

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

Gateway to Technology (Project Lead the Way)

DATE: September 2008

COURSE TITLE: Gateway to Technology

PROPOSED GRADE LEVEL(S): 6th – 8th

CATEGORY: Elective

GRADING: A-F

COURSE LENGTH: Trimester

PREREQUISITES: None

COURSE DESCRIPTION

Project Lead the Way provides a middle school curriculum called, Gateway to Technology (GTT). It is an activity-oriented middle school curriculum - a program designed to help students in grades six through eight explore math, science, and technology. There are six independent units. Students will be exposed to the first two and one of the other four units over three years in the elective program.

Mandatory Units

- Design and Modeling
- Automation and Robotics

Elective Units

- The Magic of Electrons
- The Science of Technology
- Flight and Space
- Energy and the Environment

Middle school students are naturally curious, and these units are designed to challenge and engage students in exciting activities. This curriculum is a good introduction to the High School Engineering program.

GENERAL GOALS/PURPOSES:

(Taken from: www.pltw.org)

Project Lead The Way® (PLTW) is a not-for-profit organization that promotes pre-engineering courses for middle and high school students. PLTW forms partnerships with public schools, higher education institutions and the private sector to increase the quantity and quality of engineers and engineering technologists graduating from our educational system.

The PLTW curriculum was first introduced to 12 New York State high schools in the 1997/1998 school year. A year later, PLTW field tested four unit Middle School Program in three middle schools. Today, the programs are offered in over 1,300 schools in 45 states and the District of Columbia.

Students in the PLTW program will:

1. Receive training in current technology using the latest computer software and equipment in use in industry.
2. Participate in a hands-on, activity oriented program that utilizes team efforts.
3. Take courses that will apply and reinforce their study of math and science.
4. Enjoy a challenging program that incorporates and addresses the goal of raising standards of learning.
5. Have the opportunity to continue the program into high school where the opportunities below are available:

- a. Participate in a program that will allow them to explore a major career path and, if they wish to continue, will prepare them for further education at a two or four year college in the field of engineering, engineering technology or biomedical science.
- b. Participate in a program that has developed articulation agreements with a number of colleges who will accept specified courses for credit or advanced placement.
- c. Be prepared to pursue a career in technology in a field where a national employment shortage exists and pay scales are among the highest levels for entry level professionals or technicians.

STUDENT READING COMPONENT:

The purpose of reading in this course is threefold: 1) students will gain competency in technical reading, both in teacher given materials and research based information on the web and in books; 2) students will gain general understanding of the work skills needed to be successful in each unit studied; and 3) students will gain an understanding of the use of the software and engineering applications utilized in all units under study. Students will read from web pages, handouts, books, and primary sources to gain knowledge of concepts and vocabulary that are important to proficient everyday use of the specific applications.

Methods will include, but are not limited to, guided reading, vocabulary-building activities, independent reading, and comprehension checks.

STUDENT WRITING COMPONENT:

Students will compile, and at the end of each unit, turn in a notebook of daily entries describing, summarizing and analyzing the skills and concepts learned during the unit. They will create PowerPoint presentations, websites, and/or essays on a variety of subjects studied in each course. The work will be consistent with the expectations laid out in the California Reading/Language Arts Standards for Grades 6-8. The main focus of these projects is to allow students to demonstrate mastery of key skills and concepts learned in the units of study. Students will be expected to edit for grade level mechanical, grammatical, and rhetorical conventions.

STUDENT ORAL COMPONENT:

Students will complete a variety of formal or informal oral presentations expressing their knowledge of the subject area of study. Students may be assessed orally as well.

DETAILED UNITS OF INSTRUCTION:

Courses are selected from the following:

GTT Core Units

1. Automation and Robotics (AR)

- a. Students trace the history, development, and influence of automation and robotics. They learn about mechanical systems, energy transfer, machine automation and computer control systems. Students acquire knowledge and skills in problem solving, teamwork collaboration and innovation.

2. Design and Modeling(DM)

- a. This unit uses solid modeling software (a sophisticated mathematical technique for representing solid objects) as part of the design process. Utilizing this design approach, students understand how design influences their lives. Students also learn sketching techniques and use descriptive geometry as a component of design, measurement and computer modeling. Students brainstorm, research, develop ideas, create models, test and evaluate design ideas and communicate solutions.

GTT Specialization Units

1. Energy and the Environment

- a. Students investigate the importance of energy in our lives and the impact energy use has on the environment. They design and model alternative energy sources and participate in an energy expo to demonstrate energy concepts and innovative ideas. Students evaluate ways to reduce energy consumption through energy efficiency and waste management techniques.
- 2. Flight and Space**
 - a. Students study the history of aerospace through hands-on activities, research and a presentation in the form of an infomercial. Students explore the science behind aeronautics and use their knowledge to design, build and test a model glider. Simulation software is used to expose students to traveling and living in space.
- 3. Magic of Electrons**
 - a. Through hands-on projects, students explore the science of electricity, the behavior and parts of atoms, circuit design and sensing devices. Students acquire knowledge and skills in basic circuitry design and explore the impact of electricity on their lives.
- 4. Science of Technology**
 - a. Students trace how science has affected technology throughout history and learn about applied physics, chemical engineering and nanotechnology through exploratory activities and projects.

GTT harnesses the enthusiasm and energy of middle school students. The program focuses on showing, not telling, students how to use engineering skills to solve everyday problems. Students won't ask, "Will I ever have to use this in real life?" because they will be applying their skills as they learn them. The primary focus is on stronger math, science, and technology inquiry skills.

SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:

Career Technical Education –

Information Technology Industry Sector:

Specific applications of Mathematical Reasoning standards (grade seven):

- (1.1) Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.
- (2.1) Use estimation to verify the reasonableness of calculated results.
- (2.2) Apply strategies and results from simpler problems to more complex problems.
- (2.3) Estimate unknown quantities graphically and solve for them by using logical reasoning and arithmetic and algebraic techniques.
- (2.4) Make and test conjectures by using both inductive and deductive reasoning.
- (2.5) Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
- (2.6) Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.
- (2.7) Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.
- (2.8) Make precise calculations and check the validity of the results from the context of the problem.
- (3.1) Evaluate the reasonableness of the solution in the context of the original situation.
- (3.2) Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
- (3.3) Develop generalizations of the results obtained and the strategies used and apply them to new problem situations.
- (5.0) Students solve multi-step problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.

Specific applications of Algebra I standards (grades eight through twelve):

- (1.1) Students use properties of numbers to demonstrate whether assertions are true or false.
- (13.0) Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.

(24.2) Students identify the hypothesis and conclusion in logical deduction.

(25.2) Students judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step.

1.2 Science

Specific applications of Investigation and Experimentation standards (grades nine through twelve):

(1.a) Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

(1.d) Formulate explanations by using logic and evidence.

Investigation and Experimentation (6th - 8th grade)

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
 - a. Develop a hypothesis.
 - b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
 - c. Construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
 - d. Communicate the steps and results from an investigation in written reports and oral presentations.
2. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
 - a. Plan and conduct a scientific investigation to test a hypothesis.
 - b. Evaluate the accuracy and reproducibility of data.
 - c. Distinguish between variable and controlled parameters in a test.
 - d. Recognize the slope of the linear graph as the constant in the relationship and apply this principle in interpreting graphs constructed from data.
 - e. Construct appropriate graphs from data and develop quantitative statements about the relationships between variables.
 - f. Apply simple mathematic relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including speed = distance/time, density = mass/volume, force = pressure \times area, volume = area \times height).
 - g. Distinguish between linear and nonlinear relationships on a graph of data.

Focus on Physical Sciences

Motion (8th grade)

1. The velocity of an object is the rate of change of its position. As a basis for understanding this concept:
 - a. Students know position is defined in relation to some choice of a standard reference point and a set of reference directions.
 - b. Students know that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary.
 - c. Students know how to solve problems involving distance, time, and average speed.
 - d. Students know the velocity of an object must be described by specifying both the direction and the speed of the object.
 - e. Students know changes in velocity may be due to changes in speed, direction, or both.
 - f. Students know how to interpret graphs of position versus time and graphs of speed versus time for motion in a single direction.
2. Unbalanced forces cause changes in velocity. As a basis for understanding this concept:
 - a. Students know a force has both direction and magnitude.

- b. Students know when an object is subject to two or more forces at once, the result is the cumulative effect of all the forces.

Electric and Magnetic Phenomena (8th Grade)

1. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:
 - a. Students know how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.
 - b. Students know how to solve problems involving Ohm's law.
 - d. Students know the properties of transistors and the role of transistors in electric circuits.
 - e. Students know charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.
 - f. Students know magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.
 - g. Students know how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.
 - h. Students know changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.
 - i. Students know plasmas, the fourth state of matter, contain ions or free electrons or both and conduct electricity.
 - j. Students know electric and magnetic fields contain energy and act as vector force fields.

1.0 Writing Strategies (6th – 8th)

Students write clear, coherent, and focused essays. The writing exhibits students' awareness of the audience and purpose. Essays contain formal introductions, supporting evidence, and conclusions. Students' progress through the stages of the writing process as needed.

Organization and Focus

- 1.1 Choose the form of writing (e.g., personal letter, letter to the editor, review, poem, report, narrative) that best suits the intended purpose.
- 1.2 Support all statements and claims with anecdotes, descriptions, facts and statistics, and specific examples.
- 1.3 Use strategies of note taking, outlining, and summarizing to impose structure on composition drafts.

Research and Technology

- 1.4 Use organizational features of electronic text (e.g., bulletin boards, databases, keyword searches, e-mail addresses) to locate information.
- 1.5 Compose documents with appropriate formatting by using word-processing skills and principles of design (e.g., margins, tabs, spacing, columns, page orientation).
- 1.6 Create documents by using word-processing skills and publishing programs; develop simple databases and spreadsheets to manage information and prepare reports.

2.3 Write research reports:

- a. Pose relevant questions with a scope narrow enough to be thoroughly covered.
- b. Support the main idea or ideas with facts, details, examples, and explanations from multiple authoritative sources (e.g., speakers, periodicals, online information searches).
- c. Include a bibliography.

2.0 Speaking Applications (Genres and Their Characteristics) (6th – 8th)

Students deliver well-organized formal presentations employing traditional rhetorical strategies (e.g., narration, exposition, persuasion, description). Student speaking demonstrates a command of standard American English and the organizational and delivery strategies outlined in Listening and Speaking Standard 1.0.

2.2 Deliver informative presentations:

- a. Pose relevant questions sufficiently limited in scope to be completely and thoroughly answered.
- b. Develop the topic with facts, details, examples, and explanations from multiple authoritative sources (e.g., speakers, periodicals, online information).

2.4 Deliver persuasive presentations:

- a. Provide a clear statement of the position.
- b. Include relevant evidence.
- c. Offer a logical sequence of information.
- d. Engage the listener and foster acceptance of the proposition or proposal.

2.5 Deliver presentations on problems and solutions:

- a. Theorize on the causes and effects of each problem and establish connections between the defined problem and at least one solution.
- b. Offer persuasive evidence to validate the definition of the problem and the proposed solutions.

4.0 Technology

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments:

- 4.1 Understand past, present, and future technological advances as they relate to a chosen pathway.
- 4.2 Understand the use of technological resources to gain access to, manipulate, and produce information, products, and services.
- 4.3 Understand the influence of current and emerging technology on selected segments of the economy.
- 4.4 Understand effective technologies used in Web site development and the Internet.
- 4.5 Know procedures for maintaining secure information, preventing loss, and reducing risk.

5.0 Problem Solving and Critical Thinking

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques:

- 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
- 5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components.
- 5.3 Use critical thinking skills to make informed decisions and solve problems.

THIS COURSE WILL PREPARE STUDENTS FOR THE CAHSEE and/or CSTs:

Writing, Reading, Language Arts, Math and Science

LAB FEE IF REQUIRED:

(optional: \$5 fee as needed)

DISTRICT ESLRs TO BE ADDRESSED:

Students will be:

- **Self Directed Learners:** - who will be able to use the internet, books, and teacher given materials, to assist them in continuing their learning outside of the classroom setting.
- **Efficient Communicators:** - who can explain concepts to others, and use computers and their notebooks to organize and explain data.
- **Quality Producers:** - who understand the importance of neat, organized work, that demonstrates their thinking and understanding of the solution they've formed to solve a problem.

- **Constructive Thinkers**: - who are able to attack problems with organization, logic, research, and computer skills they've developed in a systematic fashion.
- **Collaborative Workers**: - who can work in a variety of settings in culturally diverse groups.
- **Responsible Citizens**: - who accept the responsibility and consequences of their actions and who demonstrate their understanding of their role in the learning process.