Organizing a Texas 4-H Robotics Project Group or Club

Congratulations on taking your first step into the wonderful world of robotics. It can sound daunting, but please know there are a lot of resources available, and today's robots and software have been developed with the kids in mind. If you can guide them, they can learn it, and together you can do it!

There is no right or wrong place to start, and much of what you do will be determined by the goals and outcomes you want your kids to achieve. The outline below is intended to help you identify resources you may need, but also some you may already have.

Questions to Help You Get Started

First, determine what it is that you want to teach. The best way to find that out is to have an open conversation with the students about what excites them. Here are some questions to ask yourself, the parents, and/or students.

- Do you want to learn about engineering/robot design?
- Is coding (computer programming) something of interest? What language(s) do you want to learn?
- Do you want to learn math concepts?
- Is there a need to develop problem-solving skills?
- Is teamwork and communication a priority?
- What are the ages and stages of the youth you will be working with?
- Do you want to learn about STEM degrees/careers?
- Will the club/group be educational, competitive, informative, or a combination?

Needs Assessment

The next step after identifying some goals is to determine what resources you may need. Those can take the form of physical or human resources. You may also want to survey the parents, administrators, support groups (like a PTA) to see how much time, resources, and support you will have.

- Who is going to lead the activities?
- Are there other adult or youth volunteers who can help?
- What ages/grades will be allowed to participate?
- What equipment do you already have?
- What equipment do you think you might need?
- What is your budget to get started and then to maintain the program?
- Where will you meet and is there ample space to work on robots?
- Is there safe storage space for valuable equipment?
- What is the best time of day/month/year to meet?
- Are there any professionals in the area that can lend support?

Words of Wisdom

Before we dive off into the specifics, please adhere to a few words of advice. Prior to venturing into the world of competitions, make certain your students are proficient in building, programming, and troubleshooting their robot. Without that firm foundation, kids will not likely succeed nor stay in the program long.

The Budget

The critical factor with starting any new endeavor is determining the budget. Just like a baseball team needs money for uniforms, bats, balls, and gloves, a robot club or group will need funds for robot kits, tools, and computers. Robotics equipment can easily last for years if proper care is taken, thus extending the initial investment well into the future.

Costs may vary drastically depending on some of the educational goals you answered earlier and the number of kids you serve. Some general figures to help you budget are to set aside:

- 10-25% for tools (highly dependent on the type of robot kit selected)
- 50-75% for kits and hardware (robots and computers)
- 25-40% for training and curriculum

If you already have access to computers or tablets, you can adjust your figures accordingly. If possible, avoid purchasing cheap computing equipment. The frustrations and potential lack of speed, compatibility, and connectivity may outweigh the cheap price tag.

If competitions are going to be a part of your program, you will also need to factor in costs of contest registration fees, practice game supplies and mats, travel expenses, meals, etc.

Robot Equipment

There are many types of robots on the market. In Texas 4-H, the predominant robot kit is a version of the Lego Mindstorm®. The SPIKE PRIME® is the newest version (no product endorsement implied nor intended). It is used in all Texas 4-H contests and those found at major stock shows, which are open to 4-H members. Kits are ideal for 3-8th grade but may also be suitable for high school and even scaled downward to K-2 if needed. A single kit is recommended for 2-3 students.

Below is list of suggested supplies needed for a classroom of 20 kids, assuming 3 kids per kit. Some costs are one-time, and others (*) are a recurring annual expense if competing.

Item	Quantity	Price	Cost
Lego Mindstorm Spike Prime Set	7	$360	$2,520
Lego Mindstorm Spike Prime Expansion Set	3	$110	$330
Computer/Tablet	7	$400	$2,800
Challenge Pieces for Learning and/or Competition*	Varies		$100
Challenge table for Learning and/or Competition *	2	$160	$320
Challenge mat for Learning and/or Competition *	2	$100	$200
Miscellaneous Supplies (power cords, replacement batteries, etc.)	Varies		$200
Curriculum, Online Course	Varies		$500
Virtual Robot Curriculum Access	20	$9	$180

Programming Language

Students will spend a great deal of time constructing and programming their robot. Now that you have identified your equipment needs, it is time to think how students will learn how to program. Lego is now using a block-based programming interface commonly referred to as Scratch. It is quite common among beginner programmers and is a great steppingstone toward more advanced programming such as Python.

Keep in mind, Lego is a toy company. As such, their robotic "toys" are very kid-friendly, and Scratch has become one of the most popular visual programming tools worldwide. Rest assured; kids can figure it out!

Extension Ideas

Beyond robotics, youth can learn about a wide array of STEM topics. Below are some suggestions to extend learning.

- National 4-H STEM Challenge (set of themed challenges released each fall)
- National 4-H Junk Drawer Robotics Guides
- Field trips
- Guest speakers

Training

Training is available on an as-requested basis and includes hands-on, experiential learning for educators to learn firsthand how to build, program, and troubleshoot robots just like the students. To schedule an educator training, please contact your local County Extension office.

Links to Suggested Equipment and Supplies

- Lego Education Spike Prime Set
- Lego Education Spike Prime Expansion Set
- Geyer Instruction Products Portable Robotics Table Topper
- Lego Mindstorms Education EV3 Space Challenge Set (example)
- Coding and Computational Thinking with LEGO SPIKE Prime (free course)
- Carnegie Mellon Robotics Academy Virtual Robot Curriculum (subscription required)
  - Virtual environment
  - No robots required

- [National 4-H STEM Curriculum at Shop4-H.org](#)
- [Texas 4-H Robotics](#) (provides links many more resources, including contests)
- [Educational Evaluation](#)
- [Lego Education Spike Prime App/Software](#)