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| **TEXAS CTE LESSON PLAN**  [www.txcte.org](http://www.txcte.org) | |
| **Lesson Identification and TEKS Addressed** | |
| **Career Cluster** | Science, Technology, Engineering, & Mathematics |
| **Course Name** | Robotics I |
| **Lesson/Unit Title** | Intro to Robotics I - Part 5 - Programming |
| **TEKS Student Expectations** | **130.408. (c) Knowledge and skills**  (6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:  (A) demonstrate the use of computers to manipulate a robotic or automated system and associated subsystems  (B) maintain systems to ensure safe and proper function and precision operation  (C) describe feedback control loops used to provide information  (D) describe types and functions of sensors used in robotic systems  (10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:  (C) use multiple software applications to simulate robot behavior and present concepts |
| **Basic Direct Teach Lesson**  (Includes Special Education Modifications/Accommodations and  one English Language Proficiency Standards (ELPS) Strategy) | |
| **Instructional Objectives** | The student will be able to:   * Describe how a communication port allows a computer to interface with an external device. * Name the parts of a computer program, including initialization, main program loops, functions, and statements. * Define and use variables in a computer program. * Create and use program loops. * Differentiate three types of program loops, including WHILE loops, FOR loops, and IF, ELSE conditional loops. * Compile and download a computer program. |
| **Rationale** | After completing this lesson, students will be able to demonstrate they have learned the basics of robotic programming and control through satisfactory performance on the Introduction to Robotics Part 5: Programming Quiz. |
| **Duration of Lesson** | Teacher’s Discretion |
| **Word Wall/Key Vocabulary**  *(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | The key words document is in the lesson plan attachment section. |
| **Materials/Specialized Equipment Needed** | **Instructional Aids:**   * Programming guide found on the Internet * User’s guide found on the Internet * Definitions Used in Computer Programming handout for each student * Introduction to Robotics Part 5: Programming Quiz for each student * Introduction to Robotics Part 5: Programming Quiz key   **Materials Needed:**   * Integrated Device Environment (IDE) programming software * Robotic kits with parts and supplies that are designed to work together * This lesson is based on programming using free IDE found on the Internet. Commercial vendors of robotic kits offer parts and supplies that are designed to work together and are relatively inexpensive. One robotic kit is recommended for every two students, but there can be as many as four students for every robotic kit if needed.   **Equipment Needed:**   * Computer * Projection unit and screen * Cable to connect PC to microcontroller (USB-USB or USB-serial) |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) | * **Say**: Today we are going to learn about programming. Programming is the way we make every computer and most electronic devices work. * **Ask**: Does anyone know what a computer program is? * **Say**: A computer program has a sequence or series of instructions that tell the device what to do. * **Ask**: Can we just type in any instruction or use any type of language we want? * **Say**: No. We know that we need to write a program in a specific computer language. * **Ask**: Does anyone know some names of the types of computer programming languages? * **Say**: Well, there are a lot of them. Most of you mentioned Java, Basic, Visual Basic, HTML and Fortran. No, spreadsheet software is not considered computer language. * **Say**: We are going to be learning about a language called C++. C++ is the underlying programming language for just about the entire PC industry, but C++ is considered to be a hard language to learn. We are going to try to make it easy by showing you how to apply programming to robotics. |
| **Direct Instruction \*** | I. Introduction to programming  a. Electronic devices are becoming increasingly computerized.  b. Computers require a program to operate.  c. Understanding the basics of computer programming is increasingly considered to be a component of literacy the same as math and English.  d. Hardware and software can no longer be separated into separate domains.  II. Introduction to C  a. It takes a program to write a program.  b. The programming environment is usually called an IDE.  c. Theoretically, you could write a program using any text editor, but you could not debug, compile, or download that program.  d. The program goes into a microcontroller, where it is run (executed).  e. More information about the components of an IDE can be found on the Internet  III. Microcontroller basics  a. Inputs and outputs are electrical signals.  b. The microcontroller converts the electrical signals into data, performs some logic and processing on that data according to the program, and produces electrical output signals based on that processing.  c. The operations the program performs are based on binary logic.  d. Features and specifications are given.  IV. Programming application  a. This is a continuation of the material from Introduction to Robotics Part 4: Sensors.  b. The simplest sensor is a switch.  c. Students learn to write a program that reads the switch value.  d. Start with a simple program that does not do anything.  e. The bumper sensor produces data; data requires a name and a place in memory to store it.  f. Defining a variable does both of those things.  g. Variables must be defined during initialization of the program, which comes before the main program loop.  V. Program description  a. Describe each part of the program, piece by piece.  b. Syntax is critical.  c. Syntax refers to the rules involved in creating a computer program.  d. The rules involve both keywords and formatting characters.  e. These combine to form statements and functions.  f. Abstractions are user-defined keywords.  VI. Program example  a. Modify the simple program step by step.  b. We start with our first statement.  c. The statement must go inside a loop.  d. There are three types of program loops. Go over each type and access the additional information provided by the links.  e. Make the statement work by adding variables to the program, which must be defined before they can be used.  f. Go over the steps in the programming example given so students know why as well as how they create program loops. |
| **Guided Practice \*** | The teacher provides guidance and instruction while students are trying to build their own programs. |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | Most of this lesson is independent practice. Students read and follow the directions given in the programming guide they located on the Internet or purchased through a vendor to write the programs listed. Students should review Definitions Used in Computer Programming handout. |
| **Lesson Closure** | * Question: What are the three types of loops? * Answer: Infinite, Counting, Conditional (WHILE, FOR, IF/ELSE) * Question: What two things happen when you define a variable? * Answer: You give the variable a name and set aside a particular amount of memory space. |
| **Summative/End of Lesson Assessment \*** | **Informal Assessment:**   * Observation * Question and answer * Time on task * Ability to follow directions   **Formal Assessment:**   * Introduction to Robotics Part 5: Programming Quiz * The teacher may use the Definitions Used in Computer Programming handout as a form of assessment. |
| **References/Resources/**  **Teacher Preparation** | Free IDE and programming software programs suitable for student use are available on the Internet. Select one prior to presenting this lesson and have students review the tutorials, user guides, and programming guides.  Wikipedia:   * <http://en.wikipedia.org/wiki/C>++ * <http://en.wikipedia.org/wiki/Wikipedia:WikiProject_C%2B%2B> |
| **Additional Required Components** | |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** |  |
| **Recommended Strategies** | |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy**  **Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies**  **Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication**  **90 Second Speech Topics** |  |
| **Other Essential Lesson Components** | |
| **Enrichment Activity**  (e.g., homework assignment) | Students spend time on design challenges after they have completed Introduction to Robotics Parts 1-5. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA  Technology Student Association |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)