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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** | Engineering Design and Presentation I |
| **Lesson/Unit Title** | Design Process |
| **TEKS Student Expectations** | **130.410. (c) Knowledge and Skills**  (4) The student develops skills for managing a project. The student is expected to:  (A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project  (B) develop a project schedule and complete work according to established criteria  (C) participate in the organization and operation of a real or simulated engineering project  (D) develop a plan for production of an individual product  (7) The student uses engineering design methodologies. The student is expected to:  (A) demonstrate an understanding of and discuss principles of ideation  (B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions  (C) use rational thinking to develop or improve a product  (D) apply decision-making strategies when developing solutions  (E) use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process  (F) use engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects |
| **Basic Direct Teach Lesson**  (Includes Special Education Modifications/Accommodations and  one English Language Proficiency Standards (ELPS) Strategy) | |
| **Instructional Objectives** | * Explain the purpose of design * Identify the basic steps of the design process * Identify some specific features and characteristics of each step in the design process * Explain the importance of planning before building * Practice the design process with simple to advanced drawings |
| **Rationale** | Students will be able to demonstrate they know the steps of the design process and how to apply them to robotic applications by completing the quiz and meeting the criteria in the student design process practice rubric. |
| **Duration of Lesson** | Teacher’s Discretion |
| **Word Wall/Key Vocabulary**  *(ELPS c1a, c, f; c2b; c3a, b, d; c4c; c5b) PDAS II (5)* | **Design:** To work out the structure or form of something, as by making a sketch, outline, pattern, orplans.  **Process:** A series of actions, changes, or functions bringing about a result; to put through the stepsof a prescribed procedure.  **Sequence:** A following of one thing after another; an arrangement of two or more things in asuccessive order.  **System:** A group of interacting, interrelated, or interdependent elements forming a complex whole;an organized and coordinated method.  **Iterative:** Repetitious or frequent; cyclical.  **Structure:** Something made up of several parts that are held or put together in a particular way. Something constructed, such as a building.  **Prototype:** An original, full-scale, and usually working model of a new product or new version of anexisting product which is tested so that the design can be changed if necessary, before the product is manufactured commercially.  **Integrate:** To make into a whole by bringing all parts together; unify; to join with something else.  **Troubleshoot:** To isolate the source of a problem and fix it, typically through a process of eliminationwhereby possible sources of the problem are investigated and eliminated beginning with the most obvious or easiest problem to fix. To solve problems.  **Specification:** A detailed description or assessment of requirements, dimensions, materials, etc.  **Aesthetic:** Concerning or characterized by an appreciation of beauty or good taste; discriminating,cultivated, refined.  **Objectives:** The object of one's endeavors; goal; aim.  **Criteria:** A standard, rule, or test on which a judgment or decision can be based. |
| **Materials/Specialized Equipment Needed** | * Paper and pen for taking notes * Design Process quiz * Definitions handout * Robotic project kit will be needed later for actual project. * Projector and screen * Computer |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) | No learner preparation is required since this is a basic module and prepares students for a design project. The design project would use this module for learner preparation. |
| **Direct Instruction \*** | **Introduction (LSI Quadrant I):**  **SAY:** Today we are going to learn about the design process. The design process is important because nobusiness or manufacturer wants to devote resources to a project until they can be assured that the idea is a real solution to a problem.  **ASK:** How can you convince a manager that you have a good idea for a project?  **SHOW:** Have some drawings like this (show drawings) that show the manager that you have thought about it,done some research, and have come up with something that might work. **SAY:** You cannot build something until you have a plan for it.  **ASK:** Has anyone had any ideas for something you wished you could build?  **SHOW:** This is what you need: a document, a plan, a drawing.  **Outline (LSI Quadrant II):**  Instructors can use handouts, and note pages in conjunction with the following outline.   |  |  |  | | --- | --- | --- | | MI | Outline | Notes to Instructor | | Verbal Linguistic | I. Engineering Design Process  A. A process has steps, usually defined steps  B. A series of actions, changes, or functions bringing about a result  C. Overview and the purpose of design  D. Comparison of Engineering Design to Scientific Method | Many of the central concepts are repeated over again. One of the main ideas is that students must have a plan of action before they can ever build something. Students need to take notes during this lesson. Distribute Design Process Definitions handout. | | Visual Spatial  Interpersonal | Highlight differences and similarities to other design processes, such as: <http://en.wikipedia.org/wiki/Engineering_design_process> OR   1. Engineering Design Process Steps, such as: <http://www.Teachengineering.org/collection/cub_/activities/cub_simple/cub_simple_lesson06_activity1_refsheet.pdf> | Use the links. Remove line feed on second link. | | Verbal Linguistic | III. Basic steps of the design process   1. Give each step 2. E 3. xplain each step in more detail. | Make sure students write these steps down. | | Verbal Linguistic  Visual Spatial | IV. Each step explained in more detail   1. Identify the challenge 2. Research and brainstorm 3. Design and solution 4. Test ideas 5. Evaluate 6. Build | Add personal experience, or talk about how these steps might look different for different occupations | | Verbal Linguistic | V. Have students write out a plan   1. The plan and the drawing are important to meet TEKS requirements |  | | Verbal Linguistic  Visual Spatial | VI. Other considerations   1. These are practical considerations 2. Complicated designs either don’t work or break down 3. What works best? |  | | Verbal Linguistic  Visual Spatial | VII. The process is iterative!   1. The grand finale 2. Go from here into a practice design process 3. The simplest design process example has a few sentences describing the problem and a possible solution, some details from topic research, and a drawing. |  | | Visual Spatial  Logical Mathematical | VIII. Students practice the design process (several times from simple, then to more detailed as needed)   1. Define the problem 2. Perform research of designs and solutions 3. Start with a simple drawing 4. Create detailed drawings with dimensions and specs 5. Will be able to apply steps to future robotics projects.   Note: students should practice the design process at least twice, once in simple drawings and again in more detailed drawings. More practice would be better. | It is important that students practice the design process. They can start with some simple drawings but then add research. Have several drawings ranging from simple to more detailed.  Teacher provides examples of what the students should design.  Distribute the rubric to evaluate the design process practice.  The rubric is designed and worded for the full design project, and the simpler basic designs a student will do initially should be graded with leniency, or using a few simple criteria from the rubric. The rubric lets the students know what is expected, but they should get a chance to start easy and build up to full expectations with practice. | |
| **Guided Practice \*** | **(LSI Quadrant III):**  Show the students some samples of a simple drawing. Give the students some examples of what you want them to design.  *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 \*** | **(LSI Quadrant III):**  Start with a simple drawing, perform independent research, and create more detailed drawings with dimensions and specifications.  *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** |  |
| **Summative/End of Lesson Assessment \*** | Review (LSI Quadrants I and IV):  Question: What are the steps to the design process?  Answer: Identify the challenge; research and brainstorm; design a solution; test ideas; evaluate; build!  Question: What is the most important step in the design process?  Informal Assessment (LSI Quadrant III):  Attentiveness in class, note taking, questions, sample drawings. Option to use the design process rubric in a simplified form to assess preliminary drawings.  Formal Assessment (LSI Quadrant III, IV):  The Design Process Quiz, a formal evaluation of student design process practice using the rubric (first in a simplified form for simple sketch practice, then more completely as needed for more detailed drawings and student practice on the full design process).  *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** |  |
| **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) | Have students do research and come up with designs for a more complicated project, using examples from robotic competition contest objectives. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | 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)