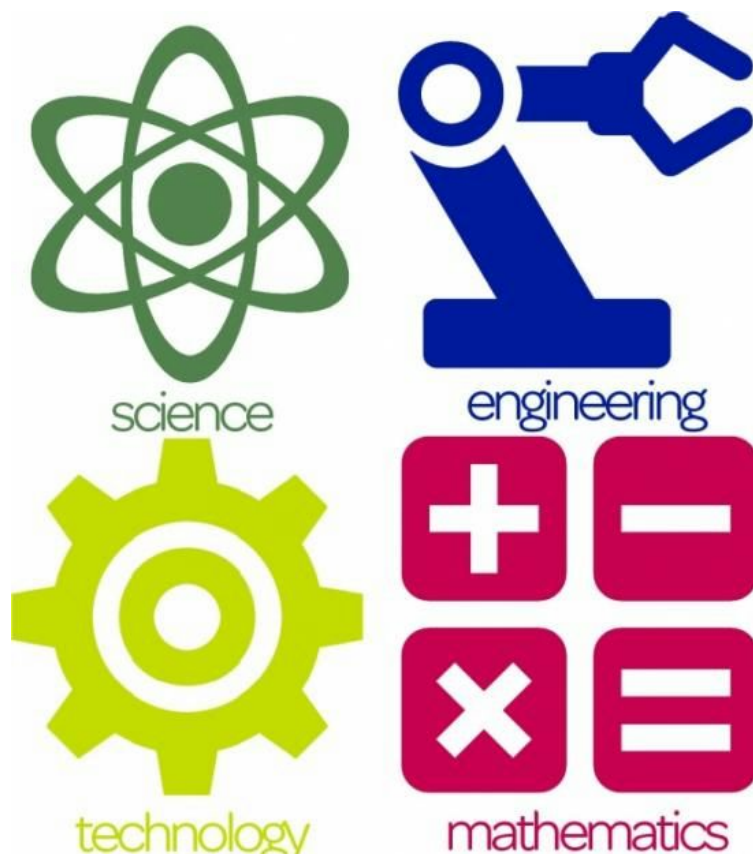


Starting a STEM Lab at Your Site



Tips, Tricks, Resources &
Ideas to Help Get You Going!

by [Karly Moura](#), [Amanda Young](#),
[Wendy Townlin](#) & [Claire Simón](#)

¹ <<http://ctbbythenumbers.info/files/2014/07/stem-logo.jpg>>

Table of Contents

[Getting Started: First Steps, Building and Purchasing Tools](#)

[Gamifying Your STEM Lab with Challenges & Badges](#)

[Not Just Robots and Circuits: Incorporating Math, NGSS & ELA](#)

[Extension Activities](#)

[Additional Resources](#)

Getting Started: First Steps, Building and Purchasing Tools

On October 1st, 2015 the very first class entered our STEM lab and it was truly magical. The kids were engaged, they were learning, exploring and discovering the entire time they were in there. It was the moment we had worked so hard for when we created this innovative learning space. It was a long journey that our little STEM lab team took to get there and we learned a lot along the way!

The lab was originally [Wendy Townlin's](#) idea. She wanted to create a dedicated science lab for our school. It evolved into a STEM lab, then (with a little help from Twitter) we decided to add in the element of a makerspace. With the support of our awesome principal Kris Martin-Meyer, four of us, Wendy, [Amanda Young](#), [Claire Simon](#), and [Karly Moura](#) put our heads together, researched, reflected then began building. Here are some things we learned along the way.

1. Put your resources and ideas in one spot. For us that place was a collaborative Pinterest page. We were able to add ideas and resources from Twitter, Facebook, TPT or anywhere we found inspiration. Here is a link to our [STEM Lab/Makerspace](#) Pinterest page.



2. Find great people to connect with and follow those on Twitter that are already doing it! Don't reinvent the wheel. We also visited [Live Oak Elementary School](#) in San Ramon, CA because we had heard they were doing amazing things with technology. There we connected with [Nick Zefeldt](#) and Chi Shui who shared their awesome with us and gave us some incredible ideas. We also followed the experts on Twitter then took ideas that worked for us (and that we could afford to do) and tweaked them as we went along. The great thing about Twitter is that you are able to tweet to the experts and ask questions and they will respond and help! Here are our go-to makerspace gurus.



Diana Rendina

Diana Rendina [@DianaLRendina](#) <http://renovatedlearning.com/>



Colleen Graves

Colleen Graves [@gravescolleen](#) <https://about.me/colleen.graves>



Laura Fleming

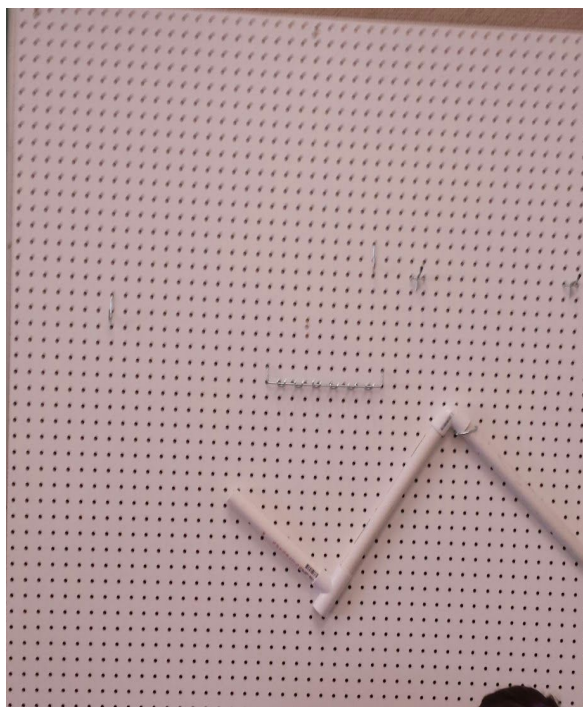
Laura Fleming [@NMHS_lms](https://twitter.com/NMHS_lms) <http://worlds-of-learning.com/>

3. Invest in some cool tech tools. There are many great devices and tools out there but here are the ones we have in our lab.

- [Dash Robots by Wonder Workshop](#). Dash is very popular in our STEM Lab/Makerspace! A cute little robot that can be programmed using apps at various levels. Dash is a fantastic edition because it can be used by our Transitional Kindergarten (TK) students as well as our fifth graders. The apps provide different levels of programming skills so the possibilities for using Dash are endless!
- [Cubelets from Modular Robotics](#). Cubelets are robot blocks that kids as young as TK can put together to form tons of different types of robots. We also purchased the Lego adapters to make even more creations!
- [LittleBits](#) by LittleBits. Small electronic building blocks that snap together to make circuits. We started out with 5 [Base Kits](#) \$99 and upgraded with 5 [Gizmo and Gadgets kits](#) \$199.95. This kits contains the materials to make tons of cool projects. Even the littlest inventors can create some seriously cool stuff. The step-by-step instructions provide lots of easy to build creations. Our innovative kiddos can use the [littleBits app](#) to browse through hundreds of project ideas or they can just start inventing their own! Each LittleBits tub we have contains the two base kits and one Gizmo and Gadgets kit, 5 Lego adapters and a bag of "maker" materials (cardboard tubes, tape, wire, lightbulbs, straws, paper cups, rubber bands and more) so students are able to create amazing things! We love these [LittleBits Task Cards](#) from Mrs. J in the Library. A freebie from TPT!

- Green Screen backdrop from [ChromaKey](#) sold on Amazon. We used PVC pipe to make a frame for the screen so it is moveable. Using the green screen with the [DoInk](#) app available on the App Store is an easy way to start using a green screen. If you want a cheap way to get a green screen check out the bright green shower curtains from the Dollar Store, they work great!
- [Sphero Robots](#) from [@Sphero](#) \$129.99. A very cool app enabled sphere shaped robot. Sphero is super tough and can get moving up to 4.5 mph! Sphero has it's own app for IOS and Android and can also be programmed using the [Tickle App](#) (currently only available for IOS). You must have a smartphone or tablet to use these robots so be sure to take that into account when ordering!
- [MaKey MaKey](#) from [@TheJoyLabz](#) classic starts at \$49.95. MaKey MaKey is an awesome little inventor's kit that turns almost anything into a touchpad. Plug the board into a computer and use the alligator clips to connect all sorts of fun objects creating your very own mouse and keyboard.
- [Piper](#) from [@withpiper](#) \$269.99. This amazing little kit includes everything you need to build a fully working computer! It includes a plywood case, 7" LED screen, Raspberry Pi, USB mouse, sensors, lights, buttons, power bank AND a DIY Minecraft controller! Once it's built students can build hardware in real-life to control to build and create in a modified Minecraft world. Piper is an engaging and very effective way to get kids creating rather than just consuming technology.

4. Build a Lego and Pegboard wall! We are VERY proud of our Lego wall and pegboard wall. The building, creating and engineering that is happening in these two spaces is pretty cool. Watching the kids put together pvc pipes to build a marble run or use the Legos to make a map of the school is pretty fantastic. Plus they are just plain fun! To make our Lego wall we followed Diana Rendina's tips found [here](#).



5. Find ways to connect and extend the learning after the students leave the lab. We are constantly growing and thinking of new ways to use our resources. Attending conferences, viewing webinars or finding information on Twitter is a great way to get ideas. Our team attended [Fall Cue](#) in October of 2015 and got a ton of great ideas to help us make sure we are using all of these "cool tools" to meet multiple Common Core and Next Generation Science Standards. See our [Extension Activities](#) section for more ideas and links to resources.

The most important factor in making our STEM Lab & Makerspace successful is creating a culture of innovation at your site. Our STEM Lab & Makerspace would be just that, a space with a bunch of cool tools, if we didn't have an amazing staff that is constantly learning and growing to meet the needs of our diverse community of scientists, technicians, engineers, mathematician and makers. The staff at [Sun Terrace Elementary School](#) deserves some major props for all that they do to bring STEM education to our students!

Gamifying Your STEM Lab with Challenges & Badges

Our STEM Lab/Makerspace is a HUGE hit with our students. Since Karly oversees the lab and takes the classes in she gets bombarded by kids all day asking if it is their day to go to the STEM Lab. They are building, discovering, exploring, designing, problem solving, and having a blast doing it. However, as the kids continued to explore the STEM Lab we began to notice that they had moved past the exploration phase and wanted a bit more direction and challenge. We realized that we needed to up our game a bit to take our lab to the next level so we decided to gamify our STEM Lab with challenges and badges! It took some prep but once the challenge cards and badges were created we were ready to roll. We are happy to share our tips, tricks and resources so that you can gamify your STEM or STEAM Lab too.

How You Can Gamify Your STEM/STEAM Lab

1. Make challenge cards.

We looked online for ready-made challenges and used the instruction booklets that came with our kits to create challenge cards for our students. As we add to our STEM lab and work to make our lab a true STEAM lab we will continue to add challenge cards and create badges to match. You can view our challenge cards and challenge card template [here](#). Feel free to make a copy to use and/or start creating your own.

Dash Challenge 8: Draw a Heart Level 2

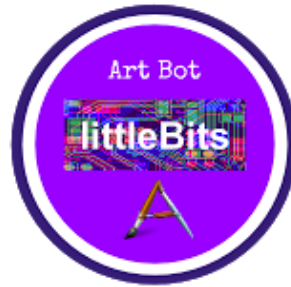


Make a Dash Robot that draws a heart using the Blockly App. *Hint, you may need the lego adapters, tape and a marker.*

Dash Challenge Card

2. Create your own or find ready-made digital badges.

We used Google Draw to create our badges. After following this tutorial [Creating a Badge with Google Draw](#) by [Alice Keeler](#) it was easy to create our own [template](#) and make our own badges. You can upload all of our [STEM Lab badges](#) for ideas and inspiration or use them in your own lab.



littleBits Art Bot Badge

Looking to find more badge resources? [Cate Tolnai](#), who inspired us to explore badges, shares lots of resources on Twitter and on her [blog](#). Also check out [5 Awesome Resources for Badges in the Classroom](#) by [Kasey Bell](#).

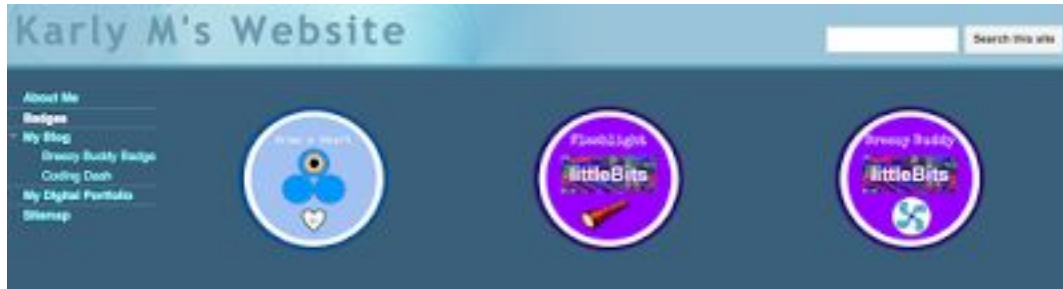
3. Identify a way to keep track of earnings.

In our lab we go pretty low tech with a simple [STEM Lab Student Check Off Sheet](#). Each student has their own check off sheet which is kept in a file under their teacher's name. While in the lab the students let us know when they have earned a badge and they get it initialed.

If you want to go totally digital check out [Creating Badges with Google Sheets](#) by Alice Keeler. This awesome post shows you how to create (in draw), then organize and assign digital badges with Google Sheets.

4. Display those shiny new badges!

Now that our students have started earning their badges they need a place to display them. The fourth and fifth graders are creating a Google Site as their digital portfolio so one page is dedicated to displaying their badges. The 2nd and 3rd graders will use this [My Badges](#) Google Doc assigned through Google Classroom to display their badges.



Example of "My Badges" page on a Google Site

What our Gamification & Badge System is NOT

So far our badge system has worked out really well in our STEM Lab. Our kids are excited about the badges and look forward to displaying them on their Google site or badge page. We are still working out the kinks and will continue to create challenges and badges as we grow our STEM Lab. However it is important to note what our challenges and badges are NOT.

- It is NOT a competition. There is no public display of which badges are earned by whom. The Google Sites and Docs can be shared of course but only if the students share them. Students who work together on projects all earn the badge. We go over this together and teamwork is encouraged.
- It is NOT a requirement. Students do not have to earn badges. It is completely optional for students to work towards badges. We also created "inventor" badges for students who just want to create something new but also would like a badge (check the badges folder and challenge cards for updates).
- It is NOT used for assessment. Our challenges and badges are a fun way to encourage students to create and discover in the lab. The badges give students something to "take" with them after their time in the lab. It can be tough for a kid to work hard on an awesome marble run then have to dismantle it when it's time to clean up!
- Our Makerspace is NOT gamified. When the kids are just making and creating there are no directions or badges to earn (other than an "I am A Maker" badge) just tools, resources and their own imagination.

Not Just Robots and Circuits: Incorporating Math, NGSS & ELA

Math

Lego Wall

Legos aren't just for playing or making marble runs! Legos are an excellent way to teach math concepts! [Use Lego to Teach Math Concepts](#) an article by Scholastic that contains ideas for using Legos to teach Part-Part-Total, Arrays, Multiplication, Division, Fractions and more.

Use Coding to Teach Geometry

Using Dash or Sphero and the Tickle App provides students with a concrete way to learn about angles, measurement, patterns, problem solving, computational strategies and more. In his article [Exploring Geometry by Coding With Sphero and Tickle App](#) Brian Aspinall breaks down the different areas of math that can be taught using robots and coding.

360° Math

Our lab has whiteboard covered cabinets which create 3 walls of whiteboards. The idea behind 360° math is that students are standing around the room completing their math problems while the teacher gives real-time feedback. [Ed Campos Jr](#) is where we learned about 360° math, visit his blog and check out this [documentary](#) to learn more. Also follow [#360Math](#), [@MathPrincessC](#), [@reubenhoffman](#), [@jasonseliskar](#), [@tbed63](#), [@AlexOverwijk](#), and [@jcorippo](#) on Twitter for more information on 360 degree math.

ELA

STEM into STEAM with Language Arts

Novel Engineering is so simple and easy to incorporate into ANY Language Arts program, theme or unit. “*Students use existing classroom literature – stories, novels, and expository texts – as the basis for engineering design challenges that help them identify problems, design realistic solutions, and engage in the Engineering Design Process while reinforcing their literacy skills.*” [novelengineering.org](#). You can use any

book that your class is reading and turn it into an engineering project. Use this [Design Process Hyperdoc](#) created by [Sean Fahey](#) to get your students familiar with the design process and get started with Novel Engineering.

Science: NGSS

Elementary Is Engineering [EIE](#)

EIE is a science curriculum designed with incorporating more engineering into our science teachings. They have over 20 flexible curriculums for grades 1-5. The EIE curriculum is designed so that each topic is adaptable to all grade levels 1-5. EIE also has after school curriculums for 1-5 and 6-8. Each topic has several engineering challenges and experiments in order extend the learning. Our STEM Lab serves as a perfect way for the teachers at our school utilize the resources we have in our lab and set up these engineering challenges.

Science Demonstrations

We all know a great way to hook students with our next science topic is through a great demonstration that leaves them wondering about the phenomenon they just witnessed. Our STEM Lab gives teachers a great space that allows them to set up, conduct, and clean up engaging science demonstrations without having to re-arrange or worry about making a mess in their own classroom. It also allows the extra space need for teachers to have students conduct their own investigation.

Makerspace

Our STEM Lab also serves as our school's [Makerspace](#). In our STEM Lab we have gathered materials such as cardboard, cardboard tubes, yarn, feathers, cups, plates, rubber bands, lots of tape, etc. Students have used these materials to make their own inventions as well as to add to and adapt the challenges we have presented using the little bits challenge cards. This year our school opted to do a Maker Faire instead of your traditional Science fair. We showed the students the video of [Caine's Arcade](#) and then presented our students with the [cardboard challenge](#). We have seen some great inventing, engineering and making come out of our makerspace!

Extension Activities

Blogging

If you are ready to have your students start blogging (or if they already are) having them reflect on their time in the STEM lab can make for an excellent blog post. Since your class has the shared experience of visiting the lab they can comment on each other's posts.

A blogging platform like [Kidblog](#) gives your students a safe space to write for an authentic audience while still giving the teacher the ability to monitor students blogs and comments. Unfortunately, Kidblog does cost money so check it out and ask other users to see if it's worth the cost.

Not quite ready for blogging or just want something free? Google Slides can provide your students with a blogging like experience in the class or beyond depending on share settings. You can share your students' "blog" posts with another class or even another school to give your students a global audience. Use this [STEM Lab Class Blog Template](#) and modify as needed.

Google Classroom

Another way you can have your students reflect on their learning in the STEM Lab is by posing a [question](#) in Google Classroom. This allows you to focus in on one key aspect you wanted your students to get out of the STEM Lab that day. This also poses as a more simplified reflection of what students learned in the STEM Lab by simply asking "What did you learn in the STEM Lab today?" One nice feature about asking questions is that it shows up in your classroom stream; all students will be able to see their classmates responses. This allows for you to be able to do your own mini version of blogging if you want by enabling students comments to each other. The comment feature allows you to extend this activity from a simple teacher to student conversation to a virtual collaborative class conversation.

Google Drawing

For younger students or as a quick reflection tool you can have your students recreate their inventions in Google Drawing. They can add text, images and can even make 3D shapes. For more ideas on how to use Google

Drawing check out [Eric Curts' Google Apps User Group](#) for tutorials plus a link to [40+ graphic organizer templates](#) you can adapt to fit your needs.

Padlet

Another simple reflection tool is [Padlet](#). A free application that creates an online bulletin board that anyone can use to display information including images, videos, attachments, text and more.

STEM Lab Reflection Hyperdoc

We have our students complete this [STEM lab reflection hyperdoc](#) after visiting the lab as one way to extend the learning. A simple 3-2-1 reflection, a Google drawing, a padlet link and a few games at the end provide students with multiple opportunities to show what they learned.

Show What You Know Bingo

Use this [Show What You Know Bingo hyperdoc](#) (originally created by Lisa Highfill) to have students create a project that will share their learning at the end of a lesson or unit. Each bingo box contains a link to a tutorial for students.

Google Site

Students can easily create a Google Site with an “announcement page” that can serve as a blogging platform. If students are already using Google Sites as their online portfolio, creating a “blog” page along with a page for displaying badges would be an easy addition. Here is a [Creating a Google Sites](#) hyperdoc with links to examples and how-to screencasts.

Additional Resources

- [Jerry Blumengarten](#) has a page on almost everything so it's no surprise that he has one on [STEM Education](#). Check out his site for TONS of resources!
- [Makerspaces.com](#) has a [FREE e-book](#) that includes a list of maker materials, conferences, links to conferences, Twitter hashtags to follow and MORE!
- Be sure to check out [Elementary Library Makerspace Resources](#) by [Colleen Graves](#) for a list of people doing amazing things with Makerspaces and STEM Labs.
- [Starting a Makerspace](#) by Lori Gracey from TCEA Technotes Blog.
- Check out this [Green Screen activities page](#) and [Creating a Green Screen Video in Your Classroom](#) from Scholastic for ideas for using a green screen with your students.

*Do you have more resources to share?
Please add them to this crowdsourced [padlet](#)!*