The Tech Challenge
Presented by Dell Technologies

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

Adviser Guide

Welcome to The Tech Challenge, presented by Dell Technologies! This guide is for team advisers, educators and parents of participants in The Tech Challenge. Thank you for supporting the young innovators who are the heart of this special program.

Please read this guide, as well as the accompanying Team Guide. They contain guidelines, resources and ideas that will help you and your students get the most out of this program.

Follow us: Get news, updates and reminders on The Tech Challenge Facebook page and follow us on Instagram!

Revised 10.18.2019

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

1. The Basics

I want to be an adviser and a judge. Is this allowed?
No. A person may not serve as adviser and judge in the same year.

How many students may be on a team?
A team can have two to six students.

Can we have more than six people on our team?
No. If you have more than six students, split your group into two teams.

Can my student participate in The Tech Challenge by him or herself? He or she doesn't want to work as part of a team, or can't find anyone with whom to team up.
The Tech Challenge is a team activity. Each team must have at least two students.

Can you help my student find a teammate?
The Tech Challenge does not organize teams. Come to an info clinic and/or adviser training. There are other students in the same boat!

How old does one have to be to participate in The Tech Challenge?
Students must be in 4th grade or higher.

I have a student in 3rd grade who would like to be part of our team. Is this allowed?
No, this is not an appropriate activity for students who are not in at least 4th grade.

I have a 4th grader who wants to work with his or her sibling or friend who's in a higher grade. Can they be on the same team?
Yes, a team may have students from different grades. It will compete in the division based on the highest grade on the team. For example, if a team has both a 4th grader and a high school student, then it will participate in the Grades 9-12 division.

Does each team need an adviser? My student is very responsible.
Each team needs an adviser. Advisers must be at least 18 years old, understand safety rules and help teams stay on track. Advisers can be any responsible adult including teachers, parents and scout leaders.

I'm an educator with a class/program of 36 students. How do I manage 6+ teams?
An adult may be an adviser to more than one team, but it is important that the adviser is not spread too thin so each team gets the attention it deserves. Consider recruiting some help.

Do I need technical or engineering skills to be an adviser?
No. Many teams intentionally seek an adviser who will *not* offer technical assistance. If you do have technical expertise, show restraint when sharing it. Remember that this is a challenge for the students.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

How do I register my team?
Click here to register.

How much does it cost to register?
$50 per team (not per student), with two to six students on each team. The fee is waived if your team is from a Title I school or recognized after-school program. Email challenge@thetech.org if you have questions.

How do I know if my team is registered?
You'll receive a confirmation email containing a link to add information such as team and student names. Save this confirmation email. It has your team number, an important thing to know!

How many events do we have to attend?
We recommend attending one info clinic, one adviser training and at least one test trial. Students may attend one team workshop. And, of course, we hope to see you at the showcase in April!

How do I find out about these events?
Check out participant events here.

After the team is registered, how do we get started?
Advisers and parents should read the Team Guide so they are aware of the expectations, guidelines and resources for student participants. Also, see section 4, "Getting Started," below.

2. Safety

You are the adult in the room, and you know the capabilities of the students, so take the lead where safety is concerned — especially when using tools. Let them do what they can, but step in if you feel your students can't do something safely.

3. The Adviser's Role

How involved in the project should I be?
Here are some tips:

- Do not direct. Mentor and guide the team. The project should be designed, built and tested by the students.
- Facilitate conversations to help the team consider the challenge from different perspectives.
- Help the team solve problems by asking open-ended questions. Do not provide answers or solutions.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

- "I don't know" or "I'm not sure" followed by "let's find out" are useful phrases.
- When providing assistance with tools, be sure to follow the team's exact directions even when it may be flawed (as long as it's safe).
- Be supportive. Encourage. Be patient.
- Keep your hands off the device, except to ensure safety.

Your role as adviser can range from chauffeur to chef, from referee to manager. The most important job is to be encouraging and help the team solve the challenge themselves.

What are some questions I should be asking myself as work progresses?

- Are the students doing the actual work?
- Are the design ideas generated by the team?
- Are you advising and mentoring, or problem solving?
- Are your questions steering the team toward solutions, or are you asking open-ended questions that allow the team to come up with their own?

What if more than one parent wants to be an adviser?

They may be well meaning, but the more adults advising a team the greater the chance they will take over the project.

Here are helpful roles other adults who want to be involved can play:

- Provide transportation to hardware or other stores, team meetings and events such as test trials.
- Organize and host team meetings.
- Prepare lunch/snacks for team meetings.
- Donate items to be used in prototyping/building and provide tools.
- Assist with team costumes.
- Attend the showcase (and cheer loudly!)

It's a good idea to hold a parent meeting at the beginning of the project so that everyone understands the scope of the challenge, puts key dates on their calendars, and has a common understanding of each person's role.

Will I be with my team during the showcase?

No. You'll check the team in and be the only adult to accompany them into the pit, where they'll prep their device and wait to be called for judging. When the team goes to judging, you'll go to the stands as an observer. **Please don't stand in the aisle to watch your team go through the interview.** Trust that your team is ready. Your team should be able to handle everything themselves.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

4. Getting Started

I'm not sure how to get the team started. Do you have suggestions?
Many students have never taken on a project like The Tech Challenge. Help them see the big picture by creating a project schedule. Break down the work into stages.
Here's a sample schedule:

Stage 1

- **Get organized.** Schedule team meetings. Not all meetings will be productive, but you can help team members stay on track by getting them to set some ground rules such as:
  - We will attend all team meetings.
  - We will commit to helping each other as much as possible.
  - We will focus on the project during team meetings.
  - We will put every team member's skills to use.
  - We will be open to ideas from all team members.
  - Most of all, we'll have fun!
- **Start thinking.** Help the team research the challenge and its constraints. Have everyone read the rules. Encourage the team to break the challenge into smaller parts. Remind them to look at the world around them for ways this problem can be approached.
- **Register for The Tech Challenge.**
- **Prepare for and attend an info clinic.** Encourage the team to create a list of questions to ask. Have them take notes and pictures at the clinic. Put these in the engineering journal.

Stage 2

- **Make a plan.** Help the team create a timeline with goals and milestones.
- **Brainstorm.** There are many brainstorming techniques. See section 2 of the Team Guide for suggestions.
- **Take notes.** The team should record every move in an engineering journal.
- **Dig deeper with research and development.** Have the team pick three or four favorite ideas from the brainstorm list to research and develop with sketches, words and quick prototype models.
- **Attend participant events** such as info clinics, adviser trainings and test trials. Students may also attend a team workshop (sorry, adults are not allowed in the team workshop).

Stage 3

- **Choose a design.** After the team has prototyped and tested several ideas, have them select one design to work on.
- **Document results.** Remind the team to take notes at every meeting and spend time analyzing what does and does not work well.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

- **Review judging criteria.** Judging criteria and constraints can be found in section 6 of the Team Guide.
- **Attend test trials.**

Stage 4

- **Test and redesign.** Go through a final stage of testing and troubleshooting.
- **Prepare documentation.** Encourage the team to organize their notes and review their process as they go along. This is better than trying to do it all at the end. Remind them of the judging criteria and help them find relevant examples.
- **Get creative.** Encourage the team to express its creativity at the showcase with costumes, props or even a performance.
- **Prepare for the finish line.** Have the team get ready for the showcase by making finishing touches to the device, engineering journal and team presentation. Have them practice their device operation and presentation in front of adults.
- **Celebrate early and often!** There are plenty of milestones if you break things up in steps. Celebrating can be as simple as getting excited about a small part of the prototype working.

5. Resources and Support

What sort of additional support can my team seek out?

There are many ways schools, organizations, teachers and parents can support your team:

- Seek help from teachers (examples: science, shop or woodworking, drafting, art) or volunteers at a school or community organization. Expand your search outside the school, organization or teachers you know. For example, your middle school team can connect with a nearby high school to gain access to its shops' expertise and tools.
- Speak with managers at hardware or thrift stores about sponsorships. Ask them to provide materials in exchange for mentioning their business on team costumes or the actual device.
- Invite students from school or community organizations to attend the showcase. This is a great way to build a cheering section of friends and relatives.
- Organizations can recognize the students' participation and achievement in publications.

6. Managing Your Team

When is the best time to meet?

Popular meeting times are before or after school and on weekends. Some teams meet during school when doing The Tech Challenge as a class or club project. Find a time that works for everyone and stick to it.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

How should our team meetings be organized?
Each meeting should have an agenda and goals. Keep track of time and make sure there is room in the schedule for cleanup. Keep in mind that most students can work on an activity like this for about two hours before their productivity drops. Snack time can help break up longer meetings.

Keeping an engineering journal will be a challenge for our team. Any suggestions?
To make journaling seem less difficult and help get the team's thoughts organized, ask these questions at the beginning of each meeting:

"What are we going to do today? What do we want to accomplish?"

At the end of the meeting, teams should answer:
"What did we learn today? What do we need to do at the next meeting?"

These answers can be in words, photographs or sketches. This is the beginning of a great engineering journal!

Have the team work on the journal as they go along. At this stage a journal doesn't have to be a professional-looking, "finished" document. It's important just to take notes.

Teamwork is an issue with my group. Any suggestions?
Students sometimes need a little nudging to get out of the "all about me" phase. When communication breaks down, give them hints about how to talk to each other:

Common phrasing	More productive phrasing
We should...	What if we tried...
My idea is...	Remember when you came up with the idea that...
I think...	What do you think we should try next?
We need to...	Have we looked at all of your options?

If you are advising a mixed-gender team, keep an eye on which roles boys and girls take on. Each team member should have experience in all stages of the project. Make sure all students have an equal chance to learn new skills.

It seems like one or a couple of team members are running the show. What should I do?
Some students may take over the project, leaving others' voices unheard. Some will disengage on their own, while others are pushed out. Don't let this happen. Say things like, "Have you taken a vote on this?"

We've been working on this for a while, and the team is losing focus. What should I do?
Students may lose motivation mid-way through the project, particularly if they are feeling stuck. Help guide them around this problem by having them look elsewhere for inspiration such as books, toys, other teams, games or TV shows, or back at their original brainstorms in their engineering journal.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

7. Budget, Materials and Design

How much should we spend on our solution?
The Tech Challenge offers no guidelines or constraints. Help the team establish a budget. Key considerations are:

- Materials costs for building the device.
- Documentation costs (notebook, paper, etc.)
- Spirit costs (costume and presentation). Spirit-themed items such as T-shirts, a team logo, team name and colors can be inexpensive and add creativity, fun and motivation.
- Cost to build the home test rig. The Tech does not expect teams to build their own detailed test rig, but key elements of the test rig can usually be recreated at home or school.

Where do we look for materials?
Many common items are useful for prototyping and building a device. Things for the team to take apart including electronic toys and other discarded items can help students learn valuable things about mechanics, motors and more.

- **Find used items.** In addition to items found in your recycling bin, visit garage sales, flea markets and thrift shops to find gadgets, tools, junk, used toys and other items to take apart and salvage.
- **Go shopping.** Check out hardware, hobby and craft stores. Stores that specialize in particular materials such as plastics or foam can be great sources. Also, consider online stores that can help with parts for the device or team spirit supplies.
- See our Resources page for additional information.

How do we start prototyping?
Some tips:

- Have the team mock up their top two or three ideas using cardboard, foamcore or paper.
- After getting design ideas from those mockups, encourage the team to build a functional prototype (not necessarily made of the final materials).
- The team is then ready to move to a full-sized, fully functional device. It's this prototyping phase that informs the selection of materials and many of the design features for the final device.

How important is testing?
Very important! Test early and often. Attend as many test trials as possible. The team will gain valuable experience and learn from other teams. Bring the device to try any single part of it on the test rig.

Make test trials a team meeting. Have the team bring their engineering journal, a camera and paper and pens to describe in words and pictures what happened during the test. Bring extra

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

materials and tools for quick repairs or modifications. Note: Tools brought to The Tech must be cordless; you won't be able to plug in power tools.

It's important to make sure the team doesn't get discouraged by failure. Remind them how much they're learning about what *doesn't* work, and encourage them to persevere. Failure is part of the design process.

Can we come to The Tech anytime we want to test our ideas on the official test rig?
No, the test rig is only available during test trials. Click here for dates.

Teams can build a simplified version of the test rig at home or school. Suggestions for home versions of the test rig may be found here.

8. Showcase

What should we expect at the showcase?
At the showcase, teams will interact with pairs of judges during three phases:

- **Interview** with the team about the engineering process.
- **Engineering journal** review.
- **Device performance**.

Advisers do not accompany teams through the judging process.

How long does judging take?
The process will take approximately one hour (wait time not included). Expect to spend two to three hours at the showcase. We hope you'll also stay for the awards ceremony.

What is involved in the interview process?
Pairs of judges will review the engineering journal, examine the device and talk to each team member. During interviews, team members should be prepared to:

- Discuss their roles, process and experiences working on the challenge, including how they dealt with failure.
- Point out elements of their documentation that highlight their process and experience.
- Explain their innovations in design and/or use of materials.
- Explain the real-life applicability of their designs.
- Show off their creativity, inventiveness and style using costumes, songs, marketing materials, cheers and/or videos.

Teams should prepare by practicing with their adviser. Prepared presentations are welcome, but are not required, and should last less than two minutes.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

How does device performance work?
The team will demonstrate their device on a test rig for judges to evaluate. Power outlets will not be available.

What else do we need to know?
The showcase can be hectic, so make sure everyone knows what they're supposed to do. Have the team practice. Some guidelines:

- Make sure all the parents know well in advance the date and time of the showcase.
- Have the team make a list of everything they need to bring, including spare parts and tools.
- The team should practice demonstrating their device multiple times, including setup, operation and cleanup.
- The team should practice its group presentation in front of parents or other supportive adults.
- On showcase day, allow plenty of time for travel, parking and lunch.
- Teams need support and encouragement from you and their families. Keep the focus on the fun of participating in The Tech Challenge, not the stress of competing to win an award. Celebrate the team's accomplishments regardless of the day's outcome.
- Have fun!

9. Spirit of the Challenge

The Tech Challenge emphasizes the importance of engineering solutions that would be practical in real life. Test rigs involve small-scale replication of real-world conditions. Teams should develop designs that represent real-life solutions.

The Spirit of the Challenge is an important factor in scoring. The best engineering journals document an understanding of real-world factors and contain a detailed explanation of how your design might have practical, real-life applications. Teams should expect judges to press them on this issue and will be asked questions such as "How would your design work in real life?" A good explanation of how their design approach is compatible with the Spirit of the Challenge will have a positive influence on the team's score.

Store-bought solutions are allowed but are not in the Spirit of the Challenge.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

10. Common Core Standards

What are the students supposed to learn from The Tech Challenge?
The design process — engineers' basic approach to problem solving — involves many practices. They include problem definition, model development and use; investigation, analysis and interpretation of data; application of mathematics and computational thinking; determination of solutions and optimization and trade offs.

The Tech Challenge aligns with the engineering design standards. See the Standards tab on the Educator Resources page of our website for links to the complete standards.

Here's a shortened version of those standards, along with their corresponding sections, for quick reference:

Define Engineering Problems
MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- SEP: Asking Questions and Defining Problems
- DCI: ETS1.A: Defining and Delimiting Engineering Problems

Evidence:
- Describe a problem that can be solved with an object, tool, process or system.
- Identify the system in which the problem is embedded.
- Identify individuals or groups affected, their needs and the impact of the problem/solution.
- Define criteria that enable quantitative comparisons among different solutions.
- Define constraints including time, materials, and costs, safety, environmental impact, etc.

Develop Possible Solutions
MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- SEP: Engaging in Argument from Evidence
- DCI: ETS1.B: Developing Possible Solutions

Evidence:
- Identify science knowledge related to the problem.
- Look at similar problems that have been solved in the past.
- Identify possible solutions.
- Consider social/environmental issues.
- Use a systematic method (e.g., a decision matrix) to support claims, evidence, reasoning and conclusions.

201 S. Market St.
San Jose, CA 95113
thetech.org/thetechchallenge
thetechchallenge
thetechchallenge
@thetechinteract

Optimize the Solution

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria

- SEP: Analyzing and Interpreting Data
- DCI: ETS1.B: Developing Possible Solutions, and ETS1.C: Optimizing the Design Solution

Evidence:

- Organize data into tables, charts or graphs to assess the effectiveness of possible solutions.
- Use the analyzed data to identify evidence of similarities and differences in solutions.
- Make a claim for which characteristics of each design best meet the criteria and constraints.
- Compile best features into an improved, redesigned solution.

MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved.

- SEP: Developing and Using Models
- DCI: ETS1.B: Developing Possible Solutions, and ETS1.C: Optimizing the Design

Evidence:

- Identify the limitations of the final model.
- Describe how the data generated by the model, along with criteria and constraints that the proposed solution must meet, were used to optimize the design.
- Use an iterative cycle of modeling, testing, analyzing, refining and retesting to complete the process.