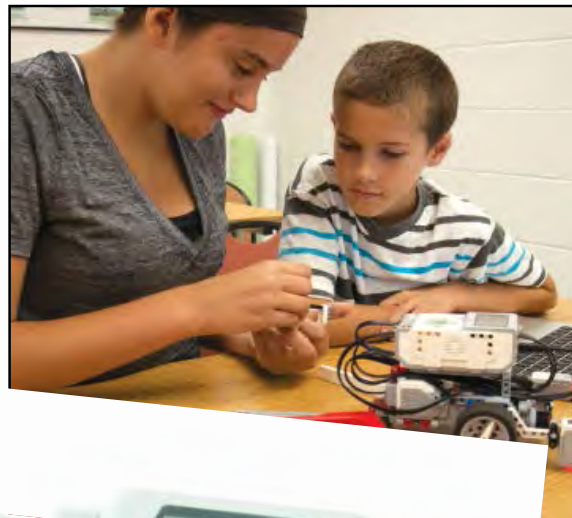


ROBOTICS



with
EV3



Name _____

Age _____

(As of January 1 of the current year)

Club name _____

Club advisor _____

County _____

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NOTES TO THE PROJECT HELPER

Congratulations! A 4-H member has asked you to serve as a project helper. You may be a parent, relative, project leader, friend, club advisor, or another person important in the 4-H member's life. Your duties begin with helping the youth create and carry out a project plan, as outlined in the Member Project Guide. This is followed by helping the youth focus on each activity, providing support and feedback, and determining what was done well, what could have been done differently, and where to go next.

As a project helper, it is up to you to encourage, guide, and assist the 4-H member. How you choose to be involved helps to shape the 4-H member's life skills and knowledge of the importance of robotics.

Your Role as Project Helper

Your contributions are critical to delivery of the 4-H program, which is committed to providing experiences that strengthen a young person's sense of belonging, generosity, independence, and mastery. It is essential that your interactions support positive youth development within the framework of these Eight Key Elements:

1. Positive relationship with a caring adult
2. Welcoming environment
3. Opportunity to value and practice service
4. Opportunity for mastery
5. Physically and emotionally safe environment
6. Opportunity for self-determination
7. Engagement in learning
8. Opportunity for self-determination

For more information on the Eight Key Elements, please refer to the Advisor Handbook available online at ohio4h.org. On a practical level, your role as a project helper means you will . . .

- Guide the youth and provide support in setting goals and completing this project.
- Encourage the youth to apply knowledge from this project book.
- Serve as a resource person.
- Encourage the youth to go beyond the scope of this 4-H project book to learn more about robotics.

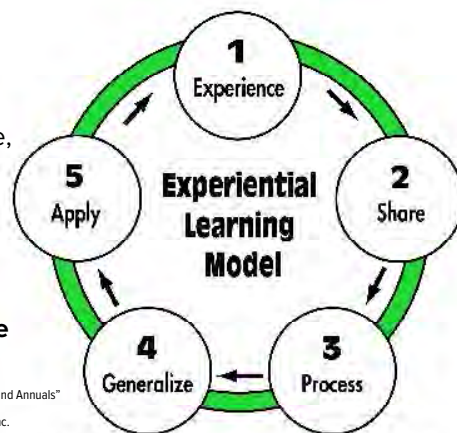
What You Can Do

- Review the Learning Outcomes (project skill, life skill, educational standard, and success indicator) 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 and the related background information. Stay ahead of the learner by trying out activities beforehand.
- Begin the project by helping the learner establish a plan. This is accomplished by reviewing the Member Project Guide.
- After each activity or project area is completed, conduct a debriefing session that allows the learner to answer the review questions and share results. This important step improves understanding from an experiential learning perspective.
- Help the learner celebrate what was done well and to see what could be done differently. Allow the learner to become better at assessing his or her own work.
- In the Member Project Guide, date and initial the activities that have been completed.



What You Should Know About Experiential Learning

The information and activities in this book are arranged in a unique, experiential fashion (see model). In this way, a youth is introduced to a particular practice, idea, or piece of information through an opening (1) **experience**. The results of the activity are recorded on the accompanying pages. The member then (2) **shares** what he or she did with the project helper and (3) **processes** the experience through a series of questions that allow him or her to (4) **generalize** and (5) **apply** the new knowledge and skill.



Pfeiffer J.W., & Jones, J.E., "Reference Guide to Handbooks and Annuals"
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Member Project Guide

Welcome to the exciting world of robotics! In this project, you'll learn what a robot is, how to build one using a LEGO® MINDSTORMS® robotics kit, and how to program a LEGO® robot to interact with its environment. All activities are based on the LEGO® EV3 system.

Robotics 1, which is appropriate for all age levels, is designed to be completed as an individual project, although many 4-H members 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, but younger members should take this project under the direction of a knowledgeable adult. The project can easily be completed in one year. Members who want to continue in robotics are encouraged to move on to *Robotics 2 with EV3*.

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 twelve** activities and **all** of 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 twelve** 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. What's What		
3. If I Only Had a Brain		
Talking It Over		
PROJECT AREA: BUILDING YOUR FIRST ROBOT		
4. Start with Something Simple		
5. Let's Get a Move On		
6. One Step at a Time		
Talking It Over		
PROJECT AREA: SENSORS		
7. Let's Be Sensible		
8. I've Got a Feeling!		
9. Do You See What I See?		
10. All the Pretty Colors		
11. Two Sensors are Better Than One		
Talking It Over		
PROJECT AREA: WHAT DO YOU WANT YOUR ROBOT TO DO?		
12. Small Tasks, Big Accomplishments		
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 meeting based on this project.
- Go on a related field trip or tour.
- Prepare your own demonstration, illustrated talk, or project exhibit.
- Participate in county judging.
- Attend or participate in a robotics competition.

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
<i>Demonstration</i>	<i>Showed club members the basic contents of a LEGO® Mindstorms EV3 kit.</i>	<i>4/5/YR</i>	<i>T.D.</i>



STEP 3:

Leadership and Citizenship Activities

Choose at least two leadership/citizenship activities from the list below (or create your own) and write them in the table below. Record your progress by asking your project helper to initial next to the date 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 another member prepare for his or her 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 with EV3.
- Arrange for someone from a local manufacturing firm to speak to your club about robotics.
- Plan your own leadership/citizenship activity.

LEARNING/CITIZENSHIP ACTIVITIES	DATE COMPLETED	PROJECT HELPER INITIALS
<i>Taught club member how to make my robot purr like a cat.</i>	<i>5/5/YR</i>	<i>T.D.</i>



What Is a Robot?

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

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

ACTIVITY 1

WHAT TO DO

The Robotic Industries Association (RIA) defines a robot “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.
- **be automatic.** A robot must be able to work without a person controlling it.
- **be a multi-use machine.** A robot must be able to do different jobs either by changing the program or by changing the parts.
- **sense its surroundings.** A robot must have sensors that are used to collect information about its environment.

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
- multi-use
- senses surroundings

Is it a robot?

- yes
- no



Blender

- programmable
- automatic
- multi-use
- senses surroundings

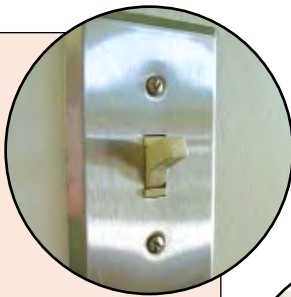
Is it a robot?

- yes
- no



Light Switch

- programmable
- automatic
- multi-use
- senses surroundings



Is it a robot?

- yes
- no

Washing Machine

- programmable
- automatic
- multi-use
- senses surroundings



Is it a robot?

- yes
- no

Answers are on page 40.



MORE CHALLENGES

- *Make a list of toys that are based on robotics. Explain to your project leader or two other club members how the toys meet the definition of a robot.*
- *Create a timeline of the history of robots. Use it for your project display at the fair.*



LEARNING OUTCOMES

Project skill: Identifying machines a robot or not a robot

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



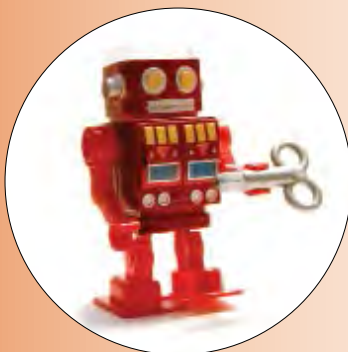
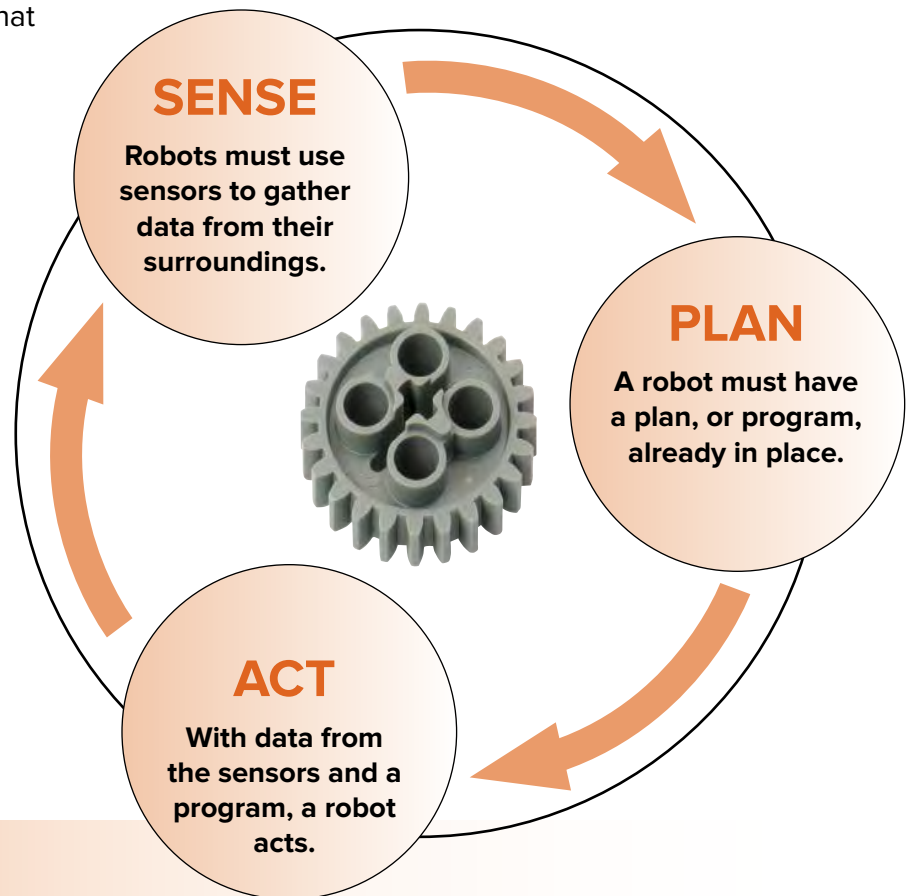
BACKGROUND

“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 book of science fiction by writer Karel Capek.