**Instructional Days:** 24-33

**Topic Description:** Complete Design Challenge final project.

**Objectives:**

Students will be able to:

* Design, build, and program a robot that solves a stated problem.

**Outline of the Lesson:**

* Explanation of project guidelines (15 minutes)
* Distribution of challenges (10 minutes)
* Design, build, and program robot (~7.5 class periods)
* Design challenge gallery walk and discussion (1 class period)
* Clean-up (1 class period)

**Student Activities:**

* In groups, determine who will complete each of the four roles.
* Use the planning document to plan the robot.
* Design, build, program, and refine a robot which meets the challenge.
* Set up their robot and participate in a gallery walk.
* Disassemble the robots and carefully organize all the robotics equipment.

**Teaching/Learning Strategies:**

* Hand out requirements, planning document, and rubric. Explain guidelines and answer questions.
* Hand out challenges. Allow students to trade challenges as necessary. You may choose to have each group working on a different challenge or have them overlap.
* Approve planning documents as students finish plan and prepare to build and program robot.
* Circulate and make sure students are on task; answer questions as needed. At the end of each day, remind information specialists to fill out paperwork and remind groups to clean up the space. Optionally, have students fill out the daily group evaluation.
* During the design challenge, fill out each rubric as you observe the robot. If possible, videotape (or have a volunteer videotape) the running of each robot. Discuss the features of the various robots and designs.
* On the final day of the unit have students disassemble the robots and organize the equipment.

**Resources:**

* Design Challenge Sample Rubric
* Information Specialist Report
* Project-Reflection
* Daily Group Evaluation
* Challenges:
* Option 1: Challenges from Design Challenges for computer-controlled LEGO products by Len Litowitz. (Litowitz-challenges.doc) Some of these challenges are more appropriate than others.
* Option 2: Gary Stager’s LEGO Challenges available from [http://www.stager.org/LEGO/challenges.pdf](http://www.stager.org/LEGO/challenges.pdf%20) (stager-challenges.pdf) Not all of these challenges are appropriate.
* Option 3: Webquest

**Final Project**

**Design Challenge Planning**

**STEP #1 TASK DEFINITION**

Determine the purpose of your challenge—What are we supposed to do?

Criteria—list the specifications the robot needs to meet

1.

2.

3.

4.

5.

**STEP #2 TASK BREAK-DOWN**

List the steps the robot will need to go through to accomplish the task.

1.

2.

3.

4.

5.

6.

7.

8.

9.

**STEP #3 BRAINSTORMING**

List some possible solutions to the challenge.

1.

2.

3.

4.

5.

6.

7.

8.

**STEP #4 ROBOT DESIGN**

Use scratch paper to sketch ideas for the robot, and then choose the “best” design idea and illustrate it NEATLY below. Include any labels or explanations necessary to make your design understandable.

**STEP #5 PROGRAM FLOWCHARTING**

Outline the programming steps for your robot to accomplish the task. This can be in the form of a chart or graph.

**STOP!!! – GET TEACHER APPROVAL BEFORE MOVING ON:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**STEP #6 ROBOT BUILDING AND PROGRAMMING**

Build the robot and program it according to your plan!

**Design Challenge Rubric**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Extra Credit | A | B | C | F |
| Successful Solution | Meets criteria and one or more super challenge criteria | Solution clearly solves the problem but not super challenges. | Solution solves problem inelegantly or inefficiently | Solution does not completely solve problem. | No reasonable attempt made to solve problem. |
| Programming | Program uses advanced techniques including Boolean logic, Complete palette blocks, etc. Program demonstrates extraordinary creativity or unique way of solving problem | Program is straightforward and efficient, and uses appropriate programming constructs. Program has a reasonable algorithm for solving problem and uses good logic. | Program is straightforward and easy to understand. Program is inefficient. Program has a reasonable algorithm for solving problem. | Program is poorly written or difficult to understand. Program has unused parts or does not correctly control robot. Algorithm is strained. | Program does not work. Program does not solve problem effectively. |
| Construction | Robot constructed using advanced gearing or other advanced construction techniques. Robot demonstrates extraordinary creativity. | Robot is of sound construction: nothing falls off, robot works as intended. Mechanics used well to achieve desired outcome. Robot can solve problem repeatedly. | Robot works as intended, but some extraneous parts fall off. Moderate degree of repeatability: robot will run again but must be adjusted or fixed | Robot does not work as intended, but does move. Robot falls apart. Very simple construction – mechanics not used well. Robot cannot run repeatedly. | Robot falls apart or does not move at all. Construction appears careless or haphazard. |
| Documentation | Documentation goes beyond required paperwork. | Ample and accurate documentation.Documentation kept consistently and thoroughly | Good documentation: documentation kept consistently but not as thorough as it could be. | Fair documentation: documentation kept inconsistently and missing parts. | Little or no documentation |
| Cooperation | Student(s) helped other groups | Student worked well with group. Student participated actively in all parts of project. | Student worked somewhat well with group. Student participated in most parts of project. | Student had trouble working with group. Student participated in few parts of project. | Student did not participate in project. Student sabotaged others’ work |

**Daily Group Evaluation** Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

List each member of your group (including yourself) and assess each area with: 3 = strongly agree (s/he was very good at this)

2 = agree (about right)

1 = disagree (this was a problem)

|  |  |  |  |
| --- | --- | --- | --- |
| *Name* | *Listened respectfully to group members* | *Was focused and on-task* | *Did his/her work* |
| (Self) |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Comments:

Information Specialist Report

You are responsible for reporting the status of the project to the Team Manager every day. How has the team progressed? Address the following questions:

1. What did your team accomplish today?
2. What problems did the team find today?
3. What solutions did the team try?
4. Other comments?

|  |  |  |
| --- | --- | --- |
|  | **Task** | **Report** |
| Per 1 | Get Challenge Begin brainstorming & Designing |  |
| Per 2 | Finish Design & get approval Begin building test parts—try different ideas |  |
| Per 3 | Finish building test parts & begin assembling robot from successfully tested parts |  |
| Per 4 | Continue assembling robot from parts Create program for robot |  |
| Per 5 | Continue building & programming robot—test regularly |  |
| Per 6 | Continue to refine robot—test regularly with the program |  |
| Per 7 | Finish refining robot—make sure it completes challenge! |  |
| Per 8 | Finish or enhance robot |  |
| Per 9 | Design Challenge: Show off robot! |  |
| Per 10 | Clean up: Take apart robot, return materials to original state |  |

Names: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_