FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OFFICE OF CURRICULUM AND INSTRUCTION

TECHNOLOGY EDUCATION DEPARTMENT

TECHNOLOGY DESIGN LABORATORY 2

Grade Level: 10-12

Credits: 5

BOARD OF EDUCATION ADOPTION DATE:

AUGUST 22, 2011

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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Tech Design Lab II Introduction

Introduction

Course Philosophy

This course engages students in projects intended to make them comfortable with technological development and change—making them "technologically literate," and to inspire them to engage in the next level of innovation and technological development.

The goal of this course is to produce students who are more than just technology content consumers or users as they work towards being content creators. One of the focuses is citizenship—working towards having students become thinkers, but also better creators, innovators, consumers, and entrepreneurial leaders. An involved and informed citizen in this fast-moving, technological world will become a better member of our workforce in the future.

The future wealth of our nation will be measured by ideas evolving from ingenuity and involving innovation. This challenge towards greatness requires new skills, new social mechanisms, continuous learning agility, and a willingness to think outside the box.

Course Description

Technology Design Laboratory II is a full year, 5 credit course open to students in grades 10 through 12 who have successfully taken Technology Design Lab I. During this course, the students will acquire and use technological knowledge to solve advanced, real world technological problems using the engineering design process.

Course Map and Proficiencies / Pacing

Course Map

Relevant Standards	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic	Formative	Summative
8.2.12.B.3, 8.2.12.C.3, 6.2.12.C.6.d 6.3.12.F.12	Technological growth is exponential in nature, and impacts all individuals, society, politics, the economy, our culture and the environment.	How could singularity forever change our world? How has new technology changed human culture in the past?	Pre-test Discussion questions	Benchmark assessments Student design journals	Unit project Midterm examination Final examination
8.2.12.D.1, 9.1.12.A.1, 9.1.12.F.3, 9.1.12.C.5 9.1.12.F.2 9.3.12.C.5	Technological soft skills required by employers include, but are not limited to critical thinking, communication, time management, safety knowledge, problem solving and team work.	How is technology relevant to employment in the 21st century? What characteristics are essential to a functional team? Why is personal responsibility important for every team member?	Do Now Pre-test Worksheets	Student design journals Student presentations Class discussion	Unit project Quiz Midterm examination Final examination
9.1.8.F.2 9.3.12.C.5	The correct use of personal protective equipment, tools and power equipment is the most important aspect of lab work.	What are the safety concerns to be considered when working in a lab setting in school or on the job? What protection can be used in a laboratory environment?	Pre-test Do Now	Benchmark assessments Class discussion Worksheets	Safety test Midterm examination Final examination

8.1.12.A.4, 8.1.12.F.1, 8.2.12.E.1 9.1.12.A.2 9.1.12.E.5 9.1.12.F.5 8.1.12.D.2	Thoroughly researching and documenting a technological problem in a portfolio leads to a well-developed solution.	How does an engineering notebook enhance the design process? How essential is design documentation in the patent application process? What methods could be used to timestamp your work? What are the components of an engineer's notebook?	Pre-test Class discussion Do Now	Student design journals Oral presentations Worksheets Class discussion	Unit project Midterm examination Final examination
8.2.12.A.1, 8.2.12.B.2, 8.2.12.B.3	To make intelligent decisions about a technology both trade-offs and benefits must be considered.	How does a person choose the best solution to a given problem? What factors must be considered when examining trade-offs? When should a morphological or comparison chart be used to assess alternate solutions?	Pre-test Class discussion Icebreakers Do Now	Benchmark assessments Class discussion Student design journals	Unit project Midterm Examination Final Examination
8.1.12.C.1, 8.2.12.A.1, 9.1.12.B.3 9.1.12.D.1	There are many possible strategies and innovative solutions to a technological problem but there is no such thing as "the correct" answer.	How does an idea evolve into a viable solution? What are the major steps of the design process? How do you effectively brainstorm a solution to a technological problem?	Pre-test Do Now Discussion questions	Benchmark assessments Class discussion Student design journals Written assignments	Unit project Midterm examination Final examination

8.2.12.A.1 8.2.12.B.2 8.2.12.B.3	Human factors should be considered when designing products for everyday use.	How is anthropometric data used in product design? How can ergonomics reduce stress on the human body?	Pre-test Class discussion Do Now	Benchmark assessments Class discussion Student design journals	Unit project Midterm examination Final examination
8.2.12.F.2, 8.2.12.F.3, 8.2.12.G.1, 5.1.12.B.2 4.2.12.A.2	Technology has strong connections to all subject areas, especially science and math.	How do science and math play a role in the various fields of technology? What impact does technology have on these other areas?	Pre-test Discussion questions Do Now	Benchmark assessments Class discussion Student design journals Written assignments	Unit project Midterm examination Final examination
8.2.12.F.1, 8.2.12.G.1	The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system.	What are the seven areas of technology? How can technological products or systems reside within multiple areas?	Pre-test Do Now Class discussion	Benchmark assessments Class discussion Student design journals Student presentations Written assignments	Unit project Midterm examination Final examination
4.2.12 A.2 3.1.12.A.1, 3.1.12.A.2 9.1.12.D.1 9.1.12.E.1 9.1.12.E.2	The purpose of graphic communication is to inform, to persuade, and to delight.	How do humans communicate? What makes one image more enticing to its audience over another?	Pre-test Do Now Class discussion	Benchmark assessments Class discussion Student design journals Student presentations Written assignments	Unit project Midterm examination Final examination

6.1.12.C.3.a, 6.1.12.C.12.a, 6.1.12.C.16.a, 6.2.12.C.5.c	Space travel is a vastly unexplored yet blossoming component of technology that has impacted our nation economically and politically.	How has privatization changed space travel? How has space exploration expanded since "the race for space" with the possibility of space tourism? What role does aerodynamics play in space exploration? What biological effects does space travel have on humans, animals, and plants?	Pre-test Do Now Class discussion	Benchmark assessments Class discussion Student design journals Student presentations Written assignments	Unit project Midterm examination Final examination
8.2.12.B.1, 8.2.12.C.2, 6.1.12.C.3.b, 6.1.12.C.16.a	As global citizens, humans need to decrease dependency on fossil fuels and work to develop renewable resources.	What possibilities exist currently for renewable energy? How does the constant depletion of fossil fuels affect the environment?	Pre-test Do Now Class discussion	Benchmark assessments Class discussion Student design journals Student presentations Written assignments	Unit project Midterm examination Final examination
8.2.12.D.1, 8.2.12.F.2, 8.2.12.F.3, 6.1.12.C.14.d 6.3.12.F.1.2 6.3.12.C.2	Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century.	How could production processes affect your health? How do the properties of materials impact the production process? How do jigs, fixtures, and automation influence the efficiency of production systems?	Pre-test Do Now Class discussion	Benchmark assessments Class discussion Student design journals Student presentations Written assignments	Unit project Midterm examination Final examination

Proficiencies and Pacing

Unit Title	Unit Understanding(s) and Goal(s)	Recommended Duration
Unit 1: Personal Responsibility and Safety Procedures	The correct use of personal protective equipment, tools and power equipment is the most important aspect of lab work. Technological soft skills required by employers include, but are not limited to critical thinking, communication, time management, problem solving and team work. Students will be able to identify and implement proper safety procedures. Students will be able to identify personal protective equipment. Students will be able to demonstrate the proper use of personal protective equipment.	1 week
Unit 2: Design Documentation	Thoroughly researching and documenting a technological problem in a portfolio leads to a well-developed solution. To make intelligent decisions about a technology both trade-offs and benefits must be considered. The designed world consists of seven unique areas of technology. Students will be able to create their own engineering notebook documenting their work for a design challenge. Students will be able to list important components of an engineering notebook. Students will be able to explain the importance of detailed documentation.	2 weeks
Unit 3: Research and Analysis	Thoroughly researching and documenting a technological problem in a portfolio leads to a well-developed solution. Technological growth is exponential in nature and impacts all individuals, society, politics, the economy, our culture and the environment. Students will be able to defend their intellectual property rights under United States patent law. Students will be able to locate information needed to solve technological problems using multiple sources. Students will apply all ethical and legal considerations when downloading or using a variety of information in technical research. Students will differentiate between reliable and inaccurate information on the Internet.	2 weeks

Unit 4: Computer Aided Design	Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century. Technology has strong connections to all subject areas, especially science and math. Students will be able to explain the advantages and disadvantages of Computer Aided Design over traditional board drafting. Student will be able to identify the various menus, toolbars, windows, and work areas of the CAD program. Students will understand the importance of dimensioning and tolerances. Students will be able to produce engineering drawings based on 3D models and parts.	3 weeks
Unit 5: Modeling and Prototyping	Technology has strong connections to all subject areas, especially science and math. Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century. Students will be able to differentiate between an alpha and a beta prototype. Students will be able to select and effectively use a variety of modeling materials. Students will be able to produce a 3D model. Students will be able to design and construct a model by correctly and safely using tools, materials, and resources.	3 weeks
Unit 6: Reverse Engineering	There are many possible strategies and innovative solutions to a technological problem but there is no such thing as "the correct" answer. Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century. Students will be able to deconstruct a mechanism. Students will be able to redesign and modify a product through reverse engineering.	3 weeks
Unit 7: Human Factors Engineering	Human factors should be considered when designing products for everyday use. There are many possible strategies and innovative solutions to a technological problem but there is no such thing as "the correct" answer. To make intelligent decisions about a technology both trade-offs and benefits must be considered. Students will be able to apply ergonomic principles and anthropometric measurements in the design of a product. Students will be able to describe how anthropometric data changes by age, gender, and demographics. Students will be able to redesign a product for humans with various modality issues.	3 weeks

Unit 8: Production Systems	There are many possible strategies and innovative solutions to a technological problem but there is no such thing as "the correct" answer. Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century. The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system. Students will be able to identify basic production processes. Students will be able to create a plan for the reuse of discarded production materials. Students will be able to develop jigs and fixtures that will increase the efficiency of production workflow. Students will be able to create a production plan using flowcharts or GANTT charts.	4 weeks
Unit 9: Renewable Energy	As global citizens, humans need to decrease dependency on fossil fuels and work to develop renewable resources. Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century. The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system. Students will be able to differentiate between fossil fuels and renewable resources. Students will be able to discuss and debate current trends in green energy. Students will be able to design and construct a system powered by renewable energy.	4 weeks
Unit 10: Consumer Graphics	The purpose of graphic communication is to inform, to persuade, and to delight. The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system. Students will be able to design two-dimensional and three-dimensional visual representations for a client. Students will be able to develop a logo and a plan for company branding. Students will be able to critique visual designs based on aesthetics and composition.	4 weeks
Unit 11: Industrial Design	Human factors should be considered when designing products for everyday use. There are many possible solutions to a technological problem but there is no such thing as "the correct" answer. Students will be able to identify design styles of several periods. Students will be able to redesign a product that will optimize function, value, and appearance for the mutual benefit of user and manufacturer. Students will be able to demonstrate industrial design and engineering aspects occurring simultaneously.	3 weeks

Unit 12: Innovations in Space	Space travel is a vastly unexplored yet blossoming component of technology that has impacted our nation economically and politically. The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system. Technology has strong connections to all subject areas, especially science and math. Students will be able to develop a timeline on the history of space travel. Students will be able to design and construct a space vehicle or habitat. Students will be able to create an experiment that will yield measurable data that could enhance life on other planets.	4 weeks

Unit 1 - Tech Design Lab II

Personal Responsibility and Safety Procedures

Enduring Understandings

Technological soft skills required by employers include, but are not limited to, critical thinking, communication, time management, safety knowledge, problem solving, and teamwork.

The correct use of personal protective equipment, tools, and power equipment is the most important aspect of lab work.

Essential Questions

What are the safety concerns to be considered when working in a lab setting in school or on the job?

What personal protection should be used in a laboratory environment?

What characteristics are essential to a functional team?

Why is personal responsibility important for every team member?

Unit Goals

Students will be able to identify and implement proper safety procedures in a work setting.

Students will be able to identify personal protective equipment.

Students will be able to demonstrate the proper use of personal protective equipment.

Recommended Duration: 1 week

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
Why should safety be the first concern while working in a technology design laboratory?	General safety rules and regulations of the lab	Safety rules printed out and handed to each student for their journal. Safety rules posted on teacher web page or Moodle page	Teacher demonstration of proper use of machines Discussion of consequences of not following proper lab procedures	Teacher will assess student knowledge via a comprehensive safety test which student must pass with 100% accuracy.

What personal protective equipment should be used when using equipment, handling chemicals or performing special operations in the Technology Design Lab?	Safety goggles / glasses, types of gloves, face shields, proper care and storage of equipment, cleaning of PPE	Internet	Teacher demonstration of personal protective equipment	Signed safety contract by both student and parent
Why is personal responsibility important when it comes to group work?	Personal responsibility, cooperation	Internet, magazines, e-zines. Guidelines for effective group work.	Class discussion of effective cooperative education methods	Worksheet on personal responsibility

2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.i	Safety
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.j	Employment application skills
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.4	Demonstrate occupational health and safety skills related to industry-specific activities.
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.2.12 F.1	Engage in an informed discussion about rules and laws designed to promote safety and health.
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.2.12 F.2	Describe and demonstrate basic first aid and safety procedures.
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.2.12 F.3	Analyze the occurrence of workplace hazards.
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.2.12 F.4	Practice the safe use of tools and equipment.
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.2.12 F.5	Implement safety procedures in the classroom and workplace, where appropriate.
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.D.1	Evaluate policies on unauthorized electronic access (e.g., hacking) and disclosure and on dissemination of personal information.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.F.2	Demonstrate a positive work ethic in various settings, including the classroom and during structured learning experiences.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.F.3	Defend the need for intellectual property rights, workers' rights, and workplace safety regulations in the United States and abroad.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.3.12.C.5	Identify transferable skills in career choices and design alternative career plans based on those skills.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.3.12.4	There is a relationship between personal behavior and employability.

Differentiation

Demonstration and hands-on individual performance tests can be utilized. A multimedia presentation of the required safety rules can be posted on the teacher web page or a Moodle page. The safety rule should be posted in the room and machines requiring personal protective equipment should display signage for visual learners. It is suggested that students take an online safety test. The date and time of the test is time-stamped for legal purposes. Students can receive immediate feedback and retake the test until they know all appropriate safety rules. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods

Technology

This curriculum unit could use technology in the following way:
Safety multimedia presentations of all rules can be posted on teachers' web pages or on a Moodle page.

College and Workplace Readiness

The Technology Design Lab II curriculum is designed for students interested in pursuing a career in technology or engineering field. Safety skills are transferable to college level design courses as well as from one occupation to another. Safety skills and knowledge are universal across many fields and workplaces. Throughout this course, safety principles will be incorporated into each activity. Some safety regulations are general and apply to many machines, tools and equipment. These universal safety rules will be able to be applied to most situations using tools and equipment whether it is in an educational or workplace setting.

Unit 2- Tech Design Lab II

Unit Plan

Enduring Understandings

Thoroughly researching and documenting a technological problem leads to a well-developed solution.
To make intelligent decisions about a technology both trade-offs and benefits must be considered.
The designed world consists of seven unique areas of technology.

Essential Questions

How does a person choose the best solution to a given problem?
What factors must be considered when examining trade-offs?
When should a morphological or comparison chart be used to assess alternate solutions?
What are the seven areas of technology?
How can technological products or systems reside within multiple areas?
How does an engineering notebook enhance the design process?
How essential is design documentation in the patent application process?
What are the components of an engineer's notebook?
What methods could be used to timestamp your work?

Unit Goals

Students will be able to create their own engineering notebook documenting their work for a design challenge.
Students will be able to list important components of an engineering notebook.
Students will be able to explain the importance of detailed documentation.

Recommended Duration: 2 weeks

Guiding/ Topical Questions	**Content/ Themes/Skills**	**Resources and Materials**	**Suggested Strategies**	**Suggested Assessments**
How does an engineer's notebook help to develop a solution?	Brainstorming, Research, Analysis, Iterative design,	Internet *"Technology" Textbook by R. Thomas Wright* Notebook	Creation of a sample engineering notebook Moodle blog for students to log their design processes	Students can be assessed on the completion of a sample engineer's notebook
What should be included in an engineer's notebook?	The Design Loop, accuracy, detail,	Examples of engineering notebooks	Multimedia presentation involving the incorporation of the steps of the design loops into documentation	Students will be assessed on the accuracy and completeness of design documentation on all projects through the year
How does design documentation help to protect the designer's work?	Copyrights, trademarks, patents	Internet	Web quest regarding United States Patent Laws Student presentations	Students will be assessed via their web quest

2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.A.4	Create a personalized digital portfolio that contains a résumé, exemplary projects, and activities, which together reflect personal and academic interests, achievements, and career aspirations.
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.F.1	Select and use specialized databases for advanced research to solve real-world problems.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.A.2	Participate in online strategy and planning sessions for course-based, school-based, or outside projects.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.E.5	Compare laws governing the unethical use of media in different countries.

Differentiation

The teacher could differentiate this lesson by interacting with students one-on-one. The teacher could allow for ambitious students to go further with their research. The teacher could also vary the methods of instruction using lecture for auditory learners, multimedia presentations and hand-outs for visual learners. This is further reinforced by the student's doing research and creating their own engineering notebooks to their own levels of ability and quality.

Technology

Technology is easily infused into this unit. There are many opportunities for students to use web quests to investigate the efficiency of documentation and patent law. Additionally, Moodle pages or blogs may be used by students instead of traditional pen and paper in an effort to keep digital engineering notebooks.

College and Workplace Readiness

The teacher could set up the design challenges to provide a realistic job setting focusing on the importance of having a paper trail. This could mean having to think about supplies, managing other people, costs, materials, etc. By providing a realistic challenge, the skills the students develop can be an asset in their careers. By creating interesting scenarios, the students become excited about areas of technology and engineering and begin to see it as a possible career choice.

Unit 3 - Tech Design Lab II

Unit Plan

Enduring Understandings

Thoroughly researching and documenting a technological problem in a portfolio leads to a well-developed solution.

Technological growth is exponential in nature which impacts all individuals, society, politics, the economy, our culture and the environment.

Essential Questions

What resources can be utilized to obtain the information needed for a well developed solution?

What ramifications could there be for unethical or illegal use of copyrights, trademarks, patents, industrial design rights and trade secrets?

What are the legal and ethical considerations in an online world?

How can someone be sure the information located when researching is valid?

Unit Goals

Students will be able to defend their intellectual property rights under United States patent law.

Using multiple sources, students will be able to locate information needed to solve technological problems.

Students will apply all ethical and legal considerations when downloading or using a variety of information in technical research.

Students will differentiate between reliable and inaccurate information on the Internet.

Recommended Duration: 2 weeks

Guiding/ Topical Questions	Content/ Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What resources can be utilized to obtain the information needed for a well-developed solution?	Locating hard to find information from a variety of sources, valid sources for reliable information	Internet, books, maps, magazines, e-zines, newspapers,	Teachers created scavenger hunt about early industry in and around town, county or state	Weight each clue on the scavenger hunt and have each valid answer worth points on the worksheet
What are the legal and ethical considerations in an online world?	Intellectual property rights, copyrights, trademarks, patents, industrial design rights and trade secrets	Multimedia presentations outlining the differences between the different types of intellectual property Hand-out with worksheet	Do now: Thinking outside the box. Brainstorm as many ways as possible to divide "15" in half. Develop a timeline of inventions developed in NJ Discussion on finding inspiration for a new product based on human wants and needs	Participation in the "do now" and brainstorm activities
How can someone be sure the information located when researching is valid?	Wikipedia, research websites, online journals vs. magazines validity of a website	Computer with internet access	Web quest	Rubric from web quest
What ramifications could there be for unethical or illegal use of copyrights, trademarks, patents, industrial design rights and trade secrets?	Legal and financial ramifications of using protected content without permission, how to obtain permission to use protected content, how to tell if something is protected under law, licensing, patents	Internet	Analyze advertisements for ethical and legal use of copyrights, trademarks and other protected content.	Worksheets Article summaries Responses to discussion questions Journal assessments Threaded discussion groups

2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 A.2	Evaluate academic and career skills needed in various career clusters.
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.2.12 E.5	Use comparative shopping techniques for the acquisition of goods and services.
2004	Social Studies	Grades: 9-12	SOC.9-12.6.3.12 H.3.1	Technological growth
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.A.4	Create a personalized digital portfolio that contains a résumé, exemplary projects, and activities, which together reflect personal and academic interests, achievements, and career aspirations.
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.D.2	Demonstrate appropriate use of copyrights as well as fair use and Creative Commons guidelines.
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.E.1	Develop a systematic plan of investigation with peers and experts from other countries to produce an innovative solution to a state, national, or worldwide problem or issue.
2009	Technology	Grades: 9-12	TEC.9-12.	Information accessed through the use of digital tools assists in generating solutions and making decisions.
2004	Technological Literacy	Grades: 9-12	TEC.9-12.8.1.12 A.4	Given a database, define fields, input data from multiple records, produce a report using sort and query, and interpret the data.
2004	Technological Literacy	Grades: 9-12	TEC.9-12.8.2.12 B.3	Develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed design in the solution of a technological problem using hands-on activities.
2004	Technological Literacy	Grades: 9-12	TEC.9-12.8.2.12 C.3	Compare and contrast the effectiveness of various products, systems, and environments associated with technological activities in energy, transportation, manufacturing, and information and communication.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.A.2	Participate in online strategy and planning sessions for course-based, school-based, or outside projects.

Differentiation

This could be a great unit to have students work on in teams and collaborate, and locate valid information from research. Students will be using a multitude of resources from online data to 2D maps and books to locate information in a scavenger hunt. The assignment should be sure to use as many valid resources as possible. It is suggested that student teams be formed by placing students with different multiple intelligences on a team. The scavenger hunt should include information that can't all be located online. Some students should even go home and ask friends and parents as they could be an excellent resource also. By making the scavenger hunt include the history of technology and industry in your town, it also covers that important information.

Technology

Students will use a variety of search engines, including Google, Bing and Blackle to locate information for the scavenger hunt assignment. Using email is another form of locating information. Both of these technologies will be covered in this unit.

College and Workplace Readiness

Understanding how to locate and research valid information is not only a valuable tool in high school but a necessity in college and the workplace. Being able to distinguish between valid and unreliable information is a life skill that all students need to be successful in many of their future endeavors. As a country, we have become very reliant on Google and other search engines. Students need to understand that there are a myriad of ways to locate reliable information and the Internet may not be the only place to find it.

Unit 4 - Tech Design Lab II

Unit Plan

Enduring Understandings

Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century.

Technology has strong connections to all subject areas, especially science and math.

Essential Questions

How do science and math play a role in the various fields of technology?

What impact does technology have on these other areas?

How do the properties of materials impact production processes?

Unit Goals

Students will be able to explain the advantages and disadvantages of Computer Aided Design (CAD) over traditional board drafting.

Students will be able to identify the various menus, toolbars, windows, and work areas of the CAD program.

Students will understand the importance of dimensioning and tolerances.

Students will be able to produce engineering drawings based on 3d models and parts.

Recommended Duration: 3 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What are the advantages of using a CAD based program over traditional board drafting?	Advantages of CAD, Basic board drafting rules	Pro/Desktop, Pro/Engineer, Rhino, AutoCAD, Inventor, or a comparable software Internet *Designing with Pro/Desktop* by John Hutchinson	Multimedia presentation on Computer Aided Design, programs available, and comparison to board drafting	Webquest information regarding computer aided design Hand drawing assignment
Why are accurate dimensions important?	Dimension, ANSI, ISO, Tolerance, Units of Measurement	*Basic Technical Drawing by Spencer, Dygdon, and Novak*	Dimensioning demonstration Multimedia presentations on Dimensioning and Tolerance Standards	Hand drawing assignment Step-by-step CAD drawing CAD design project
How do you create a 3D model using CAD software?	Menus, workspaces, features specific to the program being used.	*Designing with Pro/Desktop* by John Hutchinson	Students use the computer to design and create a digital camera	Project grade for requirements met on hands-on CAD project

2002	Science	Grades: 9-12	SCI.9-12.5.1.12 B.2	Show that experimental results can lead to new questions and further investigations.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.14.d	Relate the changing manufacturing, service, science, and technology industries and educational opportunities to the economy and social dynamics in New Jersey.
2008	Mathematics	Grade 12	MA.12.4.2.12 A	Geometric Properties
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.D.1	Reverse-engineer a product to assist in designing a more eco-friendly version, using an analysis of trends and data about renewable and sustainable materials to guide your work.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.2	Explain how material science impacts the quality of products.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Differentiation

In addition to using multimedia presentations with notes, using web quests may help students who work at different paces.

When it comes to design assignments, the teacher could assign a more challenging assignment to students who progress at a faster pace. For example; if the students are working on a project where they design their own camera and some students need more of a challenge, the teacher can add additional feature requirements like adding texture or writing.

Technology

Students will be designing and creating using computers. They will be using computers in web quests to draw their own conclusions. If the teacher requires a digital engineering notebook, this can be created on Moodle or another blog site.

College and Workplace Readiness

Designing projects to imitate real-life situations aids in workplace readiness.

This unit will help the student become prepared for college and workplace readiness as it sharpens their skills in computer applications. Additionally, students who choose to pursue a trade or a design-based profession will use CAD programs as an integral part of their job. Familiarity with computers and CAD programs will raise the desirability of these students as candidates for job in these related fields.

Unit 5 - Tech Design Lab II

Unit Plan

Enduring Understandings

Technology has strong connections to all subject areas, especially science and math.

Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century.

Essential Questions

What roles do science and math play in the various fields of technology?

What impact does technology have on these other areas?

How could production processes affect your health?

How do the properties of materials impact the production process?

How do jigs, fixtures, and automation influence the efficiency of production systems?

Unit Goals:

Students will be able to differentiate between an alpha and a beta prototype.

Students will be able to select and effectively use a variety of modeling materials.

Students will be able to produce a 3D model.

Students will be able to design and construct a model by correctly and safely using tools, materials, and resources.

Recommended Duration: 3 weeks

Guiding/ Topical Questions	Content/ Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What is a prototype?	Prototype, Model, Scale	*Textbook: Technology by R. Thomas Wright*	Discussion of prototyping Examples of different types of models	Web quest Quiz Worksheet
What are some different types of models?	Alpha, Beta, Proof-of-concept, Presentation model, Functional model, CAD Model,	*Textbook: Technology by R. Thomas Wright*	Students will create a model by hand using materials readily available	Project grade for completed model
Why is a model useful to a client?	Customer Satisfaction, Visualization	Internet	Role play of client-professional interactions Discussion of effective use of models	Participation in role-playing activity Worksheet regarding client interactions
What are some different methods of prototyping?	Rapid Prototyping, CAD/CAM, 3D Printing, Clay, Lynx Method, VEX, Stereo Lithography	*Textbook: Technology by R. Thomas Wright*	Students will create their own prototype using a form of rapid prototyping	Quiz Project grade for prototype made using rapid prototyping

2002	Science	Grades: 9-12	SCI.9-12.5.1.12 B.2	Show that experimental results can lead to new questions and further investigations.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.14.d	Relate the changing manufacturing, service, science, and technology industries and educational opportunities to the economy and social dynamics in New Jersey.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.3.12.C	Economics, Innovation, and Technology
2008	Mathematics	Grade 12	MA.12.4.2.12 A	Geometric Properties
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.D.1	Reverse-engineer a product to assist in designing a more eco-friendly version, using an analysis of trends and data about renewable and sustainable materials to guide your work.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.2	Explain how material science impacts the quality of products.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Differentiation

Differentiation in this unit is possible by allowing the student some choice in the product they choose to prototype. By allowing student to choose something that is interesting to them, the teacher can help guide them and challenge their skill set without overburdening them. Using multimedia presentations, the teacher can provide notes as students request them. The multimedia presentation notes engaging both visual and auditory learners. When the students then work on an activity, we are engaging tactile learners.

Technology

The suggestions in this unit plan already use a lot of technological influences. CAD/CAM utilizes the process of taking a computer model and translating it into a real 3D product. The students are also designing and creating. They should be documenting in an engineering notebook that can be digitized using Moodle or another blog site.

College and Workplace Readiness

Students who wish to go into a field of engineering or a trade will benefit most from this unit as it contains skills for use in their respective trades. Any field which may require design will benefit from this unit as many clients request models in both computer and physical forms.

Unit 6 - Tech Design Lab II

Unit Plan

Enduring Understandings

There are many possible strategies and innovative solutions to a technological problem but there is no such thing as "the correct" answer.

Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century.

Essential Questions

How does an idea evolve into a viable solution?

What are the major steps of the design process?

How do you effectively brainstorm a solution to a technological problem?

How could production processes affect your health?

How do the properties of materials impact the production process?

Unit Goals:

Students will be able to deconstruct a mechanism.

Students will be able to redesign and modify a product through reverse engineering.

Recommended Duration: 3 weeks

Guiding/ Topical Questions	Content/ Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What is reverse engineering?	Reverse Engineering, Systems, Redesign	Internet	Multimedia presentations on Reverse Engineering	Web quest Worksheet on reverse engineering
Why is reverse engineering important?	Replication, Patents, Innovation	Internet, Magazines, e-zines	Discussion on reverse engineering techniques	Quiz
How do you reverse engineer a product?	Tools used Analysis, mechanisms, fastening methods, and production methods.	Pliers, Hammer, Screwdrivers.	Students will disassemble and redesign a product	Project grade on success of reverse engineering and redesign project

2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.14.d	Relate the changing manufacturing, service, science, and technology industries and educational opportunities to the economy and social dynamics in New Jersey.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.3.12.C	Economics, Innovation, and Technology
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.C.1	Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.D.1	Reverse-engineer a product to assist in designing a more eco-friendly version, using an analysis of trends and data about renewable and sustainable materials to guide your work.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.2	Explain how material science impacts the quality of products.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.B.3	Assist in the development of innovative solutions to an onsite problem by incorporating multiple perspectives and applying effective problem-solving strategies during structured learning experiences, service learning, or volunteering.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.D.1	Interpret spoken and written communication within the appropriate cultural context.

Differentiation

Some items might be more difficult to reverse engineer. Students who want more of a challenge could work on more difficult products while students who have difficulties could be create a less intense reverse engineering product.

Examples of reverse engineering projects help visual and tactile learners.

Demonstrations are very effective for auditory and visual learners.

Tactile learning will be enhanced when students disassemble a product.

Technology

To incorporate more technology, students could use the internet to search for patents. They could also search the web, including streaming video on the disassembly of their product. Students could use multimedia presentations to present their findings. Additionally, students can be required to create 3D models of their new redesigned product.

College and Workplace Readiness

Workplace readiness is achieved for students who wish to work in a trade or engineering field because these activities are practiced in the field.

For other students, this unit practices problem solving strategies. Every solution can be innovated and improved upon, exposing students to the practice of creative, higher level thinking.

Unit 7- Tech Design Lab II

Unit Plan

Enduring Understandings

Human factors should be considered when designing products for everyday use.

There are many possible strategies and innovative solutions to a technological problem but there is no such thing as "the correct" answer.

To make intelligent decisions about a technology both trade-offs and benefits must be considered.

Essential Questions

How is anthropometric data used in product design?

How can ergonomics reduce stress on the human body?

Unit Goals

Students will be able to apply ergonomic principles and anthropometric measurements in the design of a product.

Students will be able to describe how anthropometric data changes by age, gender, and demographics.

Students will be able to redesign a product for humans with various modality issues.

Recommended Duration: 3 weeks

Guiding/ Topical Questions	Content/ Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What is the difference between anthropometric data and ergonomics?	Anthropometric data, ergonomic principles, human percentiles, human proportions, median, mean, central tendency	Internet	Teacher developed multimedia presentation	Participation Journal entries
How does anthropometric data differ around the world?	Anthropometric data is based upon continent, gender and age.	Teacher created worksheet that enables them to measure themselves and determine what percentile they fall into. Notebook	Anthropometric worksheet - In teams, record their own measurements to determine percentile Discussion on the importance of designing for specific environments.	Worksheet answers Discussion questions participation
What ergonomic factors should be taken into consideration when designing products to work with the human body? How should products for children be scaled to keep them safe and usable?	Designing for special needs or abilities, human needs vs. human wants, comfort, ease of use, statistical analysis; posture and movement; information input; human output and control; workplace design; environmental conditions	Prismatic Cell Sandal Project handout with specifications Materials for project: cardstock, wonder-foam, white glue, thread Equipment: ruler, sewing needle, paper cutter, hobby knife and cutting mat "Tiny Toys" project handout with specifications Materials: Assorted plastic objects including tubes, ping pong balls, corks, string, rubber bands, glue, screw eyes Equipment: Drill press, hobby knife and cutting mat, scissors, ruler	Apply human factor engineering principles to redesign an existing product i.e. something designed for a left handed person or a person with disabilities Prismatic cell sandal design project Scale down a full size product or a young child based on anthropometric data	Project rubrics Design documentation Engineering notebook Performance based project testing

2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.2.12 D.1	Analyze how character influences work performance.
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.C.1	Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
2004	Technological Literacy	Grades: 9-12	TEC.9-12.8.2.12 A.1	Use appropriate data to discuss the full costs, benefits and trade-offs, and risks related to the use of technologies.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.B.3	Assist in the development of innovative solutions to an onsite problem by incorporating multiple perspectives and applying effective problem-solving strategies during structured learning experiences, service learning, or volunteering.

Differentiation

Differentiation in this unit is possible by allowing the students some choice in the product they choose to redesign or design. By choosing something that is interesting to them, the teacher can help guide the student to something that will be challenging to their skill set without overburdening them. When notes must take place from a multimedia presentation, the teacher can provide notes when students request them. Also, by speaking and showing slides you are engaging both visual and auditory learners. When the students then work on an activity, we are engaging tactile learners.

Technology

The teacher can introduce the unit with a multimedia presentation.

Students will need to utilize the Internet during this unit to calculate percentiles and measurements for the particular worksheets and projects assigned. Because base percentiles vary from continent to continent and by age group and gender, there will be a need to research different anthropometric measurements.

Students can use the data and insert it into an Excel spreadsheet to determine their own percentile of growth.

College and Workplace Readiness

Students who wish to go into a field of engineering or a trade will benefit most from this unit as it contains skills for use in their respective trades. Any field that requiring skills in product design will align to this unit, as many clients require that the product be ergonomic and safe.

During the project, students should be made to keep an inventor's notebook that will keep teams on task and learn time management skills, team building skills and a positive work ethic.

Unit 8 - Tech Design Lab II

Unit Plan

Enduring Understandings

There are many possible strategies and innovative solutions to a technological problem but there is no such thing as "the correct" answer.
Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century.
The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system.

Essential Questions

How could production processes affect your own health?
How do the properties of materials impact the production process?
How do jigs, fixtures, and automation influence the efficiency of production systems?

Unit Goals

Students will be able to identify basic production processes.
Students will be able to create a plan for the reuse of discarded production materials.
Students will be able to develop jigs and fixtures that will increase the efficiency of production workflow.
Students will be able to create a production plan using flowcharts or GANTT charts.

Recommended Duration: 3 weeks

Guiding/ Topical Questions	Content/ Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
During pre-production, how is a jig chosen and developed over a fixture?	Pre-production processes, jigs vs. fixtures, fabrication methods, tooling	*Textbook: Processes of Manufacturing by R. Thomas Wright*	Students will be given a challenge to design and manufacture scroll saw blade organizer A flowchart outlining the production plan will be designed The jigs and fixtures will be designed and produced for each step of the manufacturing process	Manufacturing contest rubric and judging sheet Team design portfolio Work ethic Teamwork and participation Jig and fixture sketches and technical drawings Product drawings Orthographic drawings Pictorial assembly drawings
What factors, both environmentally and structurally, are considered in the development of a product?	Engineering properties of materials, environmental precautions of utilizing materials, safety, mandrel, strength and durability of materials, raw materials (metals, wood, composites, foam, rubber, casting compounds, insulation, glass, fabric, felt, plastics, ceramics, wire mesh, graphite, casting compounds, wire, expanded foam, traditional composites	*Make Magazine: Volume 9, Working with Carbon Fiber*, pages 164-171 *Textbook: Processes of Manufacturing by R. Thomas Wright*	Create a carbon fiber case for an iPod to specs by using wet layup and compression molding (directions for the activity in Make Magazine)	Project rubrics Self and peer evaluations Journal assessments

	(plywood and concrete) vs. high performance (carbon fiber)			
What methods of production are considered the most safe and efficient?	Casting, forming, molding, machining, joining, rapid manufacturing including stereo lithography, selective laser sintering, fused deposition modeling, 3D printing, lamination and laser engineered net shaping, batch production, job production and flow production, just in time manufacturing	www.tutor2u.net/business/production/methods-of-production.htm Materials calculator	Students will be given a challenge to design and manufacture scroll saw blade organizer A flowchart outlining the production plan will be designed	GANTT chart or Flow process chart Facilities/plant layout CAD drawing grade
How is labor calculated into the development of a product?	labor vs. automation, costs associated with human labor (lunch breaks, vacation time, health benefits etc)	www.manicore.com/anglais/documentation_a/slaves.html *Textbook: Processes of Manufacturing by R. Thomas Wright*	Production Line Competition - Divide each class in half and compete in the manufacturing challenge using the jigs, fixtures and production plan. Each team will have 20 minutes to assemble as many scroll saw blade organizers as possible	Bill of materials Cost analysis of production Participation and work ethic Design portfolio Participation and work ethic
Why does tolerance and specifications relate to quality control for consumers?	Measurement, accuracy, inspection, calibrating, meters and gauges, calipers, micrometers, levels and testers	http://www.tecaeast2010.info/files/2010-2011TECAregionalContestManualAll.pdf (pages 12 to 28)	Multimedia presentation followed by practice using devices of measurement During the assembly line competition, at least one member of each team will conduct quality control	Quality control assessment sheet Project rubric judging sheet

2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.a	Communication
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.c	Time management
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.d	Organization
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.e	Decision making
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.f	Goal setting
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.g	Resources allocation
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.i	Safety
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.k	Teamwork
2004	Social Studies	Grades: 9-12	SOC.9-12.6.4.12 H.1.1	Inventions such as the telephone and electric light
2004	Social Studies	Grades: 9-12	SOC.9-12.6.4.12 H.2	Analyze the development of industrialization in America and New Jersey during this period and the resulting transformation of the country, including the construction of the transcontinental railroad, the introduction of mechanized farming, the rise of corporations and organized labor, and the growth of cities.
2004	Social Studies	Grades: 9-12	SOC.9-12.6.4.12 H.4	Describe the economic development by which the United States became a major industrial power in the world and analyze the factors that contributed to industrialization.
2009	Technology	Grades: 9-12	TEC.9-12.8.1.12.C.1	Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.D.1	Reverse-engineer a product to assist in designing a more eco-friendly version, using an analysis of trends and data about renewable and sustainable materials to guide your work.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.2	Explain how material science impacts the quality of products.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.B.3	Assist in the development of innovative solutions to an onsite problem by incorporating multiple perspectives and applying effective problem-solving strategies during structured learning experiences, service learning, or volunteering.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.1	Communication with people from different cultural backgrounds is enhanced by the understanding of different cultural perspectives.

Differentiation

During the in-class manufacturing competition, students will have to use their individual talents and abilities to successfully complete the challenge. Whether it be drawing, designing, brainstorming, building, researching, measuring or calculating, students will be challenged to use their knowledge and unique multiple intelligences. During the assembly line competition, students will select the production job they feel best suited to their interests.

Technology

Students will utilize a variety of technology in this unit. The pre-production plans and orthographic projection will be drawn using CAD software such as ProDesktop, Rhino or AutoCAD. The flow charts or GANTT charts will be completed using a spreadsheet application or with an online template. The material calculator (the link is referenced above) will be helpful when calculating and completing the bill of materials. The teacher can use multimedia presentations to introduce each concept. Teams can collaborate with ideas through Moodle or a wiki. The final presentation is an oral multimedia presentation. The design portfolio or inventor's notebook can be developed using a variety of software programs and submitted on either a CD or jump drive.

College and Workplace Readiness

This unit will provide the opportunity for the students to sharpen their time management skills, team building and collaborative skills as well as their documentation savvy. Students should be able to utilize their personal strengths towards completing a goal. The manufacturing competition requires that all team members be delegated jobs for peak performance. These jobs could lead to a career path in the manufacturing industry or the desire to attend trade school.

Unit 9 - Tech Design Lab II

Unit Plan

Enduring Understandings

As global citizens, humans need to decrease dependency on fossil fuels and work to develop renewable resources.
Technologically literate citizens have an understanding of manufacturing and construction processes in the 21st century.
The designed world consists of seven unique areas of technology that can be used individually or used together to form a system.

Essential Questions

What possibilities exist currently for renewable energy?
How does the constant depletion of fossil fuels affect the environment?
How could production processes affect your own health?
How do the properties of materials affect the production process?
How can technological products or systems reside within multiple areas?

Unit Goals

Students will be able to differentiate between fossil fuels and renewable resources.
Students will be able to discuss and debate current trends in green energy.
Students will be able to design and construct a system powered by a form of renewable energy.

Recommended Duration: 4 weeks

Guiding/ Topical Questions	Content/ Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What are the major differences between renewable energy and energy obtained through fossil fuels?	Fossil Fuels, Renewable energy, Conservation,	Internet	Multimedia presentation on differences between fossil fuels and renewable energy. Include information on current technologies	Web quest Worksheets Quiz
What are some sources of renewable energy?	Geothermal, Hydroelectric, Solar, Wind Turbine	Internet	Discussion on renewable energy resources.	Worksheets Participation in discussion
How does recycling conserve energy?	Conservation, Emissions, Waste management, Greenhouse gases, Recycling, Single-Stream	*"An Inconvenient Truth" Movie*	Discussion of "An Inconvenient Truth." Multimedia presentation on Recycling	Quiz
How do you construct a system that produces energy using renewable resources?	NPN Panels, Electric motors, Turbine, Hydroponic.	Solar power, Wind turbine, Hydroelectric, Hydroponics kits *"Technology" textbook by R. Thomas Wright*	Design and create a system that uses renewable energy. For example, a solar powered car. A water powered lamp.	Project grade on renewable energy assignment

2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.3.b	Relate the wealth of natural resources to the economic development of the United States and to the quality of life of individuals.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.14.d	Relate the changing manufacturing, service, science, and technology industries and educational opportunities to the economy and social dynamics in New Jersey.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.16.a	Evaluate the economic, political, and social impact of new and emerging technologies on individuals and nations.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.3.12.C	Economics, Innovation, and Technology
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.D.1	Reverse-engineer a product to assist in designing a more eco-friendly version, using an analysis of trends and data about renewable and sustainable materials to guide your work.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.2	Explain how material science impacts the quality of products.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Differentiation

Multimedia presentation presentations will appeal to visual/auditory learners. The activities will allow for tactile learners to be engaged.

Students can be paired by the teacher, which could allow for students to work together and for more advanced students to assist less advanced ones.

The renewable energy project can be tailored to the level of ability within a classroom by modifying the requirements.

Technology

Students will be using technology to research renewable energy. Students will complete a web quest.

A quiz can be done online through Moodle or another quiz site.

Students will be using technology to design and create their own renewable energy system.

College and Workplace Readiness

Renewable energy and resource conservation is important in any industry. It is a way for many businesses to save money while remaining eco-friendly. As citizens, students will be interested in reducing their own eco-footprints and reducing their own costs. As government regulation of emissions and resources increases, the information in this unit could be valuable to someone in any field.
Teachers can phrase assignments so that the scenario reflects a real-world experience.

Unit 10 - Tech Design Lab II

Unit Plan

Enduring Understandings

The purpose of graphic communication is to inform, to persuade, and to delight.

The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system.

Essential Questions

How do humans communicate?

What makes one image more enticing to its audience over another?

Unit Goals

Students will be able to design two-dimensional and three dimensional visual representations for a client.

Students will be able to develop a logo and a plan for company branding.

Students will be able to critique visual designs based on aesthetics and composition.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How do the elements and principles of design create an aesthetic result?	Elements of design (Line, space, texture, shape, form, color) and Principles of design (Unity, balance, rhythm, contrast/emphasis, proportion, scale), good design vs. poor design	*Design Through Discovery, by Marjorie Elliott Bevlin, 6th Edition* Hand-out with Design Element Mobile specifications, design documentation booklet and rubric Materials: Solid foam block 2X6X8", fishing line, swivel hook, cool melt glue sticks, tempera or acrylic water based paint Equipment: Hot wire cutter, X-Acto knife, cutting mats, safety glasses/goggles, sandpaper, paint brushes	A multimedia presentation to introduce the unit and concepts Design Element Mobile project	Self and peer evaluations Project rubric Participations and work ethic Design journal documentation

How does color have the power to elicit an emotional response from the viewer?	Color and light, additive and subtractive color, refraction and diffraction, light and pigment, color theory, properties of color, color harmonies, monochromatic, neutrals, analogous, complimentary, color interaction, tonality, the psychology of color	Design Through Discovery, by Marjorie Elliott Bevlin, 6th Edition, ISBN #0030765471 Edible color wheel hand-out Color theory hand-out Materials: White icing, paper plates, food coloring, Nilla wafers or non-iced cupcakes, popsicle sticks or plastic knives	Edible color wheel activity Color worksheets using colored pencils or markers	Color wheel Quizbowl using edible color wheel Participation and work ethic Design journal
What ways can a manufacturer utilize to ensure a product is receptive to the audience and profitable in mass production?	Package design, visual and practical considerations, design in advertising, branding, composition, media advertising, book design, printmaking methods (relief, woodcut, engraving, linocut, intaglio, dry point, etching, aquatint, mezzotint, planography, gravure, lithography, calligraphy, flexography, monography and serigraphy (screen printing)	*Design Through Discovery,* by Marjorie Elliott Bevlin, 6th Edition Materials: riso film, plastic frame, squeegee, popsicle sticks, fabric silkscreen ink, paper, t-shirt Equipment: Thermal imager, computer with any type of design software (Adobe Creative Suite, Google SketchUp, Corel Draw)	Students will design and print their own t-shirt to solve a branding challenge	Project rubric Participations and work ethic Design journal documentation

2002	Mathematics	Grades: 9-12	MA.9-12.4.2.12 A.2	Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).
2008	Language Arts Literacy	Grades: 9-12	LA.9-12.3.1.12.A.1	Interpret and use common textual features (e.g., paragraphs, topic sentence, index, glossary, table of contents) and graphic features, (e.g., charts, maps, diagrams) to comprehend information.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.1	Communication with people from different cultural backgrounds is enhanced by the understanding of different cultural perspectives.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.1	Digital media are 21st-century tools used for local and global communication.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.E.1	Create messages for different purposes and audiences with sensitivity to cultural, gender, and age diversity, using various digital media outlets.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.2	There are ethical and unethical uses of communication and media.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.1	The nature of the 21st-century workplace has shifted, demanding greater individual accountability, productivity, and collaboration.

Differentiation

This unit is geared toward the visual learner. However, the Edible Color Wheel activity is tactile as well as visual. The oral Color Quizbowl is geared toward the auditory learner. If you opt to allow the Design Element Mobile to include a natural element such as branches, leaves or even a recycled product, the natural learner will be addressed. There are a myriad of ways to include and differentiate each project to meet the needs of each learner. The t-shirt branding design could have a musical theme to it. The songs of the new band can be playing during the lab periods.

Technology

This unit is heavy on educational technology and multimedia content. There are numerous resources listed above that can be utilized to introduce the unit as well as enhance each activity. Because of the visual aspect of aesthetics, there are many opportunities to have students use design software to develop a solution (especially to the T-shirt Branding project). The slide presentations cited above could be posted on Moodle or the teacher's OnCourse web page. Additionally, these resources can be used for class presentations.

College and Workplace Readiness

Being able to differentiate between good aesthetic value and poor design of consumer products is a valuable lifelong skill. Many experiences in college require projects and products development. This unit will provide a variety of design experiences that will assist a student in the development of everything from report covers to bulletin boards. Of course, time management skills and proper documentation methods are a large portion of determining the success of a college student.

Unit 11 - Tech Design Lab II

Unit Plan

Enduring Understandings:
Human factors should be considered when designing products for everyday use.
There are many possible solutions to a technological problem but there is no such thing as "the correct" answer.

Essential Questions:
How do humans communicate?
What makes one image more enticing to its audience over another?

Unit Goals:
Students will be able to identify design styles of several periods.
Students will be able to redesign a product that will optimize its function, value, and appearance for the mutual benefit of user and manufacturer.
Students will be able to demonstrate industrial design and engineering aspects occurring simultaneously.

Recommended Duration: 3 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How did the concept of standards, quality and craftsmanship develop?	Medieval guilds, the Industrial Revolution, Arts and Crafts movement, the Bauhaus, characteristics of industrial design, impact of the World Wars on industrial design	Computer with Internet access and a color printer *Design Through Discovery, by Marjorie Elliott Bevlin, 6th Edition*	Introduce the unit with a multimedia presentation Students research design of the time period assigned Timeline of design project Project presentation	Project rubric Participation and work ethic Design journal Presentation rubric
Before investing the necessary funds to design a new product, what types of information should be researched and analyzed?	The design process, materials and techniques, form, efficiency, ergonomics, ease of use, engineering vs. industrial design	*Design Through Discovery, by Marjorie Elliott Bevlin, 6th Edition*	In teams, conduct a market survey on a new product and report to the class on their findings	Participation and work ethic Survey results Presentation rubric Self and peer evaluation

How are all tangible products classified into categories?	Categories of Industrial Design, consumer products, commercial and service equipment, durable goods, transportation design, economic and environmental considerations in product design, form and function, Raymond Loewy (father of industrial design), arts and crafts movement, art nouveau, de Stijl, Bauhaus, Art Deco, late Modernism, Pop, Post-Modernism, Frank Lloyd Wright	*Design Through Discovery, by Marjorie Elliott Bevlin, 6th Edition*	In teams of 3, students will be assigned or select a topic on industrial design such as inventions, inventors, famous industrial designers, social or environmental impacts of design Then each team will present the research in the form of an educational display	"Poster Session" rubric from the TECA-East competition Oral presentation rubric Design Documentation Portfolio

2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.a	Communication
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.c	Time management
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.k	Teamwork
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
2004	Technological Literacy	Grades: 9-12	TEC.9-12.8.2.12 A.1	Use appropriate data to discuss the full costs, benefits and trade-offs, and risks related to the use of technologies.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.B.2	Create and respond to a feedback loop when problem solving.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.B.3	Assist in the development of innovative solutions to an onsite problem by incorporating multiple perspectives and applying effective problem-solving strategies during structured learning experiences, service learning, or volunteering.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.1	Collaboration and teamwork enable individuals or groups to achieve common goals with greater efficiency.
2009	21st Century Life and Careers	Grades: 9-12	WORK.9-12.9.1.12.1	Communication with people from different cultural backgrounds is enhanced by the understanding of different cultural perspectives.

Differentiation

Several of the activities in this unit allow students to select their own topics. This will give them the freedom to select a topic that is interesting and relevant to them. The first project is an online, multimedia time line. Students will be able to present information, sounds and images into their presentation for the audio, visual and word smart learner. The market survey project will allow those students with inter-personal skills to shine as they conduct the survey. The educational research and display allows for students to create a 3D project for the visual and tactile learner.

Technology

From using the Internet for research, to developing and conducting a market survey using online survey tools, this unit has technology integrated throughout. The teacher will use a multimedia presentation to introduce the concept of industrial design and the father of industrial design, Raymond Loewy. Students will use the computer to generate portions of their 3D educational display. A variety of software programs may be utilized including Adobe Creative Suite, Corel Draw and Google Sketch Up. The student presentation of the research project may utilize multimedia as well. It is recommended that each team work collaboratively using a wiki such as GTDTiddlyWiki.com. This type of wiki allows for hyper cards to be generated and printed. It will allow all team members to create and modify checklists.

College and Workplace Readiness

There is a great deal of collaborative teamwork in this unit. Students must coordinate the timeline with each other to create ONE timeline. Working in a team is not only a workplace readiness and college skill but also a life skill. Most students will not have the luxury of selecting their colleagues and superiors so it is an important skill to learn to work with a variety of people. The market survey assignment in this unit will allow students to create a survey, conduct the survey, and analyze and present the results. This will be a skill that will be used repeatedly in college and the workforce. Developing presentations while keeping on task requires time management skills that will be necessary for success in life. Understanding the world of industrial design will enable the students to be good consumers and learn the value of a well-designed product.

Unit 12 - Tech Design Lab II

Unit Plan

Enduring Understandings

Space travel is a vastly unexplored yet blossoming component of technology that has impacted our nation economically and politically.

The designed world consists of seven unique areas of technology that can be studied individually or used together to form a system.

Technology has strong connections to all subject areas, especially science and math.

Essential Questions

How has privatization changed space travel?

How has space exploration expanded since "the race for space" with the possibility of space tourism?

What role does aerodynamics play in space exploration?

What biological effects does space travel have on humans, animals, and plants?

Unit Goals

Students will be able to develop a timeline on the history of space travel.

Students will be able to design and construct a space vehicle or habitat.

Students will be able to create an experiment that will yield measurable data that could enhance life on other planets.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
In the development of aerospace research, how was the V2 rocket a technological triumph?	Wernher von Braun, Nazi Germany, guided ballistic missiles, political and technological impact of rockets, first weapon of mass destruction	Internet	View audio and video clips of the V2 rocket Discuss the impact of this rocket both politically and in the race for space Complete worksheets Develop a historically correct timeline of the race for space	Worksheets Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups on Moodle or a wiki Timeline rubric Self and peer evaluations
What kinds of design considerations would have to be made for housing, communications, manufacturing, transportation, energy, food production and radiation protection to be able to live on Mars?	Similarities and differences of Earth and Mars, habitability, radiation, transportation to Mars, permanent Mars settlement, robot precursors, possible Mars colony sites, economics of the mission to Mars, communication, early human missions, possibility of tourism	Internet	Mars Millennium Challenge - Design a community for 100 earthlings on Mars in 2030 that is an environmentally and safe biosphere	Project rubric Participation and work ethic Design documentation journal
How can using private contractors as a major component of U.S. space ambitions weaken the country's lead in space?	Privatization vs. NASA, principles of model rocketry, model rocket components, STEM (science, technology, engineering and math), payload, nosecone, recovery system, rocket motors, Newton's Laws of Motion, aerodynamics, stability, Model rocket safety code	*Model Rocket Design and Construction, by Timothy S. Van Milligan* *Handbook of Model Rocketry by G. Harry Stine and Bill Stine,*	TARC model rocket contest Rocket safety test Complete the TARC workbook for documentation Psychrometer worksheet	TARC model rocketry rubric Pass safety test with 100% accuracy Accurate completion of TARC workbook Launch log of all flights Participation and work ethic

2002	Science	Grades: 9-12	SCI.9-12.5.2.12 B.2	Discuss significant technological achievements in which science has played an important part as well as technological advances that have contributed directly to the advancement of scientific knowledge.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.3.a	Analyze how technological developments transformed the economy, created international markets, and affected the environment in New Jersey and the nation.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.12.a	Explain the implications and outcomes of the Space Race from the perspectives of the scientific community, the government, and the people.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.1.12.C.16.a	Evaluate the economic, political, and social impact of new and emerging technologies on individuals and nations.
2009	Social Studies	Grades: 9-12	SOC.9-12.6.2.12.C.5.c	Assess the impact of the international arms race, the space race, and nuclear proliferation on international politics from multiple perspectives.
2008	Mathematics	Grade 12	MA.12.4.2.12 A	Geometric Properties
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.a	Communication
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.c	Time management
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.f	Goal setting
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.g	Resources allocation
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.h	Fair and equitable competition
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.i	Safety
2004	Career Education and Consumer, Family, and Life Skills	Grades: 9-12	WORK.9-12.9.1.12 B.4.k	Teamwork
2010	College- and Career-Readiness Standards and K-12 Mathematics	High School Number and Quantity Introduction	MA.9-12.	Calculators, spreadsheets, and computer algebra systems can provide ways for students to become better acquainted with these new number systems and their notation. They can be used to generate data for numerical experiments, to help understand the workings of matrix, vector, and complex number algebra, and to experiment with non-integer exponents.
2010	College- and Career-Readiness Standards and K-12 Mathematics	High School Geometry Introduction	MA.9-12.	An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts-interpreting a schematic drawing, estimating the amount of wood needed to frame a sloping roof, rendering computer graphics, or designing a sewing pattern for the most efficient use of material.
2010	College- and Career-Readiness Standards and K-12 Mathematics	High School Statistics and Probability Introduction	MA.9-12.	Data are gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns. Quantitative data can be described in terms of key characteristics: measures of shape, center, and spread. The shape of a data distribution might be described as symmetric, skewed, flat, or bell shaped, and it might be summarized by a statistic measuring center (such as mean or median) and a statistic measuring spread (such as standard deviation or interquartile range). Different distributions can be compared numerically using these statistics or compared visually using plots. Knowledge of center and spread are not enough to describe a distribution. Which statistics to compare, which plots to use, and what the results of a comparison might mean, depend on the question to be investigated and the real-life actions to be taken.
2004	Social Studies	Grades: 9-12	SOC.9-12.6.3.12 H.3.1	Technological growth
2004	Social Studies	Grades: 9-12	SOC.9-12.6.4.12 H.4	Describe the economic development by which the United States became a major industrial power in the world and analyze the factors that contributed to industrialization.
2004	Social Studies	Grades: 9-12	SOC.9-12.6.6.12 E.8	Delineate and evaluate the environmental impact of technological change in human history (e.g., printing press, electricity and electronics, automobiles, computer, and medical technology).
2002	Mathematics	Grades: 9-12	MA.9-12.4.2.12 A.2	Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.2	Explain how material science impacts the quality of products.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
2009	Technology	Grades: 9-12	TEC.9-12.	The designed world is the product of a design process that provides the means to convert resources into products and systems.
2009	Technology	Grades: 9-12	TEC.9-12.8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.
2009	Science	Grades: 9-12	SCI.9-12.5.1.12.B.2	Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.

Differentiation

Since this is a STEM (Science, Technology, Engineering and Math) based unit, there are many different learners addressed by each activity. This unit offers multi-modality teaching for all learning styles. Multimedia, including presentations and video clips, are utilized to show the historical significance of the race for space enhances visual and audio learning. Learners will record and analyzing data from the launch logs. They will also calculate the trajectory of the rocket. Students will learn about nature and the environment as they learn about the habitat differences and similarities between Earth and Mars. Model rocket construction will enhance tactile learning. Working as a TARC team will allow students build skill for collaboration and cooperation.

Technology

This unit is filled with possibilities for the use of educational technology. From teacher multimedia media and video clips to utilization of 3D software, such as ProDesktop, Google SketchUp or Pro-Engineer to design a human habitat for a community of 100 earthlings on Mars, this unit integrates technology. The student handbook can be downloaded and printed or completed online in a portfolio. The Team America Rocketry Challenge (TARC) has a variety of resources online as well. NASA for Educators web site is wealth of information for a teacher new to rocketry. There are also a variety of freeware rocket simulators that can be downloaded and used.

College and Workplace Readiness

One of the goals of the Team America Rocketry Challenge is to promote interest in science and aerospace careers. There is a great deal of collaboration needed to build a Mars habitat or a model rocket for a competition. Time management skills and project planning are needed for success. The delegation of the workload will be critical. Students preparing for college or the workforce must be able to work as a team. Utilizing computers to research, compile and analyze data is also a skill that will be utilized in college or the workforce.