|  |  |  |
| --- | --- | --- |
| **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** | Principles of Applied Engineering | |
| **Lesson/Unit Title** | Applied Engineering Problem Solving - DR. GABIC | |
| **TEKS Student Expectations** | **130.402. (c) Knowledge and skills**  (6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:  (A) identify and describe the fundamental processes needed for a project, including the design process and prototype development, and initiating, planning, executing, monitoring and controlling, and closing a project;  (C) use problem-solving techniques to develop technological solutions;  (9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:  (A) apply the design process as a team participant;  (B) assume different roles as a team member within the project;  (D) develop and test the model for the project; and | |
| **Basic Direct Teach Lesson**  (Includes Special Education Modifications/Accommodations and  one English Language Proficiency Standards (ELPS) Strategy) | | |
| **Instructional Objectives** | * Day 1 - Complete Assignment #1, Use the internet to find graphics that best remind them of the information given, and compare/contrast good/bad decision-making skills * Day 2 - Complete Assignment #2, put the puzzles together to help complete it, compare DR. GABIC Engineering to the Scientific Problem-Solving Process, and create their own example of the Universal System Model * Days 3-5 -Construct prototype per problem given, test prototype and hopefully complete the mission given successfully. NOTE: 1 day to design and 2 to construct is the normal allotment for this. You can shorten it to 1 build day if preferable. * Day 6 - Complete the TAKS Math-based problems and take the practice test * Day 6 - Complete the Teamwork Rubrics 1 OR 2 * Day 7 -Take the DR. GABIC Problem Solving Written Test * BONUS: Complete the online Problem-Solving games   NOTE: You may find you need an extra day depending on the speed at which your students work. Recommend that 8 days be the maximum time you spend. You may remove 1 day of constructing the prototype if you so wish, again depends on your student’s level. | |
| **Rationale** | Upon completion of this lesson, students will be able to use the Engineering and/or Scientific Problem-Solving steps so that they can solve any problem that arises or gets assigned to them in the class and show they have learned the process by solving at least one of the assigned problems and/or taking and passing the written test. | |
| **Duration of Lesson** | This lesson should take 7-8 days. | |
| **Word Wall/Key Vocabulary**  *(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* |  | |
| **Materials/Specialized Equipment Needed** | * Handouts (4) * Mayday * Sail Boat * Egg Catapult * Mrs. Gabic’s Rescue from the Hun – Circa 1500 * Computer with internet access * Tools and materials will vary depending on the actual problem you assign for the students to do. Please refer to the list given for each scenario. * Assignment 1: The Engineering Problem Solving Process (Participation, TAALS, Osborn’s Rules for Brainstorming, Good/Bad Decision Making) * Assignment 2: The Engineering Problem Solving Process (Puzzles, Scientific Problem Solving, Compare/Contrast, Universal System Model) * Math TAKS Based Scenario Problems and Answers * Problem Solving Pre-Test/ Test and Answers * Materials for the students to use to solve the problem(s) given * Writing utensils for students who don’t have any | |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) | * At the end of class, the day before asking students to give you some ideas about how they think they could solve the problem assigned. * They will need 10-15 minutes for this discussion. * NOTE: The class discussion is meant to be Socratic in nature and not true/false, or this is the only correct answer. Encourage your students to explain WHY they think they way they do! There is NO wrong answer if they can explain the WHY! * SAY: Today I will be putting you into teams of two. Your teams will all be given the same amount of materials and time to complete the problem given. * SAY/SHOW: Supplies - they can use based on the ones you have selected. * SAY: Once your team has come up with its name and sketches of ideas, I will then give you the supplies. * You have two days to construct your prototype and then we will test and see how well you did. | |
| **Direct Instruction \*** | Outline | Instructor Notes |
| * Day 1 - Intro Notes: (Daily grade) Grades, Percentages, TAALLS, & Good versus Bad Decision Making * Day 2 - DR. GABIC and Scientific Problem-Solving Methods, and the Universal System Model (Major grade) Solve the three (3) puzzles and put the answers into the document provided. * Days 3-4 - Solve the Problem: (Major grade) Given ONLY the materials provided, solve the problem * Day 5 - Test the prototype/solution day * Day 6- TAKS Math and Review for Test (Major grade) Complete the TAKS Math-based problems given and take the practice test * Day 7- DR. GABIC and Problem-Solving Test * \*NOTE: There is a DR. GABIC – Problem Solving Pre-Test available with this lesson that can be used prior to the test.   I. Complete Assignment #1,  A. Grades  B. Percentages  C. TAALLS  D. Good versus bad decision making  II. Complete Assignment #2  A. Solve 3 puzzles  B. Insert answers in document provided  C. Compare DR. GABIC Engineering to the Scientific Problem-Solving Process  D. Create your own example of the Universal System Model  III. Class discussion to introduce the team project to brainstorm and begin building prototype  A. Question: Can anyone give me some ideas of how they think they can solve the problem given?  IV. Place students into teams of two, brain storm, begin building the prototype.  V. Build the prototype per problem given  A. Mayday  B. Sail Boat  C. Egg Catapult  D. Mrs. GABIC’s Rescue from the Hun – Circa 1500  VI. Test the prototypes and hopefully complete the mission given successfully  VII. Discuss whose design did well and did not do so well. Compare and change as necessary.  VIII. Complete the Teamwork Rubrics 1 OR 2  IX. Complete the TAKS Math-based problems and take the practice test  X. Take the DR. GABIC Problem Solving Test | * This is a 7-day lesson. The teacher may choose which of the four problems the students will solve from the four handouts provided with the lesson. * Day 1 – Teacher begins with introduction notes. * Help students complete assignment and use the internet to find graphics that best remind them of the information given, and compare/contrast good/bad decision-making skills. * Day 2 - DR. GABIC and Scientific Problem-Solving Methods, and the Universal System Model (Major grade) Have students solve the three (3) puzzles and put the answers into the document provided. * Day 3 - Socratic discussion on whether it is a good example. Allow enough time for input so that every student gives an idea. * Day 4 - You may have 1 team of 3, but try to keep to teams of 2 if possible. * Day 5 – Build the prototype and solve the problem. (Major grade) Given ONLY the materials provided have students solve the problem. * Teacher may select from the four problems provided as handouts in this lesson. * Do not allow students to get the materials until they can show proof of brain storming ideas. * Monitor to make sure they don’t try to use other materials or supplies not provided. * Day 6 - Test the prototype/solution. Have fun testing the prototypes. You can even team up with your Physics teacher(s) and come up with a wild problem and team-teach this if you’d like. * Day 6 - Socratic discussion, no answer is considered wrong so long as the student can explain WHY they feel that way about it and support it with facts. Allow enough time for input so that every student gives at least two examples. * Day 6 – (Daily grade) * Day 6 - TAKS Math and Review for Test (Major grade). Have students complete the TAKS Math-based problems given and take the practice test. * Day 7 – Test *(Major grade)* |
| **Guided Practice \*** | Show the students how to complete the activities, explain the problem, put students into teams to begin problem solving, test prototypes, discuss results, and test. | |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | * Complete the handouts * Build prototype * Test prototype | |
| **Lesson Closure** | Take the DR. GABIC Problem Solving Test | |
| **Summative/End of Lesson Assessment \*** | * Teacher should make sure every student has input in discussion, and that everyone helps build the prototype or demonstrate good teamwork as they are working. Students complete Teamwork Rubrics 1 OR Teamwork Rubrics 2. * Did prototype work or not after tested? The written test(s) can also be used as formal assessment. | |
| **References/Resources/**  **Teacher Preparation** | * At the end of class, the day before this lesson, ask students to give you some ideas about how they think they could solve the problem assigned. You will need to allow 10-15 minutes for this discussion. Teacher will need to read through the handouts and make sure to have enough supplies/materials for the students to solve the problem(s) given. | |
| **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) | Complete the online problem-solving games. | |
| **Family/Community Connection** |  | |
| **CTSO connection(s)** | SkillsUSA  Techology 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)