GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING & TECHNOLOGY

PATHWAY: Manufacturing

COURSE: Robotics and Automated Systems

UNIT: 10-Robotic Competitions

INTRODUCTION

Annotation:

Robotics and Automation: In this unit students will identify opportunities for robotic competition and exhibitions at the state, national and international levels. Students should understand the educational benefits of competitions.

Grade(s):

	9th
X	10th
X	11th
X	12th

Time: 5 hours

Author: Emil L. Decker

Additional Author(s):

Monique Vinski, Special Education Teacher
James Hollingsworth, Science Teacher

Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

FOCUS STANDARDS

GPS Focus Standards:

ENGR-RAS-2. Students will identify and explain the major engineering tasks in organizing automated manufacturing.
ENGR-RAS-3. Students will discuss the systems and applications of automation including: AGV, PLC, CNC, CIM, CAD, CAM, and robotics as essential to succeeding globally in a manufacturing market.
ENGR-RAS-5. Students will apply the principles of PLC, CIM, CAD, CAM, and robotics in the manufacturing of a product.
ENGR-STEM-1. Students will recognize the systems, components, and processes of a technological system.
ENGR-STEM-3. Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.
ENGR-STEM-4. Students will apply principles of science, technology, engineering, mathematics, interpersonal communication, and teamwork to the solution of technological problems.
ENGR-STEM-5. Students will select and demonstrate techniques, skills, tools, and understanding related to energy and power, bio-related, communication, transportation, manufacturing, and construction technologies.
ENGR-STEM-6. Students will enhance reading by developing vocabulary and comprehension skills associated with text materials, problem descriptions, and laboratory activities associated with engineering and technology education.
ENGR-STEM-7. Students will develop leadership and interpersonal problem-solving skills through participation in co-curricular activities associated with the Technology Student Association.

GPS Academic Standards:

ELAALRC2. *The student participates in discussions related to curricular learning in all subject areas.*
ELAALRC3. *The student acquires new vocabulary in each content area and uses it correctly.*
ELAALRC4. *The student establishes a context for information acquired by reading across subject areas.*
MM3P1. *Students will solve problems (using appropriate technology)*
MM3P2. *Students will reason and evaluate mathematical arguments.*
MM3P3. *Students will communicate mathematically.*
MM3P4. *Students will make connections among mathematical ideas and to other disciplines.*
MM3P5. *Students will represent mathematics in multiple ways.*
SCSh1. *Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science*.
SCSh2. *Students will use standard safety practices for all classroom laboratory and field investigations*.
SCSh3. *Students will identify and investigate problems scientifically.*
SCSh4. *Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials*.
SCSh5. *Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.*
SCSh6. *Students will communicate scientific investigations and information clearly*.
SCSh7. *Students analyze how scientific knowledge is developed*.
SCSh8. *Students will understand important features of the process of scientific inquiry*.

National / Local Standards / Industry / ISTE:

ITEA -Standard 1. Students will develop an understanding of the characteristics and scope of technology.
ITEA - Standard 3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.
ITEA - Standard 4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.
ITEA – Standard 5. Students will develop an understanding of the effects of technology on the environment.
ITEA - Standard 8. Students will develop an understanding of the attributes of design.
ITEA - Standard 9. Students will develop an understanding of engineering design.
ITEA - Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
ITEA - Standard 11. Students will develop the abilities to apply the design process.
ITEA - Standard 12. Students will develop the abilities to use and maintain technological products and systems.

ITEA - Standard 13. Students will develop the abilities to assess the impact of products and systems.
ITEA - Standard 16. Students will develop an understanding of and be able to select and use energy and power technologies.
ITEA - Standard 17. Students will develop an understanding of and be able to select and use information and communication technologies.
ITEA - Standard 18. Students will develop an understanding of and be able to select and use transportation technologies.

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Students will understand how robotic competitions are designed and conducted at the state, national and international levels, and the importance of these events in promoting science, math and technology education through fun competitive events.

Essential Questions:

- What is a robotic competition?
- Who organizes robotic competitions and who can participate?
- What kits, materials, and costs are associated with these competitions?

Knowledge from this Unit:

- Students will be able to identify several competition opportunities for various age groups.
- Students will be able to describe various problem solving techniques used to solve the competition goals.
- Students will be able to identify major components, materials, requirements and restrictions of various competitions.
- Students will be able to work as a team to create a small local competition.

Skills from this Unit:

- Students will plan and organize a robotics competition.

ASSESSMENT(S)

Assessment Method Type: Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

X Pre-test
____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ Unit test
X Group project
X Individual project
____ Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
__ Self-check rubrics
__ Self-check during writing/planning process
__ Journal reflections on concepts, personal experiences and impact on one's life
__ Reflect on evaluations of work from teachers, business partners, and competition judges
__ Academic prompts
__ Practice quizzes/tests

X Subjective assessment/Informal observations
__ Essay tests
_X_ Observe students working with partners
__ Observe students role playing
____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
X Dialogue and Discussion
__ Student/teacher conferences
_X_ Partner and small group discussions
_X_ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners
____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
__ Application of skills to real-life situations/scenarios
____ Post-test

Assessment(s) Title:

Robotic Competitions Rubric

Assessment(s) Description/Directions:

Students are to investigate various competition options and report their findings.

Attachments for Assessment(s):

Robotic Competitions Rubric

CRITERIA	EXCELLENT	GOOD	FAIR	POOR
Students list and describe 3 competitions	3 or more various competitions, explained	3 or more competitions explained, incomplete	Less than 3 competitions, incomplete	Incomplete
Scope of research	Very detailed	Somewhat detailed	Incomplete research	No depth to research
English, Language Arts	Correct use of grammar	Some grammar mistakes	Contains few serious errors in grammar	Contains serious grammatical errors
Presentation	Well developed and delivered presentation	Inconsistent preparation of presentation	Incomplete/not well presented, Hard to follow	Lack of preparation for presentation
Organization	Well thought out and concise	Thought out but disorganized	Confusing order, not well thought out	Incomplete, not thought out properly
Design of Robotics Competition Course	Well thought out and executed, Details provided	Thought out and executed, some details	Problems with either thought or execution	Incomplete, not thought out properly or executed

LEARNING EXPERIENCES

Sequence of Instruction

1. Identify the Standards. Standards should be posted in the classroom for each lesson.
2. Review Essential Questions.
    - What is a robotic competition?
    - Who organizes robotic competitions and who can participate?
    - What kits, materials, and costs are associated with these competitions?
3. Identify and review the unit vocabulary.
4. Assessment Activity.

Step 1:
Students research various robot competitions being offered throughout the world. (see Introduction to Robotic Competitions document)

Step 2:
Discuss the concept of Gracious Professionalism, and why it is an important attribute. (see Gracious Professionalism document)

Step 3:
Using the results of their research, students will present overviews of the current competitions to their classmates.

Step 4:
Students will create a small robot competition of their own based on their research. (see What's My Game? document)

Step 5:
Students will evaluate their robot competitions. (see What's My Game? document)

Attachments for Learning Experiences:

http://www.robotevents.com
http://robots.net/rcfaq.html
http://www.vexrobotics.com
http://www.usfirst.org
http://www.botball.org
http://www.bestinc.org
http://www.georgiabest.org
http://www.marinetech.org/rov_competition/
http://www.robocup.org/
http://www.robotbooks.com/robot-competition-links.htm

Notes & Reflections:

While almost everyone thinks of mayhem, damage, ripping, tearing, cutting and destruction when it comes to Robot Wars, most competitions involving robots are of the non-destructive type. Consider the costs: especially with student robots, made from parts instructors hope to use in future classes, students need to consider how to compete without such aggressive tendencies.

All of the competitions the students will be investigating, (Robot Wars excepted), are friendly rounds of limited contact, scoring points, and problem solving designs to lift more, scoop faster, push more accurately, and such strategies students can come up with to overcome the obstacles and fellow competitors to win the day.

Many, if not all of the competitions put a special emphasis on the teamwork, research, documentation, and other aspects beyond the "winning" of the game. This is emphasized primarily through the concept of Gracious

Professionalism. If students learn to work together, even when competing against each other, they gain so much more than when rivalry overcomes and winning takes precedence over all other aspects of the game.

When having students research, have them focus as much on the details as possible. Often students brush quickly over the limits, requirements, and possibilities within the written rules to be totally absorbed in the scenario of the game. I have seen teams arrive on game day to a tournament with a robot that is out of tolerance for size, and have to dismantle and rebuild it to make it compliant. Others have been told that they misunderstood the rules, or did not read them properly and had to take off illegal attachments. Still others could not make adaptations in the short time, and could not compete. Some who do not read the Rules of play carefully may become the focus of other teams who will consider them cheaters, or worse, Non-Gracious opponents. Many tournaments are set up to have the high scoring teams pick lower scoring teams as partners for the finals. Such teams are often not chosen, in spite of their possible quality performing robot.

When researching and presenting organized games to the rest of the class, you may want to have students work in groups. The groups can look for information in the same basic categories as listed on the "What's My Game" Rubric. This way, everybody is involved in researching, but there will not be a large number of the same presentations over and over again.

Similarly, when developing games of their own, students might work in teams, sharing the burden of determining what one hopes will be a series of well thought out objectives, rules, and scenarios. Some individuals can do well alone on this project, but the time requirements will probably need to be extended.

Because of the time limits, have the students brainstorm and keep the games simple to start with. Complexity can build as they develop the game, but games that start too massively, often become so encumbered with ideas that nothing is finally planned out. I have seen some games so complicated, that the students eventually threw the entire idea out, and started over. Students should be both "out of the box" thinkers, but should understand the limitations of the equipment they will be using. Games should be challenging, but not impossible.

Quality game plans can become the basis for a final class project, or a local tournament between close neighboring schools or districts. Over the last three years, my students have done just this, and we have had great fun and success with our workshops. The problems listed above are first hand experience.

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title:

What's My Game?

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Students are to create a robot competition similar to those they have investigated during this unit.

Attachments for Culminating Performance Task:

See 'What's My Game?' & Rubric

UNIT RESOURCES

Web Resources:

http://www.robotevents.com
http://robots.net/rcfaq.html
http://www.vexrobotics.com
http://www.usfirst.org
http://www.botball.org
http://www.bestinc.org
http://www.georgiabest.org
http://www.marinetech.org/rov_competition/
http://www.robocup.org/
http://www.robotbooks.com/robot-competition-links.htm

Attachment(s):

Chapter 10 Anticipation Guide (pre-test)
Manipulators 2008 (PowerPoint Presentation)

Materials & Equipment:

A wide variety of materials and equipment may be needed. If a portion or all of the robot competition game is to be constructed, students should prepare a bill of materials. The Teacher may then prepare a master list and determine the best method to acquire these materials.

What 21st Century Technology was used in this unit?

X	Slide Show Software		Graphing Software		Audio File(s)
	Interactive Whiteboard		Calculator	X	Graphic Organizer
	Student Response System		Desktop Publishing	X	Image File(s)
	Web Design Software		Blog		Video
	Animation Software	X	Wiki		Electronic Game or Puzzle Maker
	Email	X	Website		