

MATT GOTTILLA

Designing STEAM Challenges

SESSION FOUR



KEY IDEAS

- ➔ Use web and print resources to gather inspiration for STEAM activities.
- ➔ The engineering design process is dual-purpose. Following it will help your students advance toward successful solutions in a systematic way, and as a teacher, you can also use it as a way to plan and structure your classes during STEAM activities.
- ➔ Authentic STEAM activities should challenge students to solve a problem that requires the application of knowledge, and should not be a step-by-step process students can follow to put together a predetermined product.
- ➔ Encourage creativity and discovery by allowing your students the freedom to fail and reframing failure as a learning opportunity!



PRESENTATION

bit.ly/designingsteam



RESOURCES

www.teachengineering.org
www.eie.org
STEM Labs for Middle Grades
The Big Book of MakerSpace Projects



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10 TIPS FOR SUCCESSFUL STEAM ACTIVITIES

1

STEAM is a prime opportunity for collaboration between learners. Design activities for partners or small groups of students where they can learn not only from the activity but also each other.

2

Come up with scenarios and context around your steam activities. Better yet, find an authentic need or problem for students to solve!

3

Encourage student creativity by choose activities or problems where there are many possible solutions and providing students with a large selection of materials to work with.

4

When working on a project where there are small parts needed or created during construction, having sealable containers or Ziploc baggies ready for cleanup and storage can work wonders to keep things organized and avoid lost pieces.

5

If you want learners to observe certain phenomena or focus on a specific concept, ask questions centered around those ideas on your distributed materials. Similarly, if there are important data for learners to note, provide charts or other means for them to record it.

6

Sometimes the hardest part of running a STEAM activity is not stepping in to correct students when you can see their idea is not going to work. Resist the urge and let them find out for themselves, as they will often learn and remember more from their failures than their successes.

7

Once students have achieved the desired functionality with their design, give them the opportunity to work on the aesthetics. Student engagement and enthusiasm is always boosted when they can really make a product their own.

8

Provide students the opportunity to reflect and share at the conclusion of an activity.

9

Sending a beginning of the year letter to parents asking for old toys, cardboard boxes and tubes, legos, and other donations is a great way to build your supplies at no cost.

10

Maker space organization is critical. Create labeled bins for different materials, have marked locations for tools to be stored, and have separate containers for cut parts that can be reused!



Students engineer unique solutions through an interactive design process.

Students are required to understand and apply knowledge from multiple subject areas to succeed.

Activities are focused on the process and the knowledge and experience students gain from it.

Students experiment, test and record data to inform design decisions.

Students assemble identical solutions following step-by-step plans.

Lack of challenge, material limitations, or excessive guidance eliminate student innovation.

Activities are focused primarily on the end product rather than the process.

Students design without a clear rationale or evidence-based thinking.



THE ENGINEERING DESIGN PROCESS

A Quick Reference

ASK

Clearly define the problem. Do research on relevant topics. Conduct experiments and evaluate results.

IMAGINE

Brainstorm different ideas for the solution. Try to come up with as many as possible. Compare, contrast and combine them!

PLAN

Create a detailed, labeled diagram of your plan. Include any measurements as well as a material list necessary to build your solution.

CREATE

Gather your tools and materials and build your solution based on your plan. Make adjustments as necessary.

TEST

Test your solution. Record the results. Evaluate the strengths and weaknesses of your design's performance.

IMPROVE

Make improvements to your initial design. Test out the new solution when done.

SHARE

Reflect on the process, solution, and results. Communicate your findings to your peers.

SAMPLE STEAM ACTIVITY TIMELINE

CLASS ONE

Students are introduced to the problem they are trying to solve and are given their groups. They research information related to the challenge and brainstorm ideas for possible solutions. Once they have come up with several ideas, they discuss and compare them.

Students plan out their design in the form of a detailed, labeled diagram and create a material list based on their plan. Students begin building their design.

CLASS TWO

CLASS THREE

Students complete their first design.

Students test out their design and evaluate it based on the criteria for success. They record any testing data, and if relevant, observe and record how their design failed. Based on this information, they create a new plan for an improved design and complete a labeled diagram for it. They may begin building their improved design.

CLASS FOUR

CLASS FIVE

Students complete their improved design.

Students test their improved design and record all relevant data. Students begin working on a presentation about their builds and experiences.

CLASS SIX

CLASS SEVEN

Students complete development of presentations and share them with their classmates.