusivity at events, publicity mentions in email newsletters, posters, playgrounds, as well as ad space. MakerState had already been prototyping a free makerspace program nearby for a school in need. And they were starting a STEM Summer Camp in the community. Cape needed a STEM/maker program. The match was easy.

Of greatest importance, Cape had built a strong relationship with the principal by having done so much volunteer work. She eventually came to lead a “STEAM Team” within the PTA to raise money to build a greenhouse for lab research at the school. As her work would require approaching the principal periodically, she always made sure to be mindful. “I know that principals are busy,” said Cape. Thus, she always kept her interactions brief including emails. She always assumed that her principal had other interests that would compete for her attention so whenever she advocated for something, she made sure she was clear, brief, and effective. When she pitched to her principal about adopting a STEM/maker program of her choice, she discussed:

- How STEM was their kids’ future
- How this STEM program added value and distinction from what the school currently offered
- How successful the program was in other schools and how affordable it was
- How much the kids love the hands-on STEM learning
- How the parents love the MakerState Reports they get every day saying what their kids built and learned
- How great the program leadership was and how it aligned with the core curriculum of the school and key learning standards
- How her program of choice was certified to train the staff to meet the requirements of New York City Mayor Bill DeBlasio’s CS4All Initiative on making sure all schools offer computer science education by 2025 (teachers at right learn to teach coding in our workshops)
- How we could support her learning objectives and help her build new skills among her team

Notice how many points within this pitch are reliant upon a strong pre-existing relationship built on volunteer commitment and trust. Because Cape had exhibited diligence, passion, and competence throughout her volunteer work, any reasonable request from Cape would merit consideration. Add to that, a solid maker program with a track record for engaging elementary students in science, coding, and engineering, and your school is setting the gold standard for STEAM education like PS 199.
Top Ten Tips for Parents in Starting a STEM/Makerspace

Remember, you and your fellow parent-teammates can divide these tasks to do more together!

1. Do your homework

Before approaching your principal, find out what STEM or maker program may already be in existence. For example, if your child’s school does not have a separate science teacher, perhaps a maker program can fill this void.

2. Get involved at school

You can create change easier if you become part of the parents’ association in your child’s school. Remember that this is the most organized and vocal group of volunteers at your child’s school. As they increase their funding capacity, they also increase their influence. To make your agenda part of their agenda, you must do your part and help with the association’s needs. Helping host special events is fun and effective way to be very involved.

3. Set Up Your Own STEAM Team or makerspace club

Some school PTAs have science committees. STEAM Team’s are a growing trend. Many are starting makerspaces. Take advantage of the fact that STEM and STEAM curricula are considered trendy and cutting edge in education today. You might be surprised at how fast your fellow parents show interest and support.

4. Offer to help when you ask for something

When approaching decision makers, don’t just make requests. Always offer specific ways in which you and anyone else can offer supplies and volunteer hours. Common problems that concern decision makers are:
   a) cost of program
   b) supplies needed (i.e. parts, computers, tablets, paints, pencils, printers)
   c) outreach
   d) assistant teaching
5. **STEAM Dreams? Show me the money!**

Coding and robotics program are cutting edge for many schools. For others, it’s not what’s being tested right now. Maybe you’re somewhere in between but still don’t have the resources to make it work. Be assured: Funding exists for school programs via local leaders and national foundations alike who have resources to help start new programs. Very often, there are discretionary funds for innovative school programs in budgets for the current year. Trying to help your school become an exemplar for 21st Century STEM education? Reaching an under-served population with transformative STEM/maker learning? There are tremendous resources offered by leaders and institutions that share your mission and vision.

6. **Host a Mini-Maker Faire or Pop Up Makerspace in your school or community**

   a) Enlist MakerState to coordinate a school event or fundraiser with [hands-on maker stations and exhibits](#)
   b) Apply to create your own ongoing [Mini-Maker Faire](#)--awesome!
   c) Raise money by asking local businesses and school-related vendors to participate
   d) Use the event to gain support among school parents for maker programming
   e) Encourage student makers to show off their creations
   f) Start a LEGO Robotics team, Club Makerspace, or MakerState Maker Fellowship program with your momentum

7. **Find opportunities or challenges at your school to address**

   Maker education is impactful for kids for so many reasons—it’s student-centered, it builds STEM skills, and it’s really versatile in application. It’s about collaborative process and real-world problem solving. So take a look at some problems or opportunities your school really needs to address. What are your principal’s goals for staff? What are the learning objectives of teachers? What vision or dream does the PTA hold for kids? Your maker ed program can help address existing schools. Whether it’s helping satisfy learning standards in STEM, helping teachers meet professional development hours requirements, or raising money for extra technology, field trips, or scholarships, a maker/STEM program can carry you forward. When you meet key stakeholders where they’re at, helping them with the goals or challenges they have, you create win-wins.
8. Life skills can be part of school too

There are skills that go well beyond the “three R’s”. Skills that empower kids across the curriculum in critical thinking, communication, consensus building, perspective-taking, and leadership. The makerspace is the ideal setting for fostering these skills. As kids research, design, prototype, and present, they learn how to manage relationship and lead for change. And they’ll build healthy friendships and social emotional skills to carry on into adulthood. This empowering process is really about developing identify and discovering purpose. We’re obligated to give our kids this opportunity. If your school looking to take it the next level in social-emotional and soft-skill development, a STEM/makerspace program will be a great addition.

9. Do Your Own Classwide or Schoolwide Design Challenge

One great way to jumpstart a maker/STEM program is with a classwide or schoolwide design challenge where kids build something together or individually on a creative prompt, with constraints of resources and time. When we get students together for a few hours to design physical or virtual prototypes, it’s often called a hackathon. Software applications, games, and entrepreneurial or social activist projects are often the rapidly prototyped products. MakerState also offers a design challenge that can be completed online from home or school. In our design challenge, kids use Scratch programming blocks to code and move sprites (Cassie and the dinosaur) on a dance floor and create their own routine. Sprites are even able to talk to or think about each other as they dance. This is a super-fun activity that takes about an hour and all that’s needed is an internet-connected computer. Our design challenge is great activity for the Scratch Foundation’s annual Scratch Day or the Hour of Code project too!
10. **Ask for support from local businesses or community organizations**

Local organizations, whether they be non-profits, start-ups, or faith-based institutions love to hear from schools about kid-centered projects and ideas. If you do not have enough funding to buy supplies, hire more instructors, or rent space, try talking with a local company to see if they can help. In exchange for deep discounts or complimentary supplies, you may want to organize co-sponsored events, organized feedback on programs and products, and even social media shout-outs that help build community around your school. Let the kids be as involved in brainstorming, designing, and leading these projects. That’s maker learning too!

11. **Subscribe to your favorite organizations for ongoing inspiration**

Check out the latest cool projects from the greater maker movement at [Make Magazine](https://www.makemagazine.com), [Instructables](https://www.instructables.com), and [Shapeways](https://www.shapeways.com). Dive deep in special focus areas for skills like coding at [Scratch](https://www.scratch.org) or [Code.org](https://www.code.org), robotics at [LEGO First League](https://www.first.org) and [Arduino Education](https://www.arduino.cc), or [Minecraft education](https://www.minecraft.net). And stay in touch with organizations that foster maker education like [Computer Science for All New York (CS4all)](https://www.cs4all.org), [Mozilla Hive Learning NYC](https://www.mozilla.org), [Schools That Can](https://www.schoolsthatcan.org), and [4.0 Schools](https://www.40schools.org). Subscribe to these newsletters and stay on top of their social media as well. You’ll learn about cool beta-products and sales, conferences, competitions, and education programs that can provide great inspiration to your school. Once you're a bit familiar with an organization, reach out to connect with their in-house community relations or educational specialists. They may be looking for their next school partner!

12. **Set up a meeting with a school leader**

You want to start a STEM/makerspace and you have a lot of resources compiled. You’re an enthusiast, a budding expert even, and a rising parent/teacher leader on the topic. Take a moment to just celebrate yourself--you are an inspiration to your kids and a transformative influence for your school. This is your time to make it happen. You’ve done your research. You might even have pulled together a proposal with help from this guide or with the help of one or more of the organization’s listed here. You have your pitch ready and you believe in what you’re doing. Don’t “just pop in for a quick chat” with your principal, afterschool director, PTA leader, or local community decision-maker. Set up an appointment, present your idea, and
close your meeting with an agreement on next steps and a firm date on when that will be discussed. Helpful steps:

1. Bring “Why STEM Programs Are Important” to your meeting! (next page)
2. Consider bringing a list of local schools that have makerspaces and/or examples of successful programs
3. To talk brass tacks, bring your three models with prices below

Don’t forget to reach out to MakerState for help making your pitch, holding your meeting, or helping formulate your plan. Setting up kid makerspaces is what we do!
Why STEM Programs Are Needed for Our Kids

KEY FACTS:

- Computing jobs are the #1 source of new wages in the United States. Source: Code.org

- STEM jobs make up more than 1 out of every 10 jobs in the United States and have wages that are approaching nearly twice the U.S. average. Source: U.S. Department of Labor

- By 2020, there will be 1.4 million jobs available in computing related fields. US graduates are on track to fill 29% of those jobs. Women are on track to fill just 3%. Source: Girls Who Code

- STEM occupations are projected to grow by 17% from 2008 to 2018, compared to 9.8 percent growth for non-STEM occupations. Source: United States Department of Commerce

- Students with an interest in STEM continue to show higher levels of college readiness than ACT-tested students as a whole. Source: ACT Report: The Condition of STEM 2016 ACT

- Among individuals whose highest degree is a bachelor's in Science and Engineering, those with degrees in engineering or in computer sciences/mathematics were the most likely to have a job in their degree field: 53% and 50%, respectively. Source: National Science Foundation
In September 2015, NYC Mayor Bill de Blasio announced Computer Science For All (CS4All), a 10-year initiative to scale computer science education to 100% of the city’s public schools.
Source: CS4All: NYC

New York City Schools with MakerState STEM Makerspace Programs

Anderson School - PS 334
Ben Porat Yosef
Bronx Community Charter School
Community Roots (PS 67)
Community Roots (PS 67)
Connelly Middle School
Cornerstone Academy for Social Action
Dalton
East Village Community School
Fordham Leadership Academy
Fordham Leadership Academy
Harlem Hebrew Language Academy Charter School
Hunter College Elementary School
International School of Brooklyn
Manhattan Country School
NEST+m
Pine Street School
Pioneer Academy
PS 107
PS 11
PS 133
PS 14x
PS 158
PS 191
PS 199
PS 267
PS 333
PS 40
PS 452
PS 59
PS 6
PS 65Q
PS 65Q
PS 75
PS 87
SAR Academy
The Day School at Christ & Saint Stephen’s
The Neighborhood School
The Quad Manhattan
The School Columbia
VOICE Charter School
West End Day School
# Three Options from MakerState

<table>
<thead>
<tr>
<th>Club Makerspace</th>
<th>Partner Makerspace</th>
<th>Turnkey Makerspace</th>
</tr>
</thead>
<tbody>
<tr>
<td>* MOST POPULAR *&lt;br&gt; * YOU RUN THE PROGRAM *</td>
<td>* FULL SUPPORT *&lt;br&gt; * YOUR INSTRUCTOR *</td>
<td>* LET US DO EVERYTHING *&lt;br&gt; * GET STARTED NOW *</td>
</tr>
<tr>
<td>Run your own makerspace club in-school, after-school, or out of your home, scout troop, or community/faith center. We’ll set you up with a great Challenge Curriculum and materials to you run your own awesome Maker Club! All you need is five or more interested kids/families and you are ready to start right away!</td>
<td>MakerState partners with you in setting up and running your own in-school or after-school STEM Makerspace. Let us know who your instructor is and we will provide them with Maker Fellow training, ongoing support, and our award-winning “Challenge” curriculum and materials to make the program happen for the semester. Also includes fundraising supports to help pay for your makerspace.</td>
<td>MakerState provides everything you need for your makerspace: a trained Maker Fellow instructor, our award-winning “Challenge” curriculum, and all the the maker materials to support the program. Includes a student Exhibition &amp; Pop Up Makerspace for your students to show off their builds and lead other kids in making!</td>
</tr>
</tbody>
</table>
| Features:  
- A MakerState Challenge Curriculum in one of over 20 content areas including coding, robotics, game design, rocket science, digital arts, and more.  
- Supporting materials for running your club for a semester  
- An initial training in how to start and run your Club | Features:  
- Access to a MakerState Challenge Curriculum in one or more subject areas including coding, robotics, game design, rocket science, digital arts, and more  
- Supporting materials for running your club for a semester  
- An initial training in how to start and run your Makerspace  
- Support for establishment and operation of your makerspace  
- Participation of one of your instructors in our Maker Fellowship, featuring initial content and classroom practice training as well as ongoing coaching throughout the semester  
- A student exhibition and Pop-Up Makerspace student exhibition to introduce STEAM and making to the greater school community!  
- Funding support to help pay for your makerspace (PTA Fundraiser Program, grant writing, DOE/city contracting support) | Features:  
- A trained Maker Fellow instructor  
- The MakerState Challenge Curriculum  
- Everything you need to start and run your club for the semester  
- Fundraising support to help pay for your makerspace (PTA Fundraiser Program, grant writing, DOE/city contracting support) |
| $1,000-$1,500 | $3,000-$5,000 | $4,000-$7,000 |
Our Learning Standards: Fiero & Flow

At MakerState, setting up and running STEM makerspaces in schools is what we do. So if you said we’re an engineering design and coding makerspace program. That’d be totally true. Our kids play to learn and learn to build with code, robotics, and aeronautics. They iterate toward mastery, all along building prototypes of possible futures. But there is a much deeper reason why we are here. It’s what has taken us from simply teaching hands-on STEM to a mission of transforming kids’ lives. It’s sharpened our focus and driven us to improve the experiences we foster every day. We help kids discover their true identities and find purpose for their lives. Yes, we’re in the STEM makerspace game and we love it. But really, what we do is kid empowerment. And you can see it in moments of joy and discovery as kids find purpose every day in our makerspaces.

The process of playing, making, and learning leads to new passions and masteries in creativity and technology that will empower our children throughout their lives. These joyous moments of experimentation and mastery lead us to our identity and our purpose. We’ve found that these moments can be best described through two transformative positive psychology concepts called “fiero” and “flow”.

| The Flow State: when you’re in “the zone” and the rest of the world slips away— you’re finding new passions, skills, and purpose | The Fiero Moment: when you persist through difficulty, overcoming challenge, and discover self-sufficiency |

You’ve hopefully had lots of Fiero and Flow moments in your own life. You might have reached these moments while bonding with loved ones, finding deep learning in a class, achieving a win at work, excelling in sport, or in the joyous process of creating new art or playing beautiful music. I hope you can pause with a smile and remember some of these moments. We believe these moments can be fuel and foundation of our kids’ lifelong motivation for learning. These moments guide us as learners and humans. They may be fleeting at first as we
get used to [kinda scary at first] extended autonomy, calculated risk-taking, and empathy-driven creativity. But they become actual states of mind. We'd like to think: the MakerState of mind. For us, these moments are the foundation of learning and the future of school. Fiero and Flow are our Learning Standards. What we seek every day with every child.

**How does Flow fuel deeper learning?**

The “Flow State”, as first described by the psychologist Mihály Csíkszentmihályi, is a state of focus and exhilaration that is often compared to “being in the zone.” Flow is achieved when we immerse ourselves in an activity so deeply that the rest of the world disappears and we are immersed in a creative or exhilarating experience that brings us deep focus, joy, and reward.

**From Consumer to Creator**

At MakerState, Flow happens when our young engineers bring new ideas to life. It’s here where they find new passions, skills, and a sense of purpose. Observers may be able to recognize Flow when watching students create a rocket that finally transports a special payload safely or when they design a new comic character that faces—and solves—an actual conflict or challenge they’re concerned about in the real word. Flow happens as a child codes a victory condition and a scoring mechanism for his own game and posts it online for others to play. It’s in every experience where engagement and creativity meet new skill and possibility. That, to us, is what school can be.

Creativity in programming is at the heart of Flow. MakerState emphasizes computational thinking and coding because these are thought and language protocols that allow us to create modern technologies. They help transform our kids from passive consumers of media and technology to the active creators of their own world. Here’s our master plan: get kids so used to being in Flow, they seek it in every part of their lives. If you’re a parent, we’re just putting words to a dream you’ve always had for your child. If you’re a teacher, it’s why you got into the game. Yeah!
How does Fiero drive learning?

Little wins, big discoveries, and everything in between. That’s Fiero, an Italian word for “pride.” At MakerState, it’s the pride in yourself when you persist through challenge and achieve a win, big or small. Those wins come in many forms, most often when you’ve struggled and tried and persisted...and then wow! You got it right. Or just a little more right. When you tap that feeling, you’ve become a self-directed learner and creator.

Psychologists may describe Fiero as an elevated state of emotion. Designers build these fiero moments into games to continuously challenge and reward players. Performance in sports, art, and music give artists and athletes the same immediate feedback and reward. Neurologists say this activity takes place in the brain’s hippocampus. Short-term experiences of engagement when a person achieves mastery are then transferred to long-term memory of mastery and practice.

What if we could create a better world? What if we started by imagining a world where all of us could thrive? Can games really part of learning? Can we visit the distant corners of earth with no carbon footprint? Could we introduce products that make our lives more productive, enriching, and fun and those products be offered into a sustainable, equitable marketplace? Our short answer is YES! It’s going to be your generation of kids that does it.

We at MakerState continuously foster these Fiero moments through creative projects, rooted in the engineering design process and focused on building meta-skills that can be applied across space and time.

At MakerState, we seek Fiero moments every day for our kids in each of our Challenge Lessons. Those “a-ha moments” or hands raised in victory that signify Fiero go much deeper and have a much more lasting impact than we may suspect. They come after exploration, struggle, failure, and learning. These are the rewards of problem-solving and persistence. They reinforce the productive value of inclusive communication and collaboration. They are the unforgettable moments that give life meaning. They can happen every day for our kids.
Fiero & Flow: An Obligation to Our Kids

We ask our kids to identify in Fiero and/or Flow in each makerspace session. We're building a mindset here: a desire for deeper learning, achievement, mastery, and purpose.

The Flow state becomes a state of mind. We learn to exist in that Fiero moment. Kids will carry these moments from our program into every other class they have and into their personal relationships, careers, and life pursuits. This is how we at MakerState prepare our students for a future that none of us can foresee today. What we’re really describing is a transformative way of being for our kids and an irreversibly innovative educational model for their schools. We at MakerState believe that if we can immerse kids and teachers and parents into enough Fiero and Flow experiences, they will develop an insatiable desire for transformative life-long learning. These moments build problem-solving skills and social-emotional maturity. They give us the skills to plan and achieve what we envision. They imbue us with desire and determination to build our dreams. We can’t wait to see what our kids make next.

A young engineer shows off his Challenge badges in STEM skills.
Books that guide MakerState in its approach to student-centered STEM learning

An Ethic of Excellence: Building a Culture of Craftsmanship with Students, by Ron Berger
Veteran teacher and Expeditionary Learning leader Ron Berger details a way of learning in which students get into the flow of revision towards mastery and demonstrations of applied learning for real world audiences. A seminal work how to on formative assessment.

Invent To Learn: Making, Tinkering, and Engineering in the Classroom, by Sylvia Libow Martinez and Gary Stager
Engagement, engineering design and building are the core of learning say maker movement champions Sylvia Libow Martinez and Gary Stager. Learning by doing and making—a century after John Dewey called for “learning by doing” in schools that formed the bedrock for a thriving democracy, Martinez and Stager make the case for “learning by making”. Every classroom can become a makerspace, combining art and science through student-centered digital-age learning.

Reality Is Broken: Why Games Make Us Better and How They Can Change the World, Jane McGonigal
Game expert Jane McGonigal defines that “gamer sense of being fully alive, focused and engaged in every moment” with experiences that offer thrilling challenges to level up and constant chances for collaboration, creativity, and revision toward mastery. School design can learn great lessons from the mechanics and psychological dynamics that drive great games: exploring roles, teaming in diverse communities, encouraging choice, realizing innate rewards, and framing and seeking after our own “epic wins”. Our focus on high stakes tests instead focuses on winning vs. losing, creating a fear of failure. Our kids will face big challenges and amazing opportunities. What if our schools were designed for these quests?
Drive: The Surprising Truth About What Motivates Us, by Daniel Pink
Pink dispenses with carrot-and-stick incentive/punishment basis of modern business and schooling and establishes three new benchmarks of true motivation for our kids and society: autonomy, mastery, and purpose. With emphasis on scientific research on human psychology, Pink makes the case for self-direction, creative invention, and the innate desire of all humans to transform their world for the better.

Makers: The New Industrial Revolution, by Chris Anderson
A manifesto for the ownership of production by the end-user. Chris Anderson defines the Maker Movement’s impact on individuals and our economy with big ideas on hands-on innovation, crowdsourcing of ideas, “locavore” manufacturing, biotech engineering (“DIYBio”), and programmable matter, that unleashes the creative potential of a new generation of tinkerers and inventors.

The Element: How Finding Your Passion Changes Everything, by Ken Robinson
Robinson defines “The Element” as the point at which natural talent meets personal passion. Robinson asks not “if” but “how” our kids are intelligent and calls for a transformation in education from factory-model schooling toward the fostering of “applied creativity,” heroic non-conforming courage, determination, mentorship, circles of influence, and finding one’s tribe. Schools can be a place where attitude meets aptitude, where “work” is replaced with “passion”, and where kids are empowered to find their life’s purpose. Check out this great RSA Animate whiteboard of Sir Ken Robinson’s TED talk “Changing Education Paradigms”.

[Image of RSA Animate whiteboard of Sir Ken Robinson’s TED talk “Changing Education Paradigms”]
MakerState & Student Union STEAM-mastery makerspaces for kids

We empower kids ages 5-18 with new science, technology, engineering, arts, and math (STEAM) passions and skills through hands-on, in-school, after-school, and summer camp courses in coding and video game design, robot engineering, wearable electronic fashions, 3D design, rocket science, moviemaking, and more. We run more than 100 school-based makerspaces in NYC and are proud to be a NYC DOE CS4all professional development provider, helping train over 5,000 New York City teachers how to teach coding to their elementary students. Learn more about how MakerState is transforming STEM and coding education at www.maker-state.com.

About the Author
Stephen Gilman, Founder, Executive Director, MakerState

Stephen and his son Ben started MakerState to bring fun STEAM building and learning projects in robotics, coding, game design and more to all kids, schools and communities (STEAM: science, tech, engineering, arts, math). Stephen’s mission is to help transform K-12 education from lecture-based memorization to student-centered, inquiry-based experiential learning. He works to empower kids with life-transforming passions and creative masteries in 21st skills and 21st century technology. Stephen is a founding board member of the Urban Assembly Maker Academy, a founder of the Carnegie Learning Center, and founding teacher and dean of Bronx Expeditionary Learning High School (now Bronx Collegiate), a public school based in Outward Bound experiential learning. He is a founding board member of the volunteer network, UlsterCorps, and is the author of Nightshade, an historical thriller detailing a 1702 conspiracy to control the Atlantic slave trade. Stephen enjoys geocaching, hiking, biking, game design, and creativity of all kinds, especially if it’s with Ben and his partner Laura.

About the Editor
Jenn Choi

Jenn is a writer specializing in parenting, education, and technology. Her blog at Forbes.com and Toys as Tools have informed many parents and professionals about best uses with educational technology and educational toys. She lives in New York City with her husband and two boys.