PROGRAMMING RB5X USING
ROBOT CONTROL LANGUAGE WITH SAVVY

TEACHERS GUIDE

GENERAL ROBOTICS CORPORATION GOLDEN, COLORADO
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General Robotics Corporation
14618 West 6th Avenue, Suite 150
Golden, Colorado 80401

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TABLE OF CONTENTS

TEACHERS GUIDE

A Foreword to the Teacher

Sample Lesson Plans

Introduction: Laying the Foundation, i
Activity 1: Random Movement vs. Structured Movement, 1
Activity 2: Move in a Square, 3
Activity 3: Move in a Triangle, 3
Activity 4: Move in a Circle, 4
Activity 5: Robot Pathfinder, 5
Activity 6: Animal Charades, 6
Activity 7: Rock 'n' Roll Robot, 7
Activity 8: The Robot Waltz, 7
Activity 9: Square Dance Partner, 8
Activity 10: Robot Ballet, 9

Table of Contents

Section B: Sensing Devices, 11
Activity 1: Respond When Any Bumper is Touched, 11
Activity 2: Respond When Front and Rear Bumpers are Touched, 12
Activity 3: Respond When This Bumper is Touched, 13
Activity 4: All of the Bumper Commands Together, 14
Activity 5: Respond When Sonar Activated, 14
Activity 6: Measuring Sonar Distances, 15
Activity 7: Using Sonar and Bumpers Together, 16
Activity 8: Staying Out of the Way, 17
Activity 9: Exploring Infrared, 17
Activity 10: Find the Charger, 18

Section C: Audio-Visual Communication, 21
Activity 1: Sound Pattern #1, 21
Activity 2: Sound Pattern to Music, 22
Activity 3: Morse Code, 23
Activity 4: Light Pattern #1 or A Bright Idea, 24
Activity 5: Light Pattern #2, 24
Activity 6: The Festive Robot, 25
Activity 7: Putting Sounds and Lights Together, 26
Activity 8: Back to Morse Code, 26
Activity 9: New Year's Eve, 27
Activity 10: Sentry Robot, 27

Section D: Speech Programming, 29
Activity 1: Programming in Phonemes, 29
Activity 2: Repeating a Simple Sentence, 31
Activity 3: A Robot Introduction, 31
Activity 4: Deliver an Important Message, 32
Activity 5: The Robot Instructions, 34
Activity 6: The Alien Robot, 34
Activity 7: Robot Instructions, 34
Activity 8: A Conversation with Your Robot, 35
Activity 9: A Play for Robot and Two Actors, 36
Activity 10: The Robot Psychologist, 36
Phonemes, 38

Section E: The Robot Arm, 43
Activity 1: Exploring the Shoulder, 43
Activity 2: What is a Robot Elbow, 44
Activity 3: Wrist Wiggling, 45
Activity 4: Robot Grippers, 46
Activity 5: Find the Center, Find the Limits, 46

Activity 6: Eggs in the Basket, 47
Activity 7: A Robot Assembly-Line Helper, 48
Activity 8: Draw a Simple Geometric Form, 48
Activity 9: Robot Artist, 49
Activity 10: The Writing Robot, 50

Section F: Putting It All Together, 51
Activity 1: Robot Patrol, 51
Activity 2: Robot Exercise Leader, 52
Activity 3: Robot Express, 53
Activity 4: Robot Vaudeville, 53
Activity 5: Robot Professor, 54
Activity 6: Robot Zoo, 55
Activity 7: Robot Butler, 55
Activity 8: Robot Host, 56
Activity 9: RB5X Says, 56
Activity 10: Multipurpose Robot, 57

Appendix 1: Robot Vocabulary, 59

Appendix 2: Phonemes, 61

Appendix 3: Sample Solutions, 67
Section A: Robot Movement, 67
Section B: Sensing Devices, 76
Section C: Audio-Visual Communication, 82
Section D: Speech Programming, 96
Section E: The Robot Arm, 109
Section F: Putting It All Together, 117

ABOUT THE AUTHOR AND THE EDITOR

Author Niki Delgado is General Manager of Rio Grande Robotics, Las Cruces, New Mexico. She is a former educator with a background in early childhood education, special education, bilingual education, and educational psychology.

Editor Sharon D. Smith is a technical writer/editor who worked as RB Robot Corporation's Manager of Corporate Communications from 1983 to 1985. She now runs her own marketing communications firm, Caledonia Communications, Conifer, Colorado.

A FOREWORD TO THE TEACHER

OVERVIEW

The activities in this package are designed to teach students to effectively program all features of RB5X: The Intelligent Robot(tm) using Robot Control Language(tm) with Savvy(R) -- or RCL(tm), for short. The Teacher's Guide contains all of the activities in the Student Workbook as well as a complete set of Sample Solutions for the problems in the Student Workbook.

Each activity or portion of an activity introduces new RCL vocabulary or broadens the student's understanding of how to use specific commands to extend the robot's capabilities. RB5X(tm) can perform many more tasks than those used in these activities. Once students have mastered the RCL commands, you should encourage them to devise new applications for the robot and to write the programs that allow the robot to perform these new applications.

The exact nature of the activities (and the sample solutions contained in Appendix 3 of the Teachers' Guide) are suggestions. Indeed, the sample solutions should be used only as a last resort; they illustrate only one way to solve the general problem posed. There are many right ways to solve each problem and, in some cases, the sample solutions are not the best. Again, encourage your students to call on their own imaginations and creativity when approaching each new

problem. Several sample solutions included here were developed by elementary-school students and are more creative than my solutions for the same problem!

The activities are designed for and have been tested with a wide range of student abilities and age levels. They have proven effective in all cases. While using these activities, you can expect a great deal of ancillary learning to occur. Teachers can facilitate the transfer of this learning to other areas by using simple questioning techniques that help students see the relationship of specific insights to general areas of application.

We suggest that teachers complete the RCL Tutorial before beginning to lead students through the activities contained in this curriculum. The "Sample Robot Task" in the Tutorial provides an easy-to-understand introduction to RCL and has you enter an actual task for RB5X to accomplish.

SPECIALIZED CLASSROOM APPLICATIONS

RB5X with RCL is a very flexible teaching tool that can be adapted to many different settings and may be used for teaching a wide variety of concepts beyond just how to control and interact with a robot. RCL can be modified to suit the needs of different types of learners, eliminating the need for students to adapt to suit the inflexible demands of most computer programs and programming languages.

Computer Literacy

The combination of RB5X and RCL is a natural for computer literacy courses, because the activities involved in teaching the robot to perform various tasks are all computer-programming jobs. To have RB5X perform the various activities, students must learn a new, but simple and logical, vocabulary for communicating with the robot. They must learn to order this vocabulary in a way that permits the robot to perform the commands in the correct sequence to accomplish a given task. Students must learn to evaluate the contents of each computer program to either improve the robot's performance or to extend its capabilities. In the process, students learn about the computer and its peripherals -- such as disk drives, keyboard, cables and connectors -- and the proper care of electronic equipment.

The opportunity to see a robot execute student-written instructions is a very powerful motivational tool. Students who have minimal

interest in serious interaction with a computer can see the value of computer use when the outcome is a new-found ability to make a concrete object perform a job in time and space.

Cultural Differences and Non-English Speakers

It has been well documented that different students have different learning styles. This is particularly apparent with students who come from different cultural backgrounds. The combination of a robot (which interacts with its environment using sound and movement) and a computer (which performs more abstract tasks) can address a wide variety and combination of learning styles among students.

The flexibility of RCL allows students who are speakers of a language other than English to learn concepts dealing with computer programming and the operation of robots while they are learning a second language, instead of delaying these concepts until they have a working knowledge of English. To use this feature of RCL, teachers should do the following:

1. See Appendix 1 in the back of this Guide for a list of all the RCL commands used in these activities,

2. Select appropriate equivalent terms in the students' native language for each of these commands, and

3. ASSOCIATE each new command with each old command. (See the RCL Tutorial and RCL Programmer's Manual or the Savvy manual for more information on using the ASSOCIATE command.)

Students can then use their native language to write programs for the robot to accomplish all of the activities in their Workbook. While students are developing programs in their native tongue, they also learn more about their second language, because RCL automatically translates each command into English.

Non- or limited-English speaking students can learn a great deal about the English sound system while teaching RB5X to talk. Although RB5X has the ability to speak in any language, students can be encouraged to teach the robot to say English words and phrases when appropriate. This involves careful consideration and selection of each speech sound. Students, of necessity, gain a great deal of oral practice with these sounds.

A Foreword to the Teacher

RB5X, RCL, and Preschool Children

Preschool children are not expected to know how to read or to type. They are just learning to identify and to name numbers and letters. Two features of RCL allow young students to write programs on the computer to have RB5X perform most of the tasks in this curriculum: the ASSOCIATE command and Adaptive Pattern Recognition Processing (APRP).

The ASSOCIATE command permits the teacher, with the help of the students, to associate meaningful one- or two-letter commands with each of the robot commands in this manual. Students also gain experience with the concept of reading. RCL takes the ASSOCIATEd letters and translates these into the full commands on the screen. With a little practice, young students can identify these complete commands.

APRP compensates for young students' lack of typing skill. They may misspell or otherwise incorrectly enter a program command, and RCL's pattern recognition features checks what has been entered to see if it knows another pattern that is close. If there is a similar pattern in the computer's memory, the computer corrects the entry and moves on, ready for students to continue developing their program. If there is no close match, the computer asks the students to try again.

The combination of these features allows young students to learn about logical sequencing, prediction of outcomes, and general computer operation while learning to control the robot. Students also learn about geometry, distance, duration, and numbers.

Keep in mind that Section D, "Speech Programming," needs considerable interpretation from the teacher if it is to be used at all with children who have not yet developed reading skills. Teachers who choose to use ideas from the speech section can involve young students by having them identify the best possible sounds for words. They then listen to the robot say words made up of various combinations of phonemes and decide which phonemes most resemble the proper pronunciation of each word.

Other Applications

Many of these activities can be used with special education students. The pattern recognition processing and self-correcting features of RCL remove the frustrations of computer programming for learning-disabled students while reinforcing correct spelling of the commands and task names. The ability to associate one- or

two-keystroke commands allows students who have limited motor control to develop robot tasks without having to do much typing. The opportunity for students to assume complete control of RB5X's actions and behaviors can be extremely rewarding for those who have had little chance to experience control in their own lives.

You may need to modify activities to accommodate the disabling condition of each student. You and your students may choose to change the nature of some activities to allow the robot to perform tasks for students that they cannot perform for themselves.

SUMMARY

Whatever the classroom application, students develop many useful problem-solving and learning strategies using these activities. These gains can be generalized to all other curriculum areas. Students further develop insights into principles involved in many other content areas. The intention throughout is to allow students as much freedom as possible in designing, developing, and writing all robot tasks. This intellectual freedom is the key to achieving the learning outcomes discussed above.

Niki Delgado
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