

Teaching Guidelines

Practical, classroom-tested guidance for running hands-on STEM projects with confidence and control

These guidelines were developed in an after-school enrichment setting and optimized for rapid deployment, minimal lecturing time, and a focus on experiential learning. Please adapt as needed.

Before-Class Prep

- Acquire a firm understanding of the project's mechanics and key concepts. Build the project at home and try it out at least once.
- Gather and organize materials into containers that are easy to deploy.
- In the classroom, set up two stations: a building station (with hot glue when necessary) and a materials station.
- Arrange an open space for students to test their projects if needed.

Setup

- Set up materials table: set out containers of supplies. Make it organized. Messy materials gives students implicit permission to be messy.
- If using hot glue: Cover work tables with protective coverings such as cardboard, painter's plastic, or butcher paper.
 - Set up hot glue guns: plug glue guns into power strips and spread out on work tables (1 glue guns per 1 or 2 kids).

Suggested Lesson Structure (for 60-90 minute lessons)

- Announce the project at hand. Try to spend ten minutes or less guiding the students on how to build the project and explaining key concepts.
- Allow students to ask questions at predetermined intervals (e.g. at the end of your talk). Avoid digressing into minor details. Keep the momentum of your lecture going.
- The bulk of the class time should be spent supporting students as they build and redesign. Check up on the progress of each student and offer your help during this time.
- Have the students help clean up in the last five minutes.
- If you have more than 60-90 minutes, consider introducing real-world applications of the concepts or mechanisms at hand at the beginning of the lesson, and debrief lessons learned at the end.

Recommended Group Expectations

- Be safe, be respectful, be kind, and have fun!

- Help the teacher speed up the start-of-class lecture by being excellent listeners. This way, the teacher can say everything that needs to be said right away, which gives the students more time to build and test.
- Be an efficient engineer by taking only the materials you need. If students take exactly what they need and use it, then everyone spends less time cleaning up.

First-Time Teaching Tips

- Prepare a project that is easy for you and the students that does not require glue guns.
- Welcome the students and introduce yourself. Ask the students to introduce themselves to you as well. Have everyone turn to a neighbor to give him or her a high five and say “Hi buddy!”
- Briefly discuss what engineering is in your own words.
- Explain the class structure, including how cleanup is conducted.
- Go over class expectations.
- Tell the students what types of materials they’ll be working with and some projects they can expect.
- Encourage experimentation. Many good ideas have come from students, so give them permission to try new things. Let them know that failure is a great thing because it leads to greater understanding about what will work. Students should congratulate each other or high-five whenever someone fails. This helps take away some of the social stigma around failure.

Classroom Management

The most important part of a successful activity is a controlled classroom. Chaos = poor learning outcomes and stressed out teachers. To keep your class flowing smoothly, you can use these techniques:

- Use a consistent call-and-response attention-getters with your class (1-2-3 eyes on me; When I say/you say; If you can hear me..., Bum-ba-da-bum-bum/Bum-bum!)
- Briefly remind your students of your expectations at the beginning of every class.
- Give attention to students who are upholding your expectations. For example if students are talking loudly during the lecture: “Thank you John and Jane for being excellent listeners!”

Handling Disruptive Behavior

“Bad” behavior is a signal that the student isn’t engaged. Students often misbehave because they’re bored. Brainstorm with bored students to find something that they’re excited to build, but is still related to the engineering concepts at hand. This solves the majority of behavioral challenges.

Cleanup Techniques

- Announce to your students that you need them to fulfill a tangible clean-up goal. Hold the students accountable to you. For example, “Everyone needs to put away ten pieces of trash or put away ten things that can be used again and show it to me before leaving.”
- Beat the Clock/Song: Keep track of how long it takes for them to cleanup, then challenge them to beat that time next week. Or, play a consistent high-energy song and challenge the students to totally clean up before the song ends.
- Assign tasks to table groups. For example, table 1 puts away tape and scissors, table 2 collects and recycles paper scraps, etc.)

Hot Glue Guns

- Before using glue guns for the first time with any group of students, talk at length about glue gun safety, even if you must go beyond the 10-minute lecture time. For each subsequent time that you use glue guns, remind the students of glue gun safety.

Students can prevent most burns by doing these things:

- Keep fingers away from the glue gun and the freshly melted glue.
- Count to 30 before touching the glue.
- Avoid big globs of glue, which can drip the still-hot glue.
- Always place the glue guns on a metal tray when not in use.
- If a student gets burned, he/she should immediately set the glue gun down and move swiftly to the nearest faucet. Run cool water over the burn for a full minute. If pain returns, repeat. For more serious burns, you may apply an instant-ice pack. The student should apply and then remove the icepack repeatedly; don’t keep it on the burn for long periods.
- **Avoid using glue guns in hot environments.** The ambient temperature will allow the glue guns to become significantly hotter, which will increase the likelihood of a serious burn.

Be Flexible

- Give yourself permission to be flexible. Don’t have enough time to finish a project? Store away incomplete projects and pick it up next time.
- Did all your students finish really early? Give them new challenges or design ideas.
- Has it been raining all day and your class bouncing off of the walls? Allow your students to run outside for ten minutes before starting.
- Use your judgment to decide what works best for the class.