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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, and Mathematics |
| **Course Name** | Robotics I |
| **Lesson/Unit Title** | Construction Robotics I – Part 6 - Arm |
| **TEKS Student Expectations** | **130.408. (c) Knowledge and Skills** (7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:(A) demonstrate knowledge of Newton's Laws as applied to robotics such as rotational dynamics, torque, weight, friction, and traction factors required for the operation of robotic systems(B) demonstrate knowledge of motors, gears, gear ratios, and gear trains used in the robotic systems(8) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:(B) describe the relationship between torque and gear ratio to weight of payload in a robotic arm operation(C) demonstrate knowledge of linkages and gearing in end effectors used in a robotic arm system |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | **Performance Objective:**After completing this lesson, students will be able to lay out, dimension, and construct a basic arm and all its mounting parts, matching the criteria in the How to Construct a Robot Part by Part Rubric.**Specific Objectives:*** Explain how to make the parts and why you are looking at the main considerations – reach and strength.
* Calculate the size and speed to be determined by the controller.
* Explain what materials you are using and why.
* Explain what machines and tools you are using and how to use them.
* Identify safety required when using the machines and tools.
* Prepare a Plan Sheet using the plan sheets.
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| **Rationale** | It is critical that students can construct and attach robot arms. |
| **Duration of Lesson** | Teacher’s Discretion |
| **Word Wall/Key Vocabulary***(ELPS c1a, c, f; c2b; c3a, b, d; c4c; c5b) PDAS II (5)* | * Robotic Arm
* Friction
* Rotational Dynamics
* Torque
* Traction
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| **Materials/Specialized Equipment Needed** | **Instructional Aids:**1. How to Construct a Robot Part by Part Rubric
2. Story Board handout
3. Plan Sheet handout
4. Computer aided design/drafting software
5. Internet access

**Materials Needed:**1. Story Board handout for each student
2. Plan Sheet handout for each student
3. How to Construct a Robot Part by Part Rubric for each student
4. Computer aided design/drafting software
5. Wood, plywood, metal, screws, string, plastic, rubber tire tubs

**Equipment Needed:**1. Assorted hand tools
2. Metal cutters
3. Scroll saw
4. Drill press
5. Scratch awl
6. Compass
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | **SAY:** Today we are going to learn how to construct an Arm and attach the arm to the body of the robot.**ASK:** Does anyone know what are the three things you should keep in mind when constructing an Arm?(Allow time for answers.)**SAY:** Yes, weight, rotation, and speed.**SAY:** Next, we will look at the Arm Plan Sheet.**SHOW**: Show the Arm Plan Sheet and then stop and let the students develop the arm. After they havecompleted one device continue with the steps to create the arm and attaching parts.**ASK:** Which arm was best for this Robot and attaching parts? (Allow time for the students to EXPLAINtheir answers.) |
| **Direct Instruction \*** |

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| I. Arm defined as |
| A. A device used to move objects at an angle |
|  | using height or levers |
| B. A device used to move objects over a distance |
|  | using heights or levers |
| II. Problem solving process for an arm |
| A. | Understanding the problem |
| B. | Devising a plan |
| C. | Carrying out the plan |
| D. | Questioning students |
| E. | Looking back, evaluating |
| III. Follow procedures  |
| A. Construct by a plan sheet |
| B. | Follow Story Board |
| C. | Complete plan sheet |
| D. | Review two arm examples |
| E. | Select or revise design  |

IV. Allow students to construct the arm1. Students construct arm
2. Students try different challenges with different arms

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| V. Evaluation of challenge (arm) |  |
|  | A. Best device for certain tasks |
|  | B. Ways to improve each device |
|  | C. | What to do differently if allowed unlimited |
|  |  |  | materials |  |
|  | D. | How to do it differently |

VI. Last step of problem solving process-looking back1. Evaluate all designs
2. Vote which arm was the best for certain tasks

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:**NONE* |
| **Guided Practice \*** | Students will be taught how to make an arm and all its attachments, and how to think critically of how to design an arm and its attachments.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:**NONE* |
| **Independent Practice/Laboratory Experience/ Differentiated Activities \*** | Students will be required to be creative, think critically, and make an arm and attachments.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:**NONE* |
| **Lesson Closure** | **Question:** Which arm was the best for speed and balance?**Answer:** (It depends on the arm created.) The best answer will most likely be a kind of arm thatcompleted the job with the least effort.**Question:** Which arm could best move a lot of weight?**Answer:** (It depends on the arm created.) The best answer will most likely be a kind of arm that movedfast enough with the least effort.**Question:** Which arm worked best for combination and multiple tasks? |
| **Summative/End of Lesson Assessment \***  | Construction of a Robot Part by Part Rubric. The students will create an arm for different tasks and should be evaluated on the efficiency of the arm and design.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:**NONE* |
| **References/Resources/****Teacher Preparation** | **Teacher Preparation:**1. Prepare Story Board handout for each student
2. Prepare Plan Sheet handout for each student
3. How to Construct a Robot Part by Part Rubric for each student
4. Research books and internet for applications
5. Have materials and equipment ready for student choice

**References:**1. Malcolm, D. R. (1988). *Robotics: An Introduction (Electronics Technology)* (2nd ed.). Albany, NY: Delmar.
2. Potter, T., & Guild, I. (1983). *Robotics (New Technology)*. London, England: Usborne.
3. Magazines for mechanics
4. NASA Robotics
5. Internet search for gears, problem solving applications
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| **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) | For more enrichment, students should construct an arm that can be operated electronically. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSATechnology Student Association (TSA) |
| **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)