

Understanding Robots

Teacher's Guide



Grade Level: 6–12

Curriculum Focus: Technology

Lesson Duration: 2 class periods

Program Description

Understanding Robots (21 min.) – *Articulate Alice Bot* – Demonstrates the uses of artificial intelligence with an award-winning “chat bot.” *Robotic Surgery* – Shows the lifesaving potential of robots that can help doctors perform open heart surgery. *Magnificent Millibots* – Introduces viewers to the fascinating world of millibots – miniature robots designed to handle hazardous jobs and tight spaces.

Discussion Questions

- What are some of the potential applications of millibots?
 - What is the benefit of having the millibots work together as a team?
 - What type of design changes are engineers currently working on to enhance the millibots' performance?
 - What are the three parts of the millibots' modular design?
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DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How to Use the DVD

The DVD starting screen has the following options:

Play Video – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

Video Index – Here the video is divided into sections indicated by video thumbnail icons; brief descriptions are noted for each one. Watching all parts in sequence is similar to watching the video from start to finish. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

Standards Link – Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources – This screen gives the technical support number and Web site address.

Video Index

Segment 1: Articulate Alice Bot

Description

Articulate Alice Bot is the latest example of artificial intelligence. Learn more about how this “chat bot” was programmed to talk to human users.

Pre-viewing question

Q: What do you know about artificial intelligence?

A: Answers may include programming computers to learn new responses based on programmed experiences.

Post-viewing question

Q: What type of verbal responses would “chat bots” have trouble with?

A: Chat bots cannot respond to anything they haven't been programmed for, such as personal details about new people and current events.

Segment 2: Robotic Surgery

Description

Robots are revolutionizing the way doctors perform open heart surgery. Witness a complicated bypass operation performed with the help of four robotic arms.

Pre-viewing question

Q: What are some of the advantages of using robots in the medical field?

A: Answers will vary.

Post-viewing question

Q: What is the difference between the incisions made for conventional open heart surgery and surgery utilizing a robotic arm?

A: Traditional open heart surgery requires a large incision from the neck to the belly, whereas the robotic arms only need four small incisions and a camera to view the heart and arteries.

Segment 3: Magnificent Millibots

Description

Millibots are amazing miniature robots that will have many important applications in the near future. Discover how teamwork enables these machines to perform hazardous duties.

Pre-viewing question

Q: What do you know about the use of robots in everyday life?



A: Answers will vary.

Post-viewing question

Q: What is the main cost benefit of using small robots?

A: Small robots are cheap to make and replacing components (or the entire millibot) is less expensive and easier to accomplish than repairing a much larger robotic machine.

Lesson Plan

Student Objectives

- Discover recent advances in robotic technology.
- Collaborate with other students while designing modules for a proposed millibot.
- Develop skills important to successful scientific inquiry, such as experimentation, observation, communication, and collaboration.

Materials

- *Understanding Robots* video and VCR, or DVD and DVD player, or access to the program in downloadable or streaming format online
- Computer with Internet access
- Print and Web resources about robotics
- Construction paper, 4X6" index cards, tape, and markers for class presentations

Procedures

1. Before viewing the video, ask the students if they are familiar with robotics in everyday life. Where can you find actual robots? Possible answers include the automobile industry, where production lines are heavily automated. Tell the students that the program they are about to see will show them various advances in the field of robotics, but they should pay special attention to the segment on millibots.
2. After viewing the program, ask the students what they remember about the millibots segment. What are some of the potential applications of millibots? Discuss answers from the video, such as surveillance during a hostage situation or military uses. What is the benefit of having the millibots work together as a team? Possible answers include the fact that if one millibot malfunctions or breaks down, the rest of the team is still operable.
3. Ask the students about possible enhancements to the millibots' current design. What type of design changes are engineers currently working on to enhance the millibots' performance? Discuss answers from the video, such as the ability to move the robots over rough terrain and to disperse dozens of millibots over a wide area, especially for military applications. What other applications do you think are possible for these millibots?

4. Discuss the importance of modularity. What are the benefits of having millibots with interchangeable parts? What happens when a component breaks down? What are the three parts of the millibots' modular design? Ask the students to list the three modules of a millibot:
 - Bottom layer – treads or wheels for mobility
 - Middle layer – computers for processing and communications as well as the energy source
 - Top layer – payload that plugs into the top; could be cameras or sensors
5. Ask students to research robotics using print and Web resources. The following Web sites contain pertinent information:
 - Arrick Robotics
www.robotics.com/report.html
 - Millibot Intro (Carnegie Mellon University)
www.contrib.andrew.cmu.edu/~rjg/millibots/millibot_project.html
 - Science News for Kids Feature: Robots on a Rocky Road
www.sciencenewsforkids.org/articles/20040421/Feature1.asp
6. Tell the students that they are going to have an opportunity to design the modules of their own millibot. They can use the technologies described in the video or come up with their own ideas. Have the students design the bottom third of the millibot first. How will the robot move around? Will it use wheels, tank treads, propellers for aquatic movement, or hover over the ground? Ask the students to draw the bottom layer of their millibot on a sheet of construction paper and to write a brief description of the module on a 4x6" index card that will be taped to the back of the sheet. Make sure every sheet of construction paper used in this classroom exercise is properly labeled with the student's name.
7. After the students have finished designing the lower third of the millibot, ask them to design the middle layer. What would be its fuel source? Would it be battery operated? Powered by solar energy? What types of processing and communications equipment would be in this module? Have the students draw the middle layer of their millibot on a sheet of construction paper and write a brief description of the module on a 4x6" index card that will be taped to the back of the sheet.
8. Ask the students to design the payload for the top third of their millibot. Ask them to consider what they want the robot to do. Would the millibot's payload record audio or video? Would it use its sensors to map out a location? Have the students consider what other functions the payload could perform, like tunneling, drilling, or even bomb detonation. Have the students draw the top layer of their millibot on a sheet of construction paper and write a brief description of the module on a 4x6" index card that will be taped to the back of the sheet.

Divide the class into thirds. Have the first third of the class bring their designs for the bottom module of the millibot to the front of the class and have them tape them up to the chalk board or wall. Have the second group of students take their designs for the middle module of

their robot and tape each of them just above one of the modules that is already taped to the wall. Ask the third group of students to bring their designs for the top portion of the millibot to the front of the class and have them complete the partially constructed millibots by taping their sketches to the wall.

10. Ask the students to consider how these random combinations are different than the millibots they originally designed. Do you see any millibot designs that are a vast improvement over what you originally imagined? Are there any modules displayed here that should be put together? What sort of duties would those millibots perform?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students were highly engaged in class discussions; produced a detailed and complete set of sketches and descriptions including all of the requested information; fully contributed to the group activity; accurately cited three interesting, relevant points in their designs.
- 2 points: Students participated in class discussions; produced an adequate set of sketches and descriptions including most of the requested information; made some contributions to the group activity; satisfactorily cited two relevant points in their designs.
- 1 point: Students participated minimally in class discussions; created an incomplete set of sketches and descriptions including little or none of the requested information; made little or no contribution to the group activity; did not recall any interesting, relevant points in their designs.

Vocabulary

autonomous

Definition: Existing independent of anything else

Context: Dozens of autonomous millibots could help soldiers on the battlefield by detecting and reporting the enemy's position.

component

Definition: A part or element of something

Context: The components required for millibots are relatively inexpensive and easy to find.

modular

Definition: Constructed in similar sizes or with similar units for flexibility and variety in use

Context: The modular construction of the millibots make them easy to repair and very interchangeable.



payload

Definition: Something (such as instruments) carried by a vehicle in addition to what is necessary for its operation

Context: The “pyrobot” has a heat-seeking payload that can detect the presence of warm bodies.

sensor

Definition: A light that detects a physical quantity (as a movement or a beam of light) and responds by transmitting a signal

Context: The millibot's sensors can detect walls and other obstacles.

surveillance

Definition: Close watch

Context: Engineers can place surveillance cameras on millibots in order to monitor hostage situations.

ultrasonic

Definition: Relating to or being vibrations that are of the same kind as sound waves but have too high a frequency to be heard by the human ear

Context: The sonarbot, which has eight ultrasonic sensors, assists the camerobot by guiding it through the twists and turns of the building's ventilation system.

Academic Standards

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/compendium/browse.asp>

This program addresses the following national standards:

- Science – Nature of Science: Understands the scientific enterprise
- Science – Physical Sciences: Understands the sources and properties of energy; Understands forces and motion
- Technology: Knows the characteristics and uses of computer hardware and operating systems; Knows the characteristics and uses of computer software programs; Understands the nature of technological design; Understands the relationship among science, technology, society, and the individual; Understands the nature and operation of systems; Understands the nature and uses of different forms of technology



National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K–12 to promote scientific literacy. To view the standards visit this Web site:

<http://books.nap.edu/html/nses/html/overview.html#content>

This lesson plan addresses the following national standards:

- Science and technology: Abilities of technological design; Understandings about science and technology
 - Physical science: Transfer of energy; Motions and forces
 - Science in personal and social perspective: Science and technology in society
 - History and nature of science: Science as a human endeavor; Nature of science
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the DiscoverySchool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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Credit

Robyn Kurth, freelance writer