CFAES

COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

4-H 509

ROBOTICS ESSENTIALS

Name _____

Age (as of January 1 of the current year) _____

County _____

Club or group name _____

Project helper _____

THE OHIO STATE UNIVERSITY
EXTENSION

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Acknowledgment

Many thanks to Tad Douce, whose previous work on Ohio 4-H robotics publications served as inspiration for this one.

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Note to the Project Helper

Congratulations! A 4-H member or other youth has asked you to serve as a project helper. You may be a parent, relative, project leader, friend, club advisor, or another important person. As a project helper, it is up to you to encourage, guide, and assist. How you choose to be involved helps to shape the learner's life skills and knowledge.

Your Role as Project Helper

Your contribution is critical to delivery of the 4-H program, which is committed to positive youth development (PYD). The 4-H Thriving Model, the theory of change for positive youth development, connects high-quality program settings to the promotion of youth thriving. That's where you come in.

High-quality 4-H program settings provide youth a place to belong, matter, and explore their personal spark. These components, along with strong relationships with caring adults and supportive peers, help ensure that 4-H programs provide a nourishing developmental context—a place where youth feel a sense of belonging and can grow.

High-quality 4-H programs contribute to PYD through the intentional promotion of social, emotional, and cognitive learning. This process is described by seven indicators of youth thriving (see model).

LONG-TERM OUTCOMES

- Academic or Vocational Success
- Civic Engagement
- Employability & Economic Stability
- Happiness & Wellbeing

DEVELOPMENTAL OUTCOMES
(Positive Youth Development)

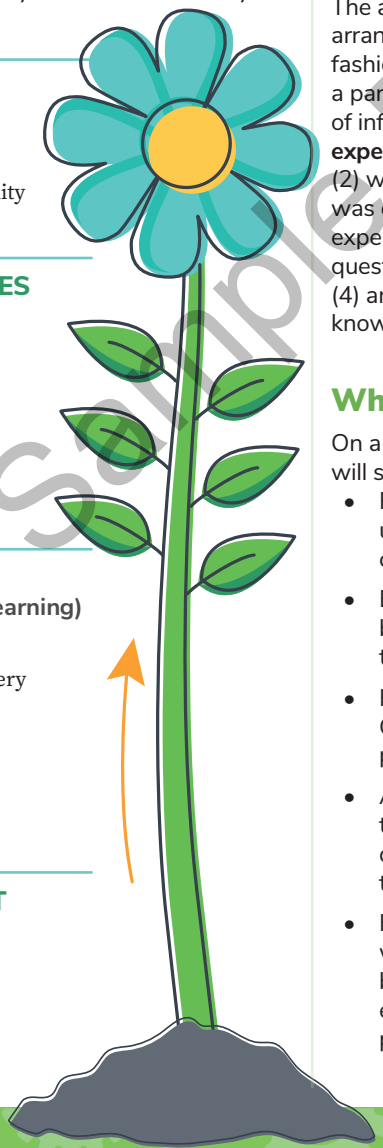
- Positive Academic Attitude
- Social Competence
- Personal Standards
- Connection with Others
- Personal Responsibility
- Contribution

YOUTH THRIVING
(Social, Emotional & Cognitive Learning)

- Growth Mindset
- Openness to Challenge & Discovery
- Hopeful Purpose
- Prosocial Orientation
- Transcendent Awareness
- Positive Emotions
- Goal Setting & Management

DEVELOPMENTAL CONTEXT
(4-H Programs)

- Sparks
- Belonging
- Relationships
- Engagement

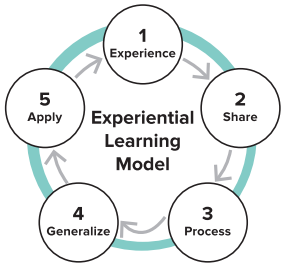


Youth who experience high-quality program settings with these key social, emotional, and cognitive skills achieve key positive youth developmental outcomes. They are then also more likely to achieve long-term outcomes marked by vocational or academic success, civic engagement, employability and economic stability, and happiness and well-being.

For more information on the 4-H Thriving Model of Positive Youth Development, please go to **helping-youth-thrive.extension.org**.

What You Should Know About Experiential Learning

The activities in this book are arranged in a unique, experiential fashion. A youth is introduced to a particular practice, idea, or piece of information through an opening **experience** (1). The learner **shares** (2) with the project helper what was done and **processes** (3) the experience through a series of questions that allow for **generalizing** (4) and **applying** (5) the new knowledge and skill.



Pfeiffer, J.W., and J.E. Jones, *Reference Guide to Handbooks and Annuals.* © 1983 John Wiley & Sons, Inc. Reprinted with permission of John Wiley & Sons, Inc.

What You Can Do

On a practical level, your role as a project helper means you will strive to do the following:

- Review the Learning Outcomes for each activity to understand the learning taking place. See the inside back cover for the Summary of Learning Outcomes.
- Become familiar with each activity, including the background information. Stay ahead of the learner by trying out activities beforehand.
- Help the learner establish a plan by reviewing the Project Guide. As a resource person, limit your involvement to providing support.
- As activities are completed, conduct debriefing sessions that allow the learner to share results and answer questions. This important step improves understanding. In the Project Guide, date and initial completed activities.
- Help the learner celebrate what was done well and see what could be done differently. Allow the learner to become better at assessing their own work. Encourage exploration of the topic beyond the scope of this project book.

Project Guide

Welcome to the exciting world of robotics! You are about to learn what a robot is, how to build one, and how to program one to interact with its environment.

Robotics 1: Essentials is an intermediate-level project because it requires fine motor skills, attention to detail, and some interest and experience with building and coding. It is designed to be completed as an individual project, although many learners complete their individual projects while working together in a small group, sharing knowledge and skills as they go. No previous knowledge of robotics is required.

If you are 10 years old or younger, you can still take this project. You might need more involvement from your project helper or even more time, but you can do it.

The amount of time for each activity varies, but the project is easily completed within one year.

For this project, you can choose either the LEGO® SPIKE Prime or VEX® IQ educational robotics kit. More information about each one is at **go.osu.edu/4hrobotics**.

Check your county's project guidelines (if any) for completion requirements in addition to the ones below, especially if you plan to participate in county project judging or plan to prepare an exhibit for the fair.

Project Guidelines

Step 1. Complete **all ten** activities and **all** the Talking It Over questions.

Step 2. Take part in **at least two** learning experiences.

Step 3. Become involved in **at least two** leadership/citizenship activities.

Step 4. Complete a project review.

Step 1: Project Activities

Complete **all ten** activities and **all** the Talking It Over questions. The More Challenges activities are optional. As you finish activities, review your work with your project helper. Then, ask your project helper to initial and date your accomplishment.

Activity	Date Completed	Project Helper Initials
PROJECT AREA: The Basics		
1. What Is a Robot?		
2. Robots for Work and Fun		
3. What's What		
Talking It Over		
PROJECT AREA: Building Your Robot		
4. If I Only Had a Brain		
5. Start with Something Simple		
6. One Step at a Time		
7. Building Blocks		
Talking It Over		

Activity	Date Completed	Project Helper Initials
PROJECT AREA: Sensors		
8. Sensors Galore		
9. Be Sensible		
10. Two Sensors Are Better Than One		
Talking It Over		

Step 2: Learning Experiences

Learning experiences are meant to complement project activities, providing the opportunity for you to do more in subject areas that interest you. What are some learning experiences you could do to show the interesting things you are learning about? Here are some ideas:

- Attend a clinic, workshop, demonstration, or speech related to robotics.
- Help organize a club or group meeting based on this project.
- Go on a related field trip or tour.
- Prepare your own demonstration, illustrated talk, or project exhibit.
- Participate in a county fair or other judging event.
- Attend or participate in a robotics competition.
- Plan your own learning experience.

Once you have a few ideas, record them here. Complete **at least two** learning experiences. Then, describe what you did in more detail. Ask your project helper to date and initial in the appropriate spaces below.

Plan to Do	What I Did	Date Completed	Project Helper Initials
Demonstration	Used my kit to show club or group members the basic parts of my robot.	5/5/yr	R.R.

Step 3: Leadership and Citizenship Activities

Use what you learn to give back to your community! Choose **at least two** leadership/citizenship activities from the list below (or create your own) and write them in the table. Record your progress by asking your project helper to initial next to the date as each one is completed. You may add to or change these activities at any time. Here are some examples of leadership/citizenship activities:

- Teach someone about programming a robot.
- Help someone else prepare for project judging.
- Help organize a club field trip to a science museum or to a manufacturing plant that has robots.
- Encourage someone to enroll in *Robotics 1: Essentials*.
- Arrange for someone from a local manufacturing firm to speak to your club or other groups about robotics.
- Plan your own leadership/citizenship activity.

Leadership/Citizenship Activity	Date Completed	Project Helper Initials
Taught friends how to make my robot purr like a cat and make other noises.	6/12/yr	R.R.

Step 4: Project Review

All finished? Congratulations! After you've completed the activities in this book, you are ready for a project review. This process helps assess your personal growth and evaluate what you have learned.

Use this space to write a summary of your project experience. Be sure to include a statement about the skills you have learned and how they might be valuable to you in the future.

Now, set up a project evaluation. You can do this with your project helper or another knowledgeable adult. If you are a 4-H member, it can be part of a club evaluation or part of your country's project judging.

What Is a Robot?

The words robot and robotics are used to describe many things, some of which are actually robots and some of which are not. To successfully use robots, you need to understand what they are and what they can do.

Words in bold throughout this book are defined in the glossary.

WHAT TO DO

Estimated time: 30 minutes

The Robotic Industries Association (RIA) defines a robot as "a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks."

Wow! Those are some big words. Let's see if we can simplify it a bit. Robots are much more than mere machines. But what, exactly, are they?

The following list serves as a good, basic description. A robot must be . . .

- **programmable**. A robot must have some type of instructions that can be changed by the operator.
- **automatic**. A robot must be able to work without a person controlling it.
- **a multiuse machine**. A robot must be able to do different jobs either by changing the program or by changing the parts.
- **able to sense its surroundings**. A robot must have sensors that are used to collect information about its environment.

LEARNING OUTCOMES

Project skill: Identifying machines as robots or not robots • **Life skill:** Understanding systems • **Educational standard:** NGSS 3-5. ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. • **Success indicator:** Identifies machines as robots or not robots

Use the checklist next to each item below and on the top of the next page to determine whether it is a robot.

Gas Pump

- ◯ programmable
- ◯ automatic
- ◯ multiuse
- ◯ senses surroundings

Is it a robot?

◯ yes ◯ no

Blender

- ◯ programmable
- ◯ automatic
- ◯ multiuse
- ◯ senses surroundings

Is it a robot?

◯ yes ◯ no

Light Switch

- ◯ programmable
- ◯ automatic
- ◯ multiuse
- ◯ senses surroundings

Is it a robot?

◯ yes ◯ no

Washing Machine

- ◯ programmable
- ◯ automatic
- ◯ multiuse
- ◯ senses surroundings

Is it a robot?

◯ yes ◯ no

Smart Phone

- ◯ programmable
- ◯ automatic
- ◯ multiuse
- ◯ senses surroundings

Is it a robot?

◯ yes ◯ no

See answers on page 39.

MORE CHALLENGES

Make a list of toys that are based on robotics. Explain how the toys meet the definition of a robot to your project leader or to two friends.

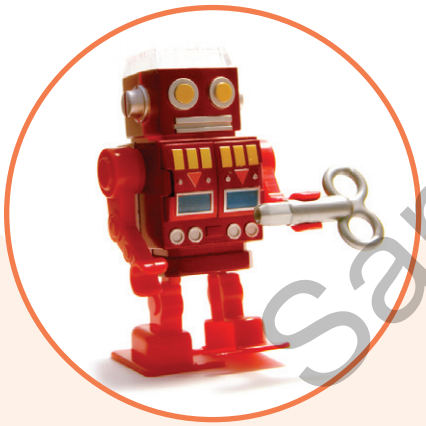
BACKGROUND

"I can't define a robot, I just know when I see one."

—Joseph Engelberger, the "Father of Robotics"

Think about the tools and machines you hear about and use every day. Can you relate to the quote above? Defining what a robot is can be challenging; scientists and engineers have been debating the topic for decades. A key part of the definition is that a robot must sense its surroundings. We'll explore this later.

Robotic technology is used in many places, including medicine, manufacturing, space programs, and even the military. From robots that help build new cars to ones that allow surgeons to perform surgery through a tiny hole in a patient's skin, it is clear that robots play an increasingly important role in our lives.



Did you know?

The word robot was first used in 1920 in R.U.R. (Rossum's Universal Robots), a science-fiction play by Czech writer Karel Capek.