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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 5 - Vertical Column |
| **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:  (A) describe the relationship between robotic arm construction and robot stability;  (B) describe the relationship between torque and gear ratio to weight of payload in a robotic arm operation; and  (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 part of vertical column and all its mounting parts that anchor into the body, 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 consideration – to declare given height (stay inside of specifications). * Calculate how the column is going to aid the function of the robot. * Identify the column height to act as a lever to lift the arm. * Identify that the size and speed will be determined by its part. * 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 |
| **Rationale** | It is critical that students can construct a basic part of a vertical column. |
| **Duration of Lesson** | Teacher’s Discretion |
| **Word Wall/Key Vocabulary**  *(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | * Vertical Column * Lever * Scroll Saw * Drill Press * Scratch Awl * Compass |
| **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, rubber tubes, plastic, pvc pipe   **Equipment Needed:**   1. Assorted hand tools 2. Metal cutters 3. Scroll saw 4. Drill press 5. Scratch awl 6. Compass |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) | **SAY:** Today we are going to learn how to construct a vertical column and attach the vertical column tothe body of the robot.  **ASK:** Does anyone know what the three things you should keep in mind when constructing a vertical column are? (Allow time for answers.)  **SAY:** Yes, height, weight, and speed.  **SAY**: We are now going to go through How to Construct a Robot Part 5:  Vertical Column. We will stop twice so that you will be able to create your vertical column and parts**.**  **SAY:** Next we will look at the vertical column Plan Sheet.  **SHOW**: Show the vertical column Plan Sheet and then stop and let the students develop their ownvertical column. After they have completed one device, continue with the rest of the attaching parts.  **ASK:** Which vertical column was best for this Robot and attaching parts? (Allow time for the students toEXPLAIN their answers.) |
| Direct Instruction \* | I. Vertical column defined as   1. A device used to support 2. As a lever or gear in moving objects over a distance   II. Problem solving process for a vertical column  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. Review four vertical column examples  D. Select or revise design  IV. Allow students to construct the vertical column  A. Students construct vertical column  B. Students try different challenges with  different vertical column and levers  V. Evaluation of challenge (vertical column)  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 back  A. Evaluate all designs  B. Vote which vertical column was 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 a vertical column or lever and all its attachments, and how to think critically of how to design a vertical column 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 their own vertical column 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 |
| **Lesson Closure** | **Question:** Which vertical column or lever was the best for speed?  **Answer:** (It depends on the vertical column created.) The best answer will most likely be a kind ofvertical column or lever that lifts with the least effort and stays inside of height specifications.  **Question:** Which vertical column could best move a lot of weight?  **Answer:** (It depends on the vertical column created.) The best answer will most likely be a kind ofvertical column that pulls or acts as a lever or gear assembly to move the object with ease.  **Question:** Which vertical column worked best for combination and multiple tasks?  **Answer:** The vertical column that had the best combination of weight, lever, and speed to carry thedistance with ease. |
| **Summative/End of Lesson Assessment \*** | Construction of a Robot Part by Part Rubric. The students will create a vertical column for different tasks and should be evaluated on the efficiency of the vertical column 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** | * Malcolm, D. R. (1988). *Robotics: An Introduction (Electronics Technology)* (2nd ed.). Albany, NY: Delmar. * Potter, T., & Guild, I. (1983). *Robotics (New Technology)*. London, England: Usborne. * Magazines for mechanics * NASA Robotics * Internet search for gears, problem solving applications   **Teacher Preparation:**   1. Prepare Story Board handout for each student 2. Prepare Plan Sheet handout for each student 3. Prepare 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 |
| **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 a vertical column that can be operated electronically and offsets weight. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA, 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)