



4-H ROBOTICS



Getting Started

4-H Robotics Year-Round Training Guide



ACKNOWLEDGEMENTS

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GETTING STARTED with 4-H Robotics Year-Round Training Guide



WELCOME to the 4-H Robotics Year-Round Training Guide

These modules will assist you in providing training for 4-H educators, volunteers and teen leaders who are interested in your *4-H Robotics Program*. They are designed to be flexible to meet the variable needs of different programs. Each module includes two to three hours of hands-on, interactive training activities; handouts; PowerPoint slides, and tips for facilitators. The trainings are designed to allow facilitators to capitalize on the expertise and resources of their audience. By participating in these modules, staff and volunteers will gain new skills and knowledge that will enhance their role in your robotics program.



The Getting Started Guide has three parts:

Section One: Planning Your Training

From setting your objectives to assessment and evaluation, this section is designed to assist you in the planning stage of your training.

Section Two: Preparing for Your Training

This section provides guidance for preparing for your training and includes everything from selecting a location to gathering the necessary supplies.

Section Three: Leading Your Training

This section offers tips and ideas for leading your 4-H Robotics training.

Let's get started!



About the Modules

The *4-H Robotics Year-Round Training Guide* consists of nine modules, however, you may find that not all of them meet the needs of your audience. The modular design makes it easy to mix and match modules to create customized trainings that address the needs of your specific audience.

MODULE 1: Comprehensive Robotics Overview (2 hours)

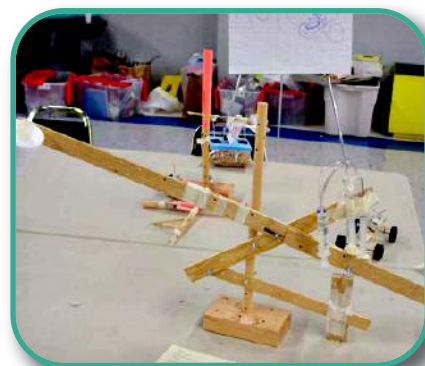
Participants are introduced to the 4-H Robotics Programs and the opportunities they offer to youth.

MODULE 2: Recruitment and Partnerships (2 hours)

Participants learn about the resources needed to build a robotics program and begin to develop an action plan for their program. This includes strategies for recruiting volunteers.

MODULE 3: Community Resource Cultivation (2 hours)

Participants develop strategies for building community support and continue to develop the action plan started in Module 2. This includes strategies for recruiting, funding and marketing a robotics program.



MODULE 4: LEGO® WeDo™ Construction Set Introduction (3 hours)

Participants will be introduced to the LEGO® WeDo™ Construction Set by LEGO® and how it can be used in a 4-H Robotics program. Participants will experience building and programming their own robot.

MODULE 5: Using Technology to Deliver a Robotics Program (1.5 hours)

Participants are familiarized with the *Virtual Robotics* Component of *4-H Robotics: Engineering for Today and Tomorrow*. They will develop strategies for facilitating the 4-H Robotics Curriculum with youth and utilizing technology in youth development.

MODULE 6: Experiencing Engineering Design (2.5 hours)

Participants are introduced to the *Junk Drawer Robotics* Component of *4-H Robotics: Engineering for Today and Tomorrow*. They will learn the Engineering Design Process and experience how the 4-H Robotics Curriculum incorporates science, engineering design and building. This includes strategies for incorporating engineering in youth development.



MODULE 7: An Experiential Model of Building Robots (3 hours)

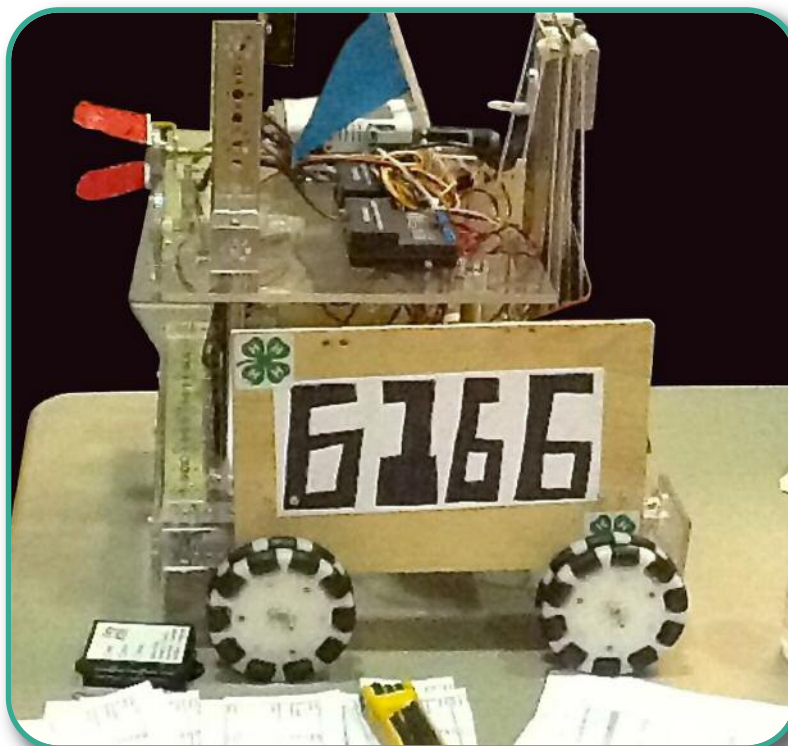
Participants will become familiar with the *Robotics Platforms* Component of *4-H Robotics: Engineering for Today and Tomorrow* and the LEGO® MINDSTORMS® Robotics Kit and Programming Software. They are introduced to the Engineering Design Process and the Experiential Learning Model and learn how these can be used as tools for positive youth development.

MODULE 8: Scientific Inquiry and Programming Robots (2.5 hours)

Participants will increase their familiarity with Science Inquiry and the *Robotics Platforms* Component of *4-H Robotics: Engineering for Today and Tomorrow*. They will also develop more advanced skills in programming using the LEGO® MINDSTORMS® Software. Using the Experiential Learning Model participants will evaluate and develop questions to enhance positive youth development.

MODULE 9: Expansion, Enrichment, Endurance (2 hours)

Participants explore strategies to strengthen and expand a new robotics program. Earlier modules focused on the initial recruitment of youth and volunteers and building community support. This module focuses on how to retain youth and volunteers and help a new program continue to grow.





Section One: **Planning Your Training**

When planning your training, start by determining your overall objective.

- Are you introducing robotics?
- Are you trying to develop a local robotics program?
- Are you trying to build specific skills in robotics?

It is important to have a goal in mind as you begin planning.

Then consider your audience.

- Who will be attending the training?
- What are their needs?
- What do they already know?



The Pre-Assessment Questionnaire included at the end of this guide is a good resource to help you determine the knowledge base and specific needs of your audience.

Knowing your objective and your audience will prepare you to mix and match the modules to design the best training for your participants. For example, the first training you offer may be designed to build local interest in robotics and introduce volunteers and staff to the resources you can provide. Later you may offer additional trainings designed to build interest in robotics into an effective program with lasting impacts on youth.

If your goal is to develop a strong robotics program in your community, county or state, you may choose to go through each of the modules in order. This sequence guides your group through:

- Learning about the opportunities robotics programs can offer
- Creating an action plan
- Building infrastructure such as community partnerships and a volunteer base
- Learning about the 4-H Robotics Curriculum
- Creating a well-rounded program that meets your local needs



Creating a Training Agenda

What follows are some items to consider as you plan your training agenda. Sample agendas are included in the appendix.



Introductions: Introductions are an important part of any training. Asking your participants to introduce themselves takes time, but it also helps build relationships. Always introduce yourself and all your co-facilitators to the group. We also recommend wearing name tags.

Sharing objectives: At the start of every module, share your objectives with the participants so they can direct their own learning. If your training location allows, consider displaying the learning objectives for the length of the session so they are easy to keep in mind.

Planning breaks: While we all require a physical break throughout a training, breaks also give participants a chance to step back from their learning and ask questions. Schedule your own break at another time so you can be available to participants during their break. We recommend that you present this training with co-facilitators and schedule accordingly to ensure that everyone receives adequate breaks.

We all learn best when we are comfortable and not hungry, thirsty, or otherwise distracted. If possible, provide participants with refreshments. At the minimum, ensure that drinking water is available.

Reflection and discussion: Reflection questions are included in each module and questions are an integral part of the learning that will take place. Be sure to allow sufficient time for discussion and sharing. While each module includes an estimated time for reflection, you may want to create an agenda that gives a few extra minutes between modules to ensure that this is not rushed.

Keeping a good flow: Each training module contains a mixture of activities and discussions. It is a good idea to break up the training so that participants have an opportunity to listen and then try what they learn hands-on. Try to plan a fun, engaging activity in the afternoon (especially just after lunch) to keep everyone alert.





Endings: Be sure to allow adequate time for wrapping up the training, assessment, and putting materials away so that you can be available to answer questions.

Don't begin to clean up immediately. Instead, position yourself in such a way so that participants can talk with you if they have questions. Be sure to provide participants with contact information for your team of facilitators, so they can get in touch with any questions that come up after the training concludes.

Facilitators

The 4-H Robotics Modules are best delivered by multiple facilitators who alternate leading the instruction. This provides opportunities to:

- Include expertise in science, engineering and youth development
- Reflect the diversity of participants (position, gender, age, culture, race, etc.)
- Vary the tone and style of delivery
- Include youth with robotics experience as part of your team



At least two facilitators are recommended for groups larger than 12. As your group size increases, plan to add more facilitators accordingly. Prior to training, all facilitators should:

- Take time to prepare for the training together
- Determine who will lead each activity
- Debrief following the training

As you plan the agenda, communicate with your whole team and be sure that each presenter has enough time to prepare. In addition to knowing who will lead each activity, you should also understand your role when you are not leading. Here are some questions you may want to discuss with your facilitators:

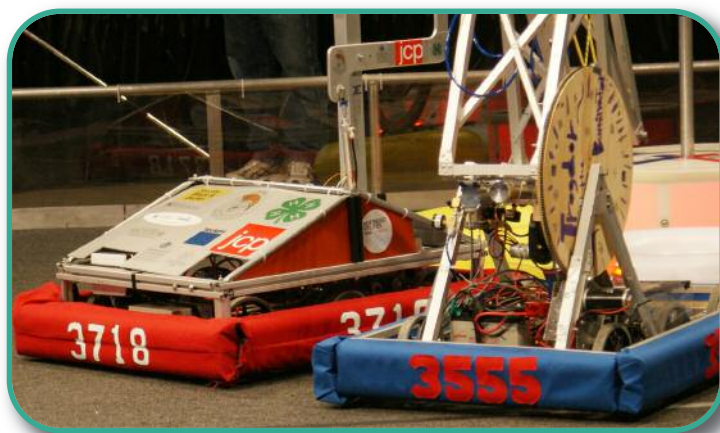
- What role will “off duty” facilitators have? Is it okay to check e-mail during the training? Is it okay for other facilitators to interact with the training during modules they are not leading? What kind of interaction would each facilitator appreciate?



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- Will the facilitator and/or participants be distracted or bothered if other facilitators prepare for an activity while another activity is taking place? How will facilitators assist each other in preparing for each session?
- What roles can facilitators fulfill for each other (for example, acting as a demonstrator, watching the clock or keeping notes)?
- How will we manage and keep track of the time, so our training runs as scheduled? What will we do if we finish early, or if we are running late?
- Is it appropriate for other facilitators to interject with anecdotes and ideas or respond to questions while another facilitator is teaching?



As you prepare, you may also want to discuss ways that you are individually suited to assist your participants. Do any of your facilitators speak sign language? Is anyone particularly good at drawing diagrams for visual learners? Be sure to fully utilize the strengths of each facilitator when you plan your training experience.

Audience

The *4-H Robotics Year-Round Training Guide* Modules are intended for 4-H professionals, volunteers, teen leaders and other who want to learn more about 4-H Robotics. The modules are best delivered to an audience of 12–24 participants, and much of the training is planned for participants to work in small groups.

As you prepare, you will need to spend some time thinking about the way your audience will interact with you, and with the material. What is their role in the 4-H Robotics project? How diverse is your audience? Do you have people with many different roles participating? What other differences are there in the audience? Are there different ages, cultures, backgrounds, or familiarity with robotics among the group?



As you facilitate the modules and apply the Experiential Learning Model, you will tailor the questions you use to your audience. For example, you might ask different questions to a group of volunteers with experience working with youth than you would to a group with experience in engineering. Sometimes good questions build on the group's experiences, and sometimes questions will lead them into unfamiliar territory.

It is important to pay attention to these differences to be sure you are meeting everyone's needs. It is often helpful to have people work together in small groups. Being part of a group gives people opportunities to share what they know and connect new experiences to prior knowledge. It also gives people the opportunity to learn from others in informal ways. Encourage discussion and sharing among the groups. Every audience brings with them their own experiences and questions and your training will be enriched if you encourage them to share both with you and with each other.

A robotics workshop should not be quiet! Consider ways in which you can encourage participants to share and connect with each other and with you as a facilitator. This network will be a valuable "take home" long after the training has concluded.

Context and Abilities

There will be many different abilities in the groups you train. Some will have more knowledge of engineering or robotics and may be able to mentor or coach other participants. Others may have difficulty seeing or hearing the facilitator. Some groups may need you to adapt your training in different ways, such as reading instructions out loud.



There will be many ways the *4-H Robotics Year-Round Training Guide* Modules can be adapted to meet the particular needs of your audience. It is important that as a trainer you are observant and consider individual differences and adapt accordingly.

- How can you plan to assist learners with mobility issues?



- What changes can you make to your presentation to accommodate visual or hearing impairments?
- What other special needs may your audience have that cannot be observed immediately?
- Will registration materials and/or the pre-assessment provide you with enough information to adequately prepare a meaningful learning experience for all participants?

Keep in mind that at every step you are not only facilitating a training for trainers, you are also modeling the training methods that they will bring back to the programs with which they work. Demonstrating techniques for adapting the training to best meet the needs of all learners will encourage them to do the same when they work in their own communities.

Assessment and Evaluation

The **Pre-Assessment Survey** included at the end of this guide is a useful tool. It will provide facilitators with information about:

- Prior knowledge and experience of participants
- Expectations participants have for the training
- Progress participants have already made in developing a 4-H Robotics program



This information will help you better understand your audience and effectively plan the training. It also provides participants with an opportunity to engage with and think about the ideas that will be presented in the training. Therefore, the pre-assessment is most effective if you ask participants to complete it between one to two weeks prior to the training. You can consider the results as you plan your final agenda.

About Assessment

Remember that you may need to adapt the assessment provided if you do not plan to use all the modules. Review the assessment carefully after you have completed your agenda and select the items that are related to the modules and activities you will be using. You may choose to create a written survey delivered to participants on paper or via e-mail, or you may use a web-survey tool that automatically records the data for you. In the appendix, following each question is the question type information you will need if you are using a web-survey tool such as SurveyMonkey.com.



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Post-Assessment and Evaluation Tools will give you information about

- What participants have gained from the training
- Gaps that should be addressed in follow-up support
- Elements of the training that participants felt were/were not effective
- Participant's plans and action steps

A post-assessment is most effective if it is completed a few days after the training, providing participant's time to think about their experiences and offer relevant feedback. However, it may be easier to get everyone to complete the post-assessment immediately following your training.



For a longer training, you may also want to include **formative assessment**. Formative assessments happen during your training and give presenters immediate feedback from the group about how things are going. Here are some possible methods of formative assessment:

Example One:

Put blank index cards on each table. Ask participants to write what has been effective for them as a learner on one side of the card. On the other side of the card, ask them to write what has been difficult for them as a learner or any topics with which they may be struggling. Take time to review the feedback from participants with your facilitators and discuss how you can adapt your training to meet the needs of the group.

Example Two:

At the end of the day, give everyone an index card or blank sheet of paper. Ask participants to record questions that they still have. Before your next session, you can review these questions and decide which are:

- **Easy-to-answer questions** that you can address in your opening the next day
- **Important questions** that may require re-teaching—or rearranging of the agenda
- **Big questions** that may require follow-up after the training
- **Upcoming questions** that will be answered over the course of the workshop

If your group has questions that don't fit into these categories, you will need to decide how to answer them.



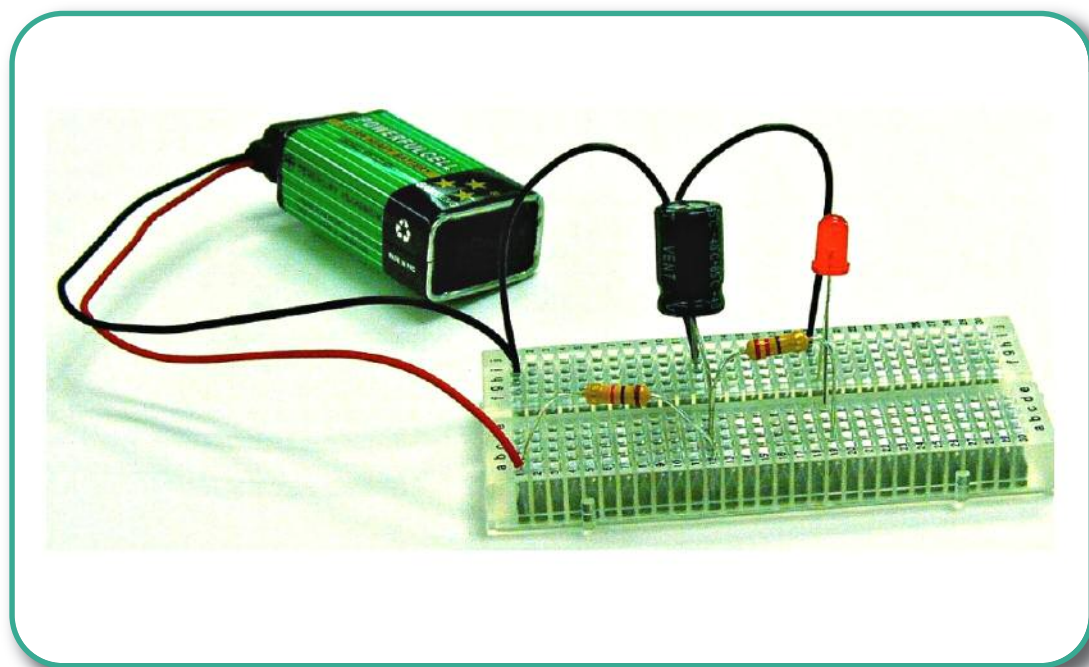
While encouraging your participants to ask questions is important, perhaps equally as important is answering them. Be sure to address all their questions in training or at least provide them with an expectation of when they might receive an answer.

From Planning to Preparing

You will know that you have reached the end of the planning stage when you know:

- What the objectives of the training are
- Who will be leading the training with you
- Who will be participating in the training
- How long and what the agenda for the training will be
- Which modules and activities you plan to include in the training

When your planning has reached this stage, you are ready to begin preparing for your training.





Section Two: **Preparation**

Now it is time to prepare yourself and your co-facilitators. Begin by reviewing all the activities you will present. If you are unfamiliar with any of the robotics, electronics or computer software referenced, take the time to learn more about them.

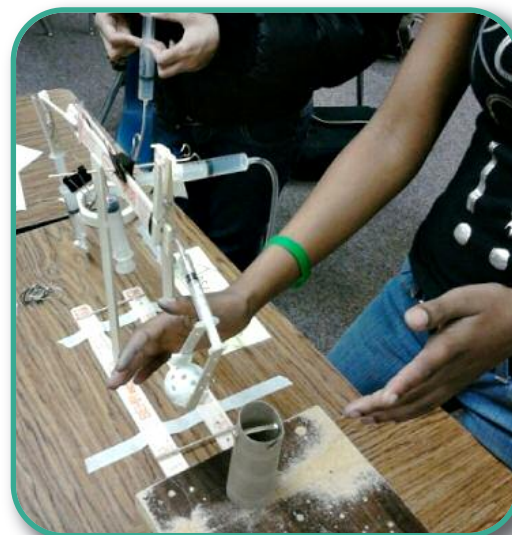
Some of the modules include robotics demonstrations. If you are inviting others (like local robotics clubs or researchers) to do demonstrations, plan ahead and share clear expectations about how much space and time is available.

Selecting a Training Location

Ideally, you can work with a local host who will organize the physical space for your training. Your training location should include:

- A spacious room with good lighting and acoustics
- Adequate tables and seating for participants to work in small groups or teams—including enough space for each group to have a computer, if needed
- Adequate space for clear walkways between desks and tables (you may need to allow extra space for computer cords and powerstrips)
- Easily accessible restrooms and emergency exits
- Space for breaks and refreshments **(It is always a good idea to keep food and drinks away from computers and robotics components)**
- Space to safely store robotics equipment and computers between sessions and overnight

A local host can help locate a space that will meet your needs, arrange the space as needed, provide refreshments and answer some of the questions that arise during the training.





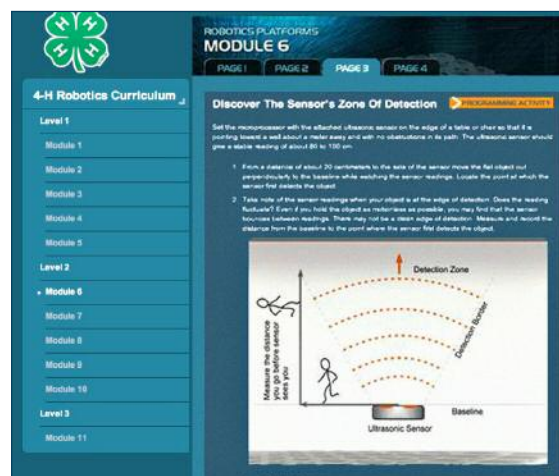
Technological Tools

In addition to the basic room requirements, there are some technological tools that will make your training easier. You may have your own technological equipment or use equipment provided.

- Your computer will be used for PowerPoint slides and for some of the trainer resources. In some of the modules, there is particular software that will need to be loaded before the training (i.e. LEGO® MINDSTORMS® Software, *Virtual Robotics Program*). Be sure you have the appropriate files loaded on the machine you in advance. Specific supplies needed for each module are written in the beginning of every training module. Be sure to allow plenty of time to get software and files loaded.
- In some instances, you will need to connect your computer to a projector and speakers. PowerPoint slides are included in each module. Plan ahead when you set up the space for where the projector and screen will be located.
- A flipchart or whiteboard is used in every module. If you don't have access to one of these tools, you may need to make posters in advance or adapt the training script.
- If each group will be working with a computer and/or robot, they will need access to electricity.

Although not required for any of the modules, Internet access will make it easier to answer questions and share resources with the group.

Note: *If you will be working with technological tools belonging to a host site or community partner, be sure to discuss the need to install any programs that your training agenda requires. You may need to present a list of computer system requirements to the person responsible for the computers at your training location and in some instances you may need to take other steps before installing programs. For example, if you will be using a computer lab at a military installation, there are likely to be very specific guidelines for computer use with which you must comply.*





Training with Computers

It can be challenging to work with multiple computers in a training. Many of the *4-H Robotics Year-Round Training Guide* Modules require a computer for each group of two to three participants. As you lead the training, you will also model for strategies that participants will use to manage computers for their own robotic afterschool program, club or team. Hints for finding computers for all participants:

- Check with locations in your community like schools, job training centers or public libraries, which may have a computer lab you can use.
- Ask your state 4-H office if it is possible to access computer labs at the university.
- Request that participants bring their own computers. Note, if you choose this option, you may have to allow extra time to load or troubleshoot software.

Considerations for using multiple computers:

- Using several computers means you will require multiple power sources. If you are using computers and robotics kits, then each robot may also need to be plugged in before or during the workshop. We recommend providing a power strip at each table. Be sure to allow adequate space to keep pathways clear of cords.
- Computers need space and if participants are building and programming robots, they will also require space next to their computer for their robot. This may require some creativity if you are using a traditional computer lab. If you have tables and laptops, a good rule of thumb is that you can fit a group of two to three people working with a laptop and robot in the space you would normally seat four people.





Training with *Robotics Platforms (Kits)*

There are many educational robotics kits available, and 4-H does not endorse any particular product. The activities in *Robotics Platforms* were designed to guide youth in learning about whatever robotics kit they are using. It is likely that the people you are training will already have kits that they would like to use for the training. However, if you are purchasing new kits here are some items to consider:

- Look for a kit that can be built and rebuilt rather than one designed to assemble a single robot.
- Look for a robot that is programmable and includes sensors. In *Robotics Platforms* there are activities specifically designed for an ultrasonic sensor, light sensor and touch sensor.
- Decide if your 4-H clubs will also participate in FIRST®. The *FIRST*® FLL® competition uses a LEGO® MINDSTORMS® Kit and the FTC® competition uses a TETRIX® Kit as the basis for the robot and LEGO® MINDSTORMS® Programming. In the FRC® competition, each year the team will design and build a new robot using the kit purchased as part of the competition.
- Consider both value and durability when selecting a kit. You can expect to use a robotics kit for several years. If you do a lot of trainings, you may want to keep six to ten kits on hand for trainings.

How many kits will you need?

Ideally you will have one kit for every two participants in your training (we suggest the same ratio when working with youth). However, logistically you may choose to have more people share a kit. We do not recommend more than four people using a single kit.





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Before the training: It is important to take time to familiarize yourself with the kit you will be using.

- Know what basic pieces are in your kit. Check to be sure critical pieces such as sensors, USB cables that connect the robot to the computer, and the power cord/batteries are not missing.
- Note if you will need to bring extra batteries and what sizes are required. A battery tester will also be useful. Consider using rechargeable batteries and always be sure to properly dispose of used batteries.
- Review the instructions that come with the kit, even if you won't be using them in the training. There are probably resources online that will also be helpful.
- Be sure you have the programming software required for your kit installed on all the computers that will be used. Try it out yourself by completing the activities in the training so that you are familiar with each step. Look for help menus in the program or online resources that provide additional help.

Trainer's Toolkit (supplies): This is a list of basic supplies that are used in almost every module. There are specific supplies needed for each module that are listed on the first pages of every training module. Be sure you check each module to know what supplies you will need. For any 4-H Robotics training, you should gather a basic toolkit that includes:

- Markers
- Flipchart and stand or whiteboard
- Pens or pencils (at least one for each group)
- Index cards
- Timer or stopwatch to monitor time
- Light and dark-colored masking tape
- Tailor's measuring tapes or locking tape measures. Ideally your measuring tapes will be at least 2 meters long and easy to carry with you. Tailor's tapes are nice because they are light and compact



Be sure to take time before the training to review all the materials you will require, gather the supplies needed and organize them in a way that is easy for you to manage. You may need to make copies of handouts before the training. This may be a task your local host can do for you. You may need to purchase some supplies, so be sure to plan ahead to gather and organize what you need.



Section Three: **Leading your Training**

Using the Training Modules

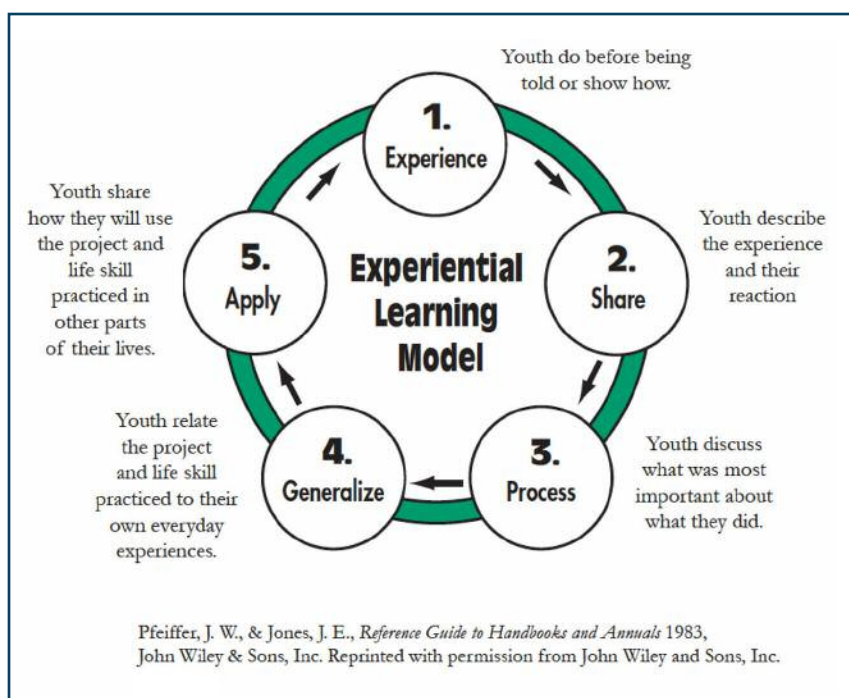
Each module includes training activities, handouts, PowerPoint slides, and tips for facilitators. The modules are designed to be easy to follow.

- The training scripts (spoken by the facilitator) are in roman type.
- Directions for facilitators are presented in bold italics.
- Training tips and background information are presented in boxes.

The training scripts were not designed to be read or followed word-for-word. Rather, each facilitator should familiarize themselves with the scripts and directions so that they can convey the content in their own words.

Applying the Experiential Learning Model

An Experiential Learning Model approach to learning has been integrated throughout the trainings, but to be effective, it needs to be purposefully applied by the facilitator. To help you, each question has been identified with which part of the model it is related to. Keep in mind if the goal is to share, process and generalize or





apply the experience. Remember your learners are the youth and adult leaders in your training. Choose your questions to build on and enhance their experience. Sometimes a good question ties to their background—sometimes it introduces new ideas. Use questions to help the learners apply the experience to their life outside of the workshop. As you lead discussions, remember you are also modeling for leaders how they can utilize the experiential learning model in their work with youth.

Utilizing Science Inquiry

A Science Inquiry approach to learning is very compatible with the Experiential Learning Model. Science Inquiry emphasizes the role learners play in directing their learning and constructing their own understanding. It supports and develops youth's curiosity about the world and can lead them to a deeper understanding of science and the world around them.

There are different approaches to Science Inquiry ranging from a structured or directed inquiry to an open inquiry. Structured inquiry is often a good place to start and is the approach used in the 4-H Robotics Curriculum. In a structured inquiry, questions and procedures are set by the facilitator and learners conduct investigations, discover relationships and use the data they collect to answer the question.

4-H has a number of online resources that have been developed to provide a background for understanding Science Inquiry methods. On the next page are ones that may be particularly useful as you prepare for your training.





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- **Experiential and Inquiry-based Learning Methods in Non-formal Programs with Youth**

Presented by Pam Larson Nippolt, Ph.D., University of Minnesota Extension, Center of Youth Development (held November 10, 2010). This webinar and paper provides a background for understanding experiential learning and inquiry-based learning methods as they relate to 4-H Science.

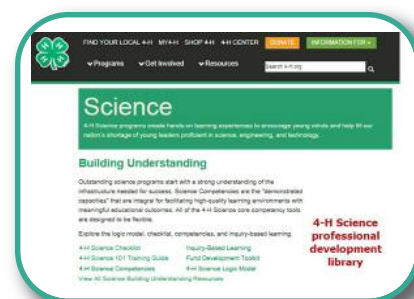
You will find The Intersection of Inquiry-based and Experiential Learning on the 4-H Online Learning Center in a course called Science Podcast and Webinar Archives. This and many other STEM content can be found at: <http://4h.interactyx.com/login.aspx>



- **Experiential and Inquiry-Based Learning Methods in 4-H Science**

This is a training activity to engage educators in three educational experiences to improve understanding of inquiry and the experiential learning cycle.

<http://www.4-h.org/Professional-Development/Content/Science/Building-Understanding/Inquiry-Based-Learning/Inquiry-Based-Learning.dwn>



- **Inquiry– Theory to Practice**

For additional resources on inquiry-based learning and building understanding in Science, Technology, Engineering, and Math (STEM) related programming, check out these important resources:

4-H Science professional development library at 4-H.org: <http://www.4-h.org/resource-library/professional-development-learning/science-training-guides-resources/> and,

The 4-H Online Learning Center at: <http://4h.interactyx.com/login.aspx> (There is a login required but it is free and easy)

Training the Trainer

As you lead your training keep in mind that participants are sometimes playing the role of a learner and sometimes their role is that of a future presenter of robotics. If you want them to think like a learner, be explicit that their role is learner. When you want them to think like a facilitator let them know that is their role. As much as possible let participants know why you've made the decisions you have about how to lead the activities. This information may help them when they are the facilitators.

Good luck and have fun! Remember we all learn by doing.



Appendix 1: **Sample Robotics Workshop Agendas**

Sample Agenda A **One-Day Training**

- 9:00** Introductions and Objectives for the Training
- Overview of 4-H Robotics Curriculum
- Introduce *Junk Drawer Robotics* and the Engineering Design Process
- 10:00** Design and Build Clipmobiles
Evaluate Clipmobile Designs
- 11:00** Apply the Experiential Learning Model to the 4-H Robotics Curriculum
- 12:00** Lunch
- 1:00** Explore *Virtual Robotics*
- 2:00** Facilitate 4-H Robotics Curriculum with Youth
- 3:00** Develop Community Support for Robotics Programs
- 3:30** Evaluation and Wrap-Up

Sample Agenda B **One-Day Training**

- 8:30** Registration and Morning Refreshments
- 9:00** Welcome and Introductions
- 9:10** Robotics Overview
- 11:30** Community Resources
- 12:00** Lunch
- 12:30** LEGO® WeDo™ Construction Set Hands-On Training
- 2:00** Create your County Robotic Plans with Teen Facilitators
- 2:30** LEGO® MINDSTORMS® Training
- 4:00** Evaluation and Wrap-Up
- 4:30** Safe Travels Home



Appendix 1: **Sample Robotics Workshop Agendas**

Sample Agenda C **Three-Day Training**

4-H Robotics Club Project

Day 1

SESSION 1: 1:00–2:30

- Opening Remarks
- Introductions and Goals for the Training
- Beginning with the End in Mind: 4-H Essential Elements and Robotics Programming

SESSION 2: 2:45–5:00

- Overview of *4-H Robotics: Engineering for Today and Tomorrow* Curriculum
- Explore the World of *Virtual Robotics*
- Delving into *Junk Drawer Robotics*

SESSION 3: 6:30–8:30

- Complete *Junk Drawer Robotics*- A Clipmobile Competition
- Create Your Robotics Dream Team

Day 2

Breakfast

SESSION 4: 8:00–10:30

- Goals for the Day
- Applying the Experiential Learning Model to 4-H Robotics
- Build a Robot
- Program Your Buddy

SESSION 5: 10:45–12:00

- Programming with Parameters
- Programming Challenges

Lunch

SESSION 6: 1:00–3:00

- Making it Happen: Implementing 4-H Robotics with Youth Building Community Support for Robotics

SESSION 7: 3:15–5:00

- Programming with Sensors
- Planning an Effective Training

Dinner

PLAYGROUND: 7:00–8:00

Robotics Playground (open time to explore the curriculum, play with your robot or get more resources for your state's action plan)

Day 3

Breakfast

SESSION 8: 8:00–10:00

- Goals for the Day
- Building Relationships with our Partners
- Year-Round Robotics

SESSION 9: 10:15–12:00

- Programming at the Next Level
- Sensor Programming Challenges
- Workshop Wrap-Up and Evaluation

Box Lunches and Safe Travels Home



Appendix 1: **Sample Robotics Workshop Agendas**

Sample Agenda D **Three Session Training/Distance Learning**

Workshop One

1:00

Robotics Overview

2:30

Start County

Robotic Plan

Workshop Two

(1–2 months after Workshop One)

9:00

Welcome and Introductions

9:10

LEGO® WeDo™ Construction Set
Hands-On Training

11:20

Volunteer Recruitment

12:00

Lunch and Demonstration
of Various Platforms

1:00

Marketing, Promotion and Outreach

2:00

LEGO® MINDSTORMS® Training

4:00

Evaluation

Workshop Three – Webinar

*(1–2 months after
Workshop Two)*

10:00

Expansion, Enrichment,
Endurance



Appendix 2: **4-H Robotics Pre-Assessment Survey**

It is recommended that you offer this survey to participants approximately one to two weeks before your training is scheduled. You may select from the questions below to create and distribute the survey on paper or via e-mail, or you may wish to use a web-based survey program of your choice. In parenthesis, after each question, is the “question type” you need if you are using the web-based survey program SurveyMonkey.com.

Pre-Assessment

The purpose of this needs assessment is to identify the skills, experience, questions and concerns of participants in the upcoming 4-H Robotics training. Thanks for taking time to complete this survey.

1. Please tell us about yourself. *(Demographic data – required)*

Name:

City:

State:

2. What is your role in 4-H Robotics? *(Single text box)*

3. Have you led robotics activities with youth? *(Multiple choice, one answer – yes/no response)*

If yes, please describe your experience working with youth. *(Comment box)*

4. Have you trained 4-H volunteers or staff in leading robotics activities?

(Multiple choice, one answer – yes/no response)

If yes, please describe your experience working with volunteers or staff. *(Comment box)*



4-H Robotics Pre-Assessment Survey (continued)

5. Have you used educational robotics kits with youth or 4-H volunteers?

(Multiple choice, one answer – yes/no response)

If you use robotics kits, which kits are you using? Select all that apply.

(Multiple choice, one answer – yes/no response) Use choices below.

- _____ LEGO® MINDSTORMS®
- _____ LEGO® WeDo™
- _____ TETRIX®
- _____ VEX®
- _____ Robotix
- _____ SeaPerch
- _____ Other—please list_____

6. Have you worked with youth participating in robotics competitions?

(Multiple choice, one answer – yes/no response)

If yes, what competitions do youth participate in? Select all that apply.

(Multiple choice, one answer – yes/no response) Use choices below.

- _____ 4-H Competition
- _____ FIRST® Jr. FLL®
- _____ FIRST® FLL®
- _____ FIRST® FTC®
- _____ FIRST® FRC®
- _____ Botball®
- _____ VEX®
- _____ SuGO
- _____ Not sure
- _____ Other – please list_____



4-H Robotics Pre-Assessment Survey (continued)

7. How prepared are you to: *(Rating scale)*

Not Prepared 1	Somewhat Prepared 2	Prepared 3	Well Prepared 4	
Develop a 4-H Robotics Program Action Plan	1	2	3	4
Promote or market 4-H Robotics in your community	1	2	3	4
Develop community support and partnerships for 4-H Robotics	1	2	3	4
Describe the 4-H Robotics Curriculum	1	2	3	4
Provide 4-H Robotics Curriculum training	1	2	3	4
Describe the opportunities 4-H Robotics offer to youth	1	2	3	4
Recruit youth for 4-H Robotics clubs or teams	1	2	3	4
Establish year-round 4-H Robotics clubs or teams	1	2	3	4
Provide opportunities for 4-H youth to be in robotics competitions	1	2	3	4
Describe the role of volunteers in 4-H Robotics	1	2	3	4
Recruit volunteers for 4-H Robotics programs	1	2	3	4
Train 4-H Robotics volunteers	1	2	3	4



4-H Robotics Pre-Assessment Survey (continued)

8. How comfortable do you feel with: *(Rating scale)*

Not Comfortable	Slightly Comfortable	Moderately Comfortable	Very Comfortable	
1	2	3	4	
Managing year-round 4-H Robotics clubs or teams	1	2	3	4
Finding a space for clubs or teams to meet	1	2	3	4
Finding technical expertise in robotics	1	2	3	4
Facilitating an engineering curriculum with youth	1	2	3	4
Supporting 4-H youth participating in robotics competitions	1	2	3	4
Preparing youth to use technology	1	2	3	4
Using computers to teach youth about robotics	1	2	3	4
Teaching programming to youth	1	2	3	4
Implementing the 4-H Robotics Curriculum	1	2	3	4
Utilizing sensors in robotics	1	2	3	4
Building robots using LEGO® MINDSTORMS® Kit	1	2	3	4
Programming LEGO® MINDSTORMS® Robots	1	2	3	4
Helping youth design and build their own robot	1	2	3	4
Using pseudocode to plan a computer program	1	2	3	4
Utilizing robotics as a vehicle for youth development	1	2	3	4
Implementing the Experiential Learning Model in robotics	1	2	3	4
Implementing Scientific Inquiry with youth	1	2	3	4
Implementing the Engineering Design Process with youth	1	2	3	4
Implementing the Essential Elements in robotics	1	2	3	4



4-H Robotics Pre-Assessment Survey (continued)

9. Which components of the *4-H Robotics: Engineering for Today and Tomorrow* curriculum do you plan to use?

4-H Virtual Robotics (Multiple choice, one answer – use choices below)

- ☐ Plan to use
- ☐ Do not plan to use
- ☐ Not sure

4-H Junk Drawer Robotics (Multiple choice, one answer – use choices below)

- ☐ Plan to use
- ☐ Do not plan to use
- ☐ Not sure

4-H Robotics Platforms (Multiple choice, one answer – use choices below)

- ☐ Plan to use
- ☐ Do not plan to use
- ☐ Not sure

10. Do you plan to use educational robotics kits? (Multiple choice, one answer – use choices below)

- ☐ Yes
- ☐ No
- ☐ Not Sure

If yes, what kits do you plan to use? Select all that apply.

(Multiple choice, multiple answers – use choices below)

- ☐ LEGO® MINDSTORMS®
- ☐ LEGO® WeDo™
- ☐ TETRIX®
- ☐ VEX®
- ☐ Robotix
- ☐ SeaPerch
- ☐ Other: please list _____



4-H Robotics Pre-Assessment Survey (continued)

11. Do you plan to include robotics competitions? *(Multiple choice, one answer – use choices below)*

- ☐ Yes
- ☐ No
- ☐ Not Sure

If yes, what competitions do you plan to include? Select all that apply.

(Multiple choice, multiple answers – use choices below)

- ☐ 4-H Competition
- ☐ FIRST® Jr. FLL®
- ☐ FIRST® FLL®
- ☐ FIRST® FTC®
- ☐ FIRST® FRC®
- ☐ Botball®
- ☐ VEX®
- ☐ SuGO
- ☐ Other– please list _____

12. Do you plan to establish new 4-H clubs or teams? *(Multiple choice, one answer – yes/no response)*

If yes, describe your plans for new clubs or teams. *(Comment box)*

13. Do you plan to recruit and/or train new volunteers? *(Multiple choice, one answer – yes/no response)*

If yes, describe your plans for recruiting or training volunteers. *(Comment box)*



4-H Robotics Pre-Assessment Survey *(continued)*

14. Do you plan to build new partnerships in your community around 4-H Robotics?

(Multiple choice, one answer – yes/no response)

If yes, describe your plans for building partnerships. *(Comment box)*

15. What are you hoping to learn at the upcoming training to prepare you to work with 4-H Robotics?

Please list your top three priorities. *(Comment box)*



Appendix 3: **4-H Robotics Post-Assessment Survey**

Post-Assessment

The purpose of this assessment is threefold. Your participation will help us:

- Evaluate the effectiveness of the training you attended,
- Assess your progress, and
- Identify additional resources and support that we can offer you.

Thanks for taking time to complete this survey.

1. Please tell us about yourself. *(Demographic data – required)*

Name:

City:

State:

2. What are your next steps for implementing 4-H Robotics? *(Single text box)*

3. What professional development strategies (if any) used at the training do you plan to implement in your work? *(Single text box)*



4-H Robotics Post-Assessment Survey (continued)

4. Following the training, how prepared are you to: *(Rating scale)*

Not Prepared 1	Somewhat Prepared 2	Prepared 3	Well Prepared 4
Develop a 4-H Robotics Program Action Plan			
Promote or market 4-H Robotics in your community			
Develop community support and partnerships for 4-H Robotics			
Describe the 4-H Robotics Curriculum			
Provide 4-H Robotics Curriculum training			
Describe opportunities 4-H Robotics offer to youth			
Recruit youth for 4-H Robotics clubs or teams			
Establish year-round 4-H Robotics clubs or teams			
Provide opportunities for 4-H youth to be in robotics competitions			
Describe the role of volunteers in 4-H Robotics			
Recruit volunteers for 4-H Robotics Programs			
Train 4-H Robotics volunteers			



4-H Robotics Post-Assessment Survey (continued)

5. Following the training, how comfortable do you feel with: *(Rating scale)*

Not Comfortable	Slightly Comfortable	Moderately Comfortable	Very Comfortable	
1	2	3	4	
Managing year-round 4-H Robotics Clubs or Teams	1	2	3	4
Finding a space for clubs or teams to meet	1	2	3	4
Finding technical expertise in robotics	1	2	3	4
Facilitating an engineering curriculum with youth	1	2	3	4
Supporting 4-H youth participating in robotics competitions	1	2	3	4
Preparing youth to use technology	1	2	3	4
Using computers to teach youth about robotics	1	2	3	4
Teaching programming to youth	1	2	3	4
Implementing the 4-H Robotics Curriculum	1	2	3	4
Utilizing sensors in robotics	1	2	3	4
Building robots using LEGO® MINDSTORMS® Kit	1	2	3	4
Programming LEGO® MINDSTORMS® Robots	1	2	3	4
Helping youth design and build their own robot	1	2	3	4
Using pseudocode to plan a computer program	1	2	3	4
Utilizing robotics as a vehicle for youth development	1	2	3	4
Implementing the Experiential Learning Model in robotics	1	2	3	4
Implementing Scientific Inquiry with youth	1	2	3	4
Implementing the Engineering Design Process with youth	1	2	3	4
Implementing the Essential Elements in robotics	1	2	3	4



4-H Robotics Post-Assessment Survey (continued)

6. Please tell us about your plans for building partnerships in your community.

Describe new ideas about building partnerships gained from the training and networking at our meeting: *(Comment box)*

Other ideas for implementation: *(Comment box)*

Additional resources you would like to have: *(Comment box)*

7. Please tell us about your plans recruiting youth and establishing 4-H Robotics clubs or teams.

Describe new ideas about recruiting youth and establishing clubs gained from the training and networking at our meeting: *(Comment box)*

Other ideas for implementation: *(Comment box)*

Additional resources you would like to have: *(Comment box)*

8. Please tell us about your plans for implementing the *4-H Robotics: Engineering for Today and Tomorrow Curriculum*.

4-H Virtual Robotics (Multiple choice, one answer – use choices below)

- _____ Plan to use
- _____ Do not plan to use
- _____ Not sure

4-H Junk Drawer Robotics (Multiple choice, one answer – use choices below)

- _____ Plan to use
- _____ Do not plan to use
- _____ Not sure



4-H Robotics Post-Assessment Survey (continued)

4-H Robotics Platforms (Multiple choice, one answer – use choices below)

- ☐ Plan to use
- ☐ Do not plan to use
- ☐ Not sure

Describe new ideas about implementing the curriculum gained from the training and networking at our meeting: *(Comment box)*

Other ideas for implementation: *(Comment box)*

Additional resources you would like to have: *(Comment box)*

9. Please tell us about your plans for utilizing educational robotics kits.

Which kits, if any, do you plan to use? Select all that apply.

(Multiple choice, multiple answers – use choices below)

- ☐ LEGO® MINDSTORMS®
- ☐ LEGO® WeDo™
- ☐ TETRIX®
- ☐ VEX®
- ☐ Robotix
- ☐ SeaPerch
- ☐ Other—please list_____

Describe new ideas about utilizing robotics kits gained from the training and networking at our meeting: *(Comment box)*

Other ideas for implementation: *(Comment box)*

Additional resources you would like to have: *(Comment box)*



4-H Robotics Post-Assessment Survey *(continued)*

10. Please tell us about your plans for involving youth in robotics competitions.

Which competitions, if any, do you plan to include? Select all that apply.

(Multiple choice, multiple answers – use choices below)

- ☐ 4-H Competition
- ☐ FIRST® Jr. FLL®
- ☐ FIRST® FLL®
- ☐ FIRST® FTC®
- ☐ FIRST® FRC®
- ☐ Botball®
- ☐ VEX®
- ☐ SuGO
- ☐ Other – please list
- ☐ Not sure.

Describe new ideas about robotics competitions gained from the training and networking at our meeting: *(Comment box)*

Other ideas for implementation: *(Comment box)*

Additional resources you would like to have: *(Comment box)*



4-H Robotics Post-Assessment Survey *(continued)*

11. Please tell us about your plans recruiting and training new volunteers for 4-H Robotics.

Describe new ideas about recruiting and training volunteers gained from the training and networking at our meeting: *(Comment box)*

Other ideas for implementation: *(Comment box)*

Additional resources you would like to have: *(Comment box)*

12. What information do you think is most important to include in future 4-H Robotics professional development trainings? *(Single text box)*

13. What information do you think is most important to offer for ongoing support in 4-H Robotics? *(Single text box)*



Appendix 4: **Materials List**

TRAINING MODULE	YOU WILL NEED	AMOUNT NEEDED
All Modules	Tables for participants to work in small groups and enough space for a computer if needed	
	Computer, projector, speakers and projection screen	1 of each
	PowerPoint slides (are incorporated into each module)	
	Power strips, surge protectors, and/or extension cords	1 per computer
	Trainer's Tool Kit:	
	Markers (for whiteboard or flipchart)	
	Pens or pencils (for each person)	
	Masking tape	
	Tailor's measuring tapes (~ 2 meters) or locking tape measures (one for each group)	
	Index cards (5–6 for each participant)	
	Timer or stopwatch to monitor time	
	Flipchart or whiteboard	
	Scrap paper or notecards for participants	
Module 1	Robotics kits you plan to demonstrate: LEGO® MINDSTORMS®, WeDo™, etc.	1 per demonstration
	Laptop computer with software for each robotic kit used in a demonstration	1 for each kit
	Building toys (LEGO®, Lincoln Logs, K'NEX or wooden blocks)	1 per group of 3–4
	Table for each planned demonstration	1 per demonstration
	Assistant facilitator	1 per demonstration
	Road To Robotic Slideshow	1



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Materials List (continued)

TRAINING MODULE	YOU WILL NEED	AMOUNT NEEDED
Module 2	See “All Modules” list	
Module 3	Large version of Recruitment Loop Worksheet– laminated	1
Module 4	LEGO® WeDo™ Construction Set	1 per 2–3 people
	LEGO® WeDo™ Construction Set Building Guides	1 per 2–3 people
	Laptop computers with LEGO® WeDo™ Construction Set Software loaded	1 per kit
	LEGO® WeDo™ Construction Set Activity Pack (software add-on)	1 per kit
	LEGO® WeDo™ Construction Set Training Guide	1 per kit
Module 5	Computers with <i>Virtual Robotics</i> loaded	1 per 1–2 people
	Headsets	1 per person
	12-inch ruler (beam)	1 per 2 people
	Cylinder– like a pencil, AA battery, or binder clip with metal handles removed (fulcrum)	1 per 2 people
	8 or more weights (coins, washers, all the same size)	1 set per 2 people
Module 6	Poster of the Engineering Design Process	1
	Box of paper clips	1 per group of 3–4
	Cardboard ramp: Sandpaper strips a total of about 36 inches in length Various tapes (masking, duct, etc)	1 per group of 3–4
	Protractor	1 per group of 3–4
	Coffee stirrers	2–4 per group of 3–4
	Drinking straws (different size diameters)	2–4 per group of 3–4
	Paper clips	6–8 per group of 3–4
	Scissors	1 per group



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Materials List (continued)

TRAINING MODULE	YOU WILL NEED	AMOUNT NEEDED
Module 6 (continued)	<i>Start-up sample bag with:</i> 1 regular craft stick 1 jumbo craft stick 1 regular paper clip 1 large paper clip 1 1-inch paper brad 1 1.5-inch paper brad 1 binder clip 1 drinking straw 1 rubber band 1 toy wheel 1 wood skewer (dull or remove the sharp pointed end, may cut or break in half to place in sample bag)	1 bag per group of 3–4
	Need to have plenty of extras of all the items in the sample bag to stock the “Supply Store”	
	Tools for building Clipmobile: Drill and/or punch, pliers, scissors or wire cutters	1 of each
Module 7	Computers with LEGO® MINDSTORMS® Software loaded	1 per kit
	LEGO® MINDSTORMS® Kits	1 for every 1–2 people
	Poster of the Engineering Design Process	1
	Balls, cups, or other objects that are easy to pick up	1 per group of 3–4
Module 8	Computers with LEGO® MINDSTORMS® Software loaded	1 per kit
	LEGO® MINDSTORMS® Kits	1 for every 1–2 people
	12-inch ruler	1 per 2 people
	Flat object such as notebook or binder	1 per group
	Object such as a binder for the robot to approach, but not run into	1 per group
	Post Its: “What?” “So What?” and “Now What?” (see Preparation section of the module))	1 set
Module 9	Computer with Internet connection (optional)	1



Appendix 5: **List of Handouts**

MODULE	WORKSHEET NAME	QUANTITY
Module 1	Robotics Program Entry Point Chart	1 per person
	Clover Countdown: Top 10 Things 4-H Educators will Love about Robotics Suggestions	1 per person
	Case Studies: Youth Development Success and Robotics	1 per person
Module 2	Volunteer Team Activity Handout	3–4 per group
	Sources for Volunteer Recruitment – Science Rich Volunteers	1 per person
	Volunteer Roles	1 per person
	<i>4-H Robotics Program</i> Action Plan Worksheet	1 per person
	Building Your 4-H Robotics Action Plan Questionnaire	1 per person
Module 3	Recruitment for Your Robotics Program	1 per person
	Participation Progression	1 per person
	Marketing and Promotion Ideas	1 per person
	Outreach and Recruitment (Youth)	1 per person
	Press Release Template	1 per person
	Press Release Sample	1 per person
	Talking Points and Conversation Starters	1 per person
	Promotional Flyer Template	1 per person
	Promotional Postcard Template	1 per person
	Promotional Poster Template	1 per person
	<i>4-H Robotics Program</i> Action Plan Update Worksheet	1 per person
Module 4	LEGO® WeDo™ Component Identification Sheet	1 per person
	LEGO® WeDo™ Success Stories	1 per person
	LEGO® WeDo™ Internet Resources	1 per person



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List of Handouts (continued)

MODULE	WORKSHEET NAME	QUANTITY
Module 5	<i>4-H Robotics: Engineering for Today and Tomorrow</i>	1 per person
	Take It Off-Line Activity: Build a Class-1 Lever	1 per group of 2–3
	<i>Virtual Robotics</i> Notebook, Module 2	1 per person
	Utilizing Your Robotics Notebook	1 per person
	Scenario Cards – <i>Virtual Robotics</i> (Technology)	1 set per group of 20–30
Module 6	<i>4-H Robotics: Engineering for Today and Tomorrow</i>	1 per person
	<i>Junk Drawer Robotics</i> Notebook (pages 34–41)	1 per person
	Junk Drawer Module 1: Get Things Moving (pages 13–30)	1 per person
	Play Money (page 26)	\$45 per group of 2–3
	Engineering Design Process	1 per person
	Experiential Learning Activity – Clipmobile	1 set per group of 3–4
	Scenario Cards – Junk Drawer (Discussion)	1 set per group of 20–30
Module 7	Utilizing Your Robotics Notebook	1 per person
	<i>Robotics Platform</i> Notebook Module 2 (pages 1–2)	1 per person
	<i>Robotics Platform</i> Notebook Module 3 (pages 1–3)	1 per person
	Engineering Design Process	1 per person
	Experiential Learning Activity – Building Robots	1 per person
Module 8	<i>4-H Robotics: Engineering for Today and Tomorrow</i>	1 per person
	Utilizing Your Robotics Notebook	1 per person
	<i>Robotics Platform</i> Notebook, Module 6 (pages 1–4)	1 per person
	Asking Good Questions	1 per person
Module 9	Success Stories	1 per person
	Program Evaluation Tools	1 per person
	<i>FIRST® (For Inspiration and Recognition of Science and Technology)</i>	1 per person
	Making Robotics Work in Your 4-H Club – All Year, Every Year!	1 per person
	<i>4-H Robotics Program</i> Action Plan Update II	1 per person
	Supplemental Materials:	
	Teens as Leaders, Teachers, Mentors	1 per person
	Delivery Modes and Expansion Ideas	1 per person
	Program Year Planner	1 per person