An Introduction to Engineering Design with SolidWorks Course Syllabus			
Course Name		**3-D Computer Design**	
Course Number			
Course Meeting Time Lecture/Laboratory Schedule		**Muscle Shoals Center for Technology**	
Course Location		**Mrs. Perkins**	
Course Credits			

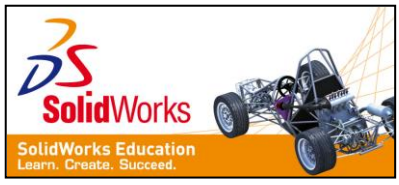
Course Description: (Maybe replaced with description from institution course catalog) An Introduction to Engineering Design with SolidWorks introduces students to the engineering design process utilizing 3D Computer Aided Design (CAD) software applications. Emphasis on 3D Skills and relevant applications in engineering principles, technology, mathematics and science is explored through a series of lessons, competency based exercises and team projects. Learning 3D design skills is an interactive process applied with the Engineering Design Process, a series of iterative steps to solve a problem. The Engineering Design Process is utilized to develop products across a variety of industries: Consumer, Process, Power, Civil, Agriculture, Electronics/Communications, Furniture and Fixtures, Machinery/Construction, Medical and Scientific, Sheet Metal, Mold, Tool and Die, Aerospace, Automotive and Transportation.

Prerequisites: Windows Literacy, Basic mathematics

Textbooks and other required materials: An Introduction to Engineering Design with SolidWorks, Student Guide

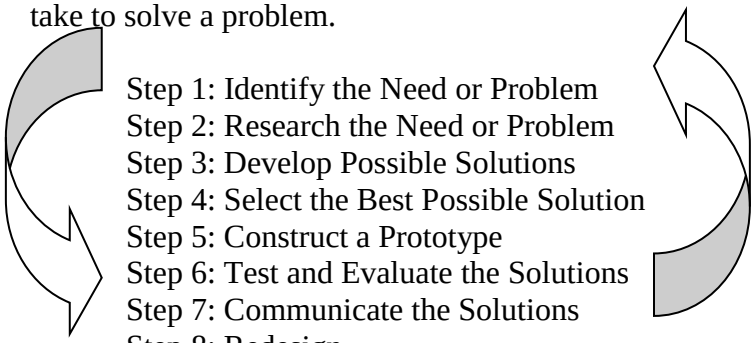
Course Objectives: Students will demonstrate their knowledge of the material covered in Introduction to Engineering Design with SolidWorks through their mastery of the following course objectives:

- Obtain the basic competencies of 3D modeling as it relates to applications of the engineering design process
- Develop the problem-solving skills utilized to create and modify a product and apply the iteration process to optimize a solution
- Acquire basic industry skill sets in 3D CAD and related manufacturing processes to recognize how products work and how products are manufactured
- Develop relevant examples of applying engineering principles, technology, mathematics and science in a real world environment with creative methods



- Attain life long learning skills through the development of multi-disciplinary teams for design projects, oral and written presentations that incorporate technology, and an understanding of different careers in engineering, mathematics and science that require solving problems in a 3D world.

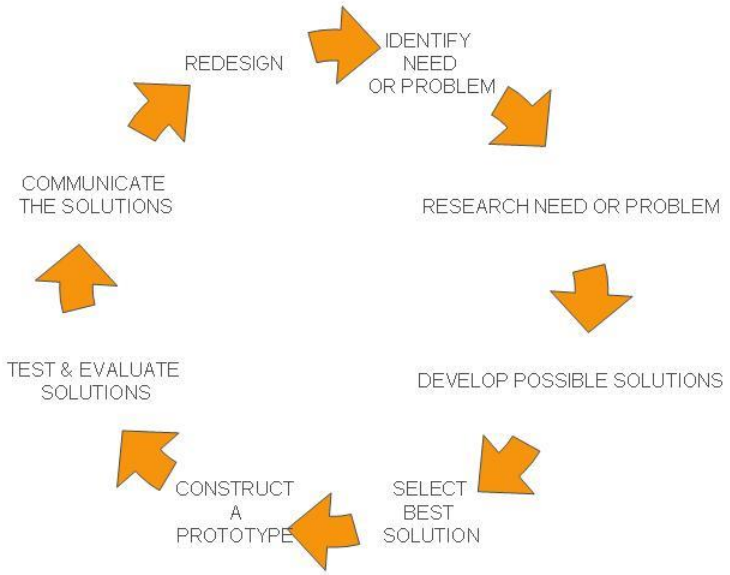
Engineering Design Process(1) is a series of iterative steps that engineers and designers take to solve a problem.



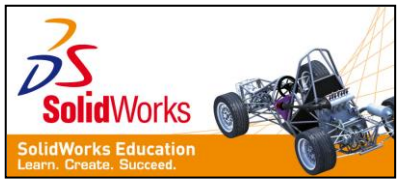
Step 1: Identify the Need or Problem
Step 2: Research the Need or Problem
Step 3: Develop Possible Solutions
Step 4: Select the Best Possible Solution
Step 5: Construct a Prototype
Step 6: Test and Evaluate the Solutions
Step 7: Communicate the Solutions
Step 8: Redesign

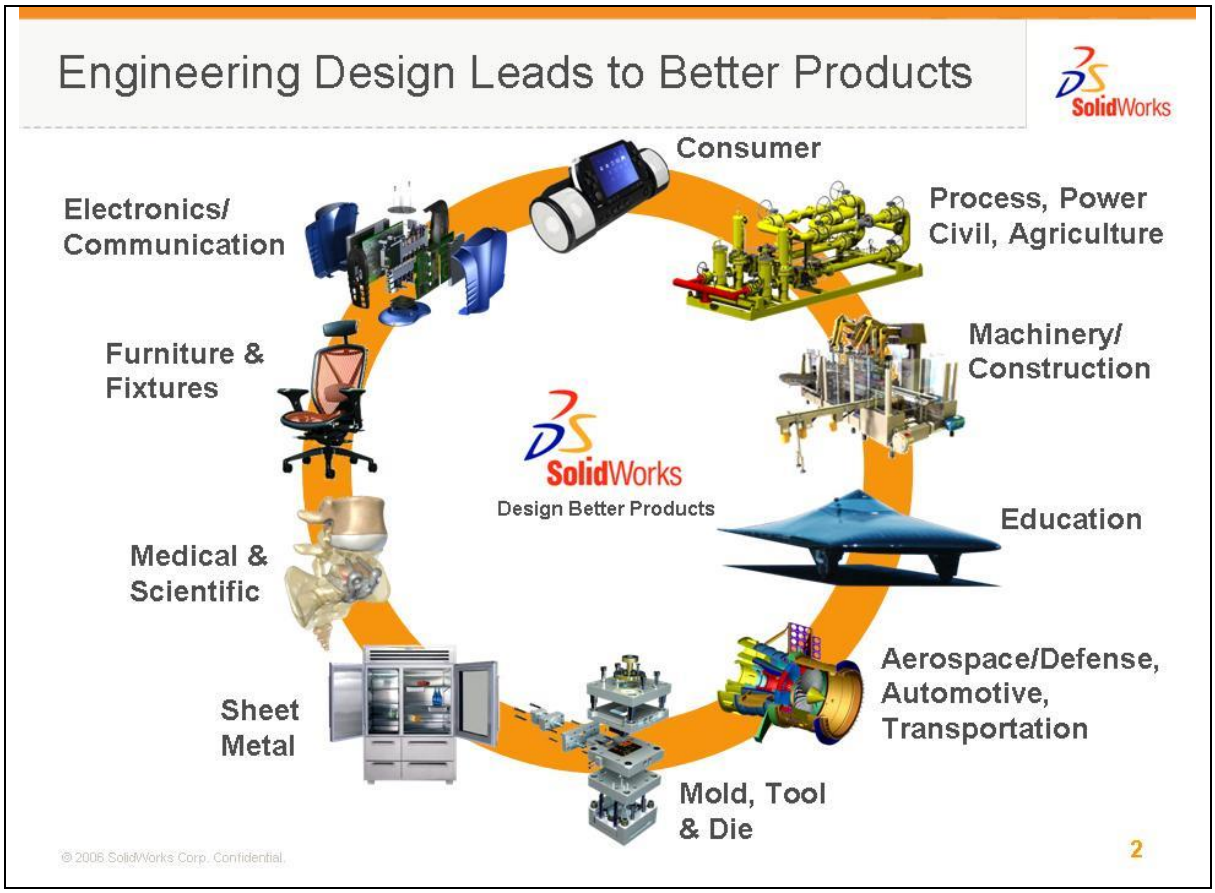
(1) The Engineering Design Process is described in many terms. These steps reference the Massachusetts Department of Education, Technology/Engineering Curriculum Frameworks, Spring 2001.

ENGINEERING DESIGN PROCESS



Reference: Massachusetts Departments of Education, Technology/Engineering Curriculum Frameworks – Spring 2001




Engineering Design Leads to Better Products
SolidWorks
Consumer
Process, Power
Civil, Agriculture
Machinery/
Construction
Education
Aerospace/Defense,
Automotive,
Transportation
Mold, Tool
& Die
Sheet
Metal
Medical &
Scientific
Furniture &
Fixtures
Electronics/
Communication
SolidWorks
Design Better Products
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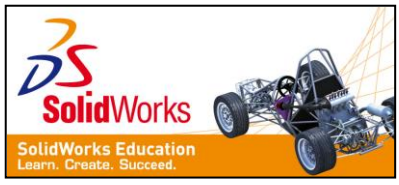
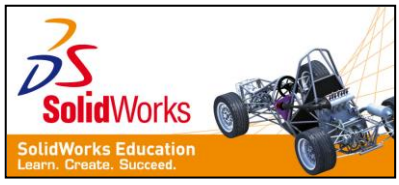

SolidWorks
SolidWorks Education
Learn. Create. Succeed.

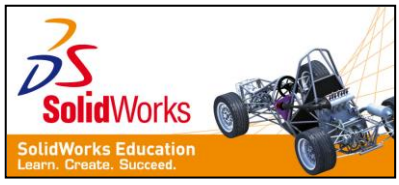
Contributions of course to meeting the professional component: In this course, students begin to develop their skills in the application of mathematics and basic sciences to engineering problems that involve the design process. The course assignments provide the opportunity for the students to practice engineering science related to the concepts of 3D modeling and design and to develop solutions to engineering problems through the application of engineering design principles.

Professional Criteria (ABET)	**Contribution**	**Discussion**
Math, science, engineering	Major	Apply principles of mathematics, science and engineering to understand the design process
Design, conduct experiments	Major	Design, build and test simple models such as a Switch Plate or CD Storage Box
Design system, component process	Major	Incorporate multiple components, library components to develop assemblies and manufacturing drawings
Multi-disciplinary teams	minor	Demonstrate ability to function as a design team. Additional exercises allow students to work together in a team.
Engineering problems	Major	Identify, formulate and solve engineering problems associated with the design of a product.
Professional, ethics	minor	Identify ethical issues associated with engineering solutions to product design processes
Communicate, written and oral	minor	Demonstrate effective solution procedures to communicate solutions to engineering problems such a eDrawings, web pages and oral presentations
Impact on engineering	minor	Write an report on the impact of engineering design for a product utilizing modern design techniques used in product design and manufacturing
Life long learning	Major	Demonstrate effective use of the internet, multiple file formats, electronic communication methods to expand information on the design process
Contemporary issues	minor	Write an essay on how the average students is affected by product design everyday
Skills, techniques and modern tools	Major	Apply SolidWorks software, Windows application and the Internet to solve engineering design problems

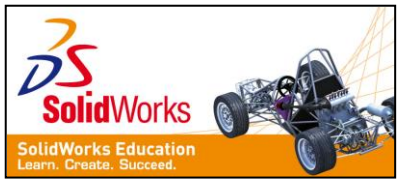


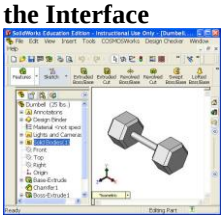
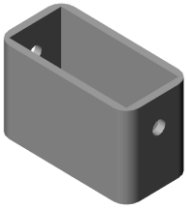
Assessment: Grading is based on lessons completed, projects competed, team work, written and oral reports, and lesson quizzes.

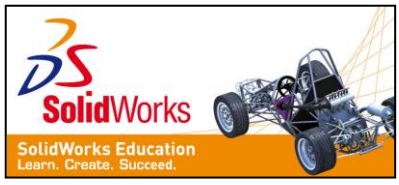
Project Assessment Rubric				
Student Name:		**Date:**		
Project Title				
	Excellent	**Satisfactory**	**Below Average**	**Comments**
Overall Process	Student(s) clearly understands the engineering design process and works	Student(s) somewhat understands the engineering design process	Student(s) needs assistance understanding the engineering design process	
Identify the Need or Problem	Student(s) properly generates questions and clearly identifies the need	Student(s) generate some questions and identifies some need	Student(s) requires prompts to generate questions and to identify the need	
Research the Need or Problem	Information is obtained from multiple electronic and non-electronic sources and referenced properly	Information is obtained from multiple electronic and non-electronic sources	Information is obtained from multiple electronic or non-electronic sources	
Develop Possible Solutions	Multiple solutions are presented, well organized and detailed	One other solution is are presented well organized	Alternative solutions are not presented or not organized	
Select Best Possible Solution	Logical sequencing of events concludes this is the best design solution	Some events suggest this product to be the solution	Minimal documents is presented to support the solution	
Construct Prototype (3D Model)	Prototype 3D model is well designed with no errors. Supporting 2D drawings are detailed according to an engineering standard. Model is completed on time.	Prototype 3D model is designed with few errors. Supporting 2D drawings are detailed somewhat according to an engineering standard. Model is completed on time.	Prototype 3D model is designed with many errors. Supporting 2D drawings are detailed not according to an engineering standard. Model is not completed on time.	

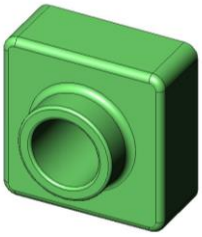


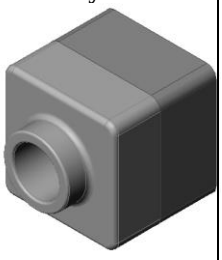
Optional: Construct Prototype (Build)	Prototype displays a clear vision of the final product and is completed on time.	Prototype displays a somewhat clear vision of the final product and is completed on time.	Prototype displays a somewhat clear vision of the final product and is not completed on time.	
Test & Evaluate the Solution	Student(s) illustrate different configurations of the prototype by changing a variety of parameters	Student(s) illustrate different configurations of the prototype by changing a one or two parameters	Student(s) illustrate one different configurations of the prototype	
Communicate the Solution	Oral and written presentations are well formatted with clear, concise and correct language. Student(s) utilize other three different media such as eDrawings, animations, 3DInstant Web Page and Photorealistic images to demonstrate product in a marketing situation	Oral and written presentations are formatted with clear, concise and correct language. Student(s) utilize two different media to demonstrate product in a marketing situation	Oral and written presentations are formatted with incorrect language. Student(s) utilize one other media to demonstrate product in a marketing situation	
Redesign the product	Student(s) show multiple options to improve the product	Student(s) show one option to improve the product	Students show no options to improve the product	

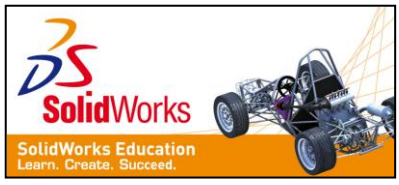


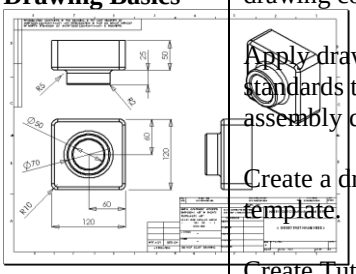
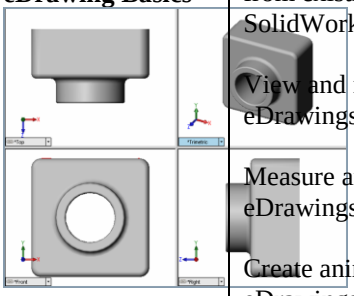
Tentative Topics Covered				
Week	**Lesson**	**Outcomes for students**	**Assessment**	**Competencies**
1	**Lesson 1: Using the Interface** 	Become familiar with Microsoft Windows Become familiar with the SolidWorks user interface	5 minute assessment Vocabulary worksheet	Engineering: Introduction to an engineering design industry software application Technology: Understand File management, search, copy, save, starting and exiting programs
2	**Lesson 2: Basic Functionality** 	Develop an understanding of 3D modeling and recognition of an object in 3D space Apply 2D sketch geometry, rectangle, circle, and dimensions Understand 3D features that add and remove geometry including Extrude Base, Extrude Cut, Fillet and Shell Complete the Box part	5 minute assessment Vocabulary worksheet Additional Exercises: Design a Switch Plate Optional Material for build projects: Switch Plate: Cardboard, construction paper or foam board 120mmx80mm for each student, tape or glue, cutting tools, ruler Box: For milled wood 100mmx60mmx50mm for each box. (Note: Cardboard sheets and tape can also be used)	Engineering: Develop a 3D part based on a selected plane, dimensions and features. Apply the design process to develop the box or switch plate out of cardboard or other material. Develop manual sketching techniques by drawing the switch plate Technology: Apply a windows based graphical user interface Math: Understand units of measurement, adding and subtracting material, perpendicularity, x-y-z coordinate system

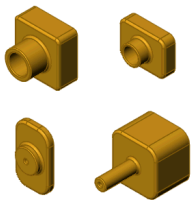


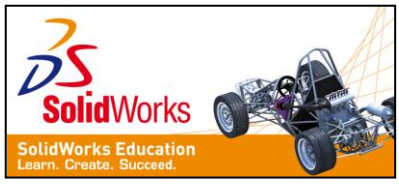
3	**Lesson 3: The 40-Minute Running Start** 	Reinforce the understanding of 3D features that add and remove geometry Apply 2D sketch geometry, rectangle, circle, and dimensions Create the Tutor1 part	5 minute assessment Vocabulary worksheet Unit conversion worksheet Material volume assessment Lesson Quiz Additional Exercises: CD Jewel Case and Storage Box parts. Optional Materials for build projects: CD Case: Cardboard or foam board, tape, wood (mill or precut pieces required) 29mmx17mmx18mm for each box. CD Jewel Case to measure, ruler	Engineering: Utilize 3D features to create a 3D part. Create a pencil sketch of a profile for chalk and an eraser Technology: Work with a common music/software case and determine the size of a CD container Math: Apply Concentric relations (same center) between circles. Understand conversion from millimeters to inches in an applied project. Apply width, height and depth to a right prism (box) Science: Apply volume of a right prism (box)

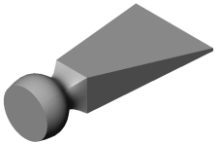
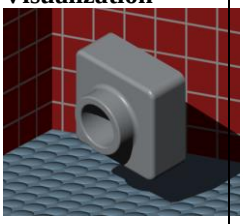
4	**Lesson 4: Assembly Basic** 	Develop an understanding of 3D assembly modeling by combining Tutor1 part with Tutor2 part Apply 2D sketch tools to offset geometry and project geometry to the sketch plane Create Tutor2 part Create Tutor assembly	5 minute assessment Vocabulary worksheet Lesson Quiz Review of fasteners selection Additional Exercises: Design a CD Jewel Case and Storage Box assembly and Claw Mechanism assembly Optional Materials for build projects: Screws for Switch Plate part, 3.5mm diameter or based on hole diameter. A variety of fasteners to discuss design and manufacturing parameters for a product	Engineering: Evaluate the current design; incorporate design changes that result in an improved product. Review fastener selection based on strength, cost, material, appearance and ease of assembly during installation. Technology: Review different materials, safety in design of a Switch Plate assembly Math: Apply angular measurements, axis, parallel, concentric and coincident faces, and linear patterns Science: Develop a volume from a profile revolved around an axis.
5	**Lesson 5: Toolbox Basics** 	Develop an understanding of SolidWorks Toolbox, a component library of standard parts Understand how library components are utilized in an assembly Modify Toolbox part definitions and create new parts for the Toolbox library	5 minute assessment Vocabulary worksheet Lesson Quiz Review different types of bolts and screws Assemble a standard Toolbox pan head screw to the Switch Plate Additional Exercises: Bearing Block Assembly Optional Material for build projects: Variety of fasteners. For Switch Plate, #6-32 Pan Head	Engineering: Select fasteners automatically based on hole diameter and depth. Utilize fastener vocabulary such as thread length, screw size and diameter Technology: Utilize the Toolbox Browser and display of thread style Math: Relate diameter of screw to screw size. Science: Explore fasteners create from different materials

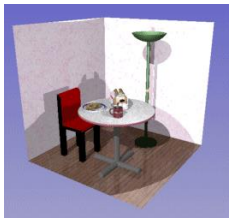
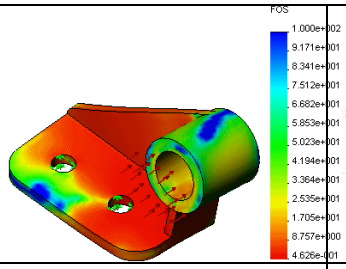
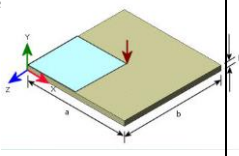
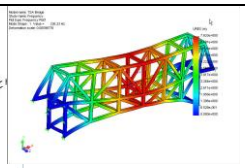


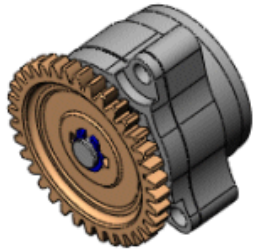
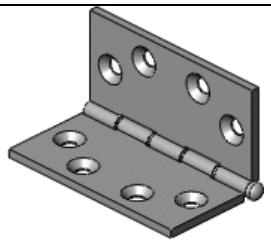
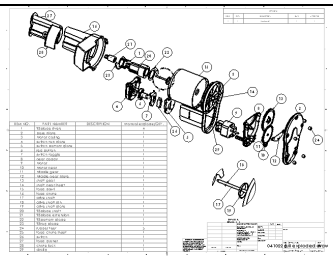
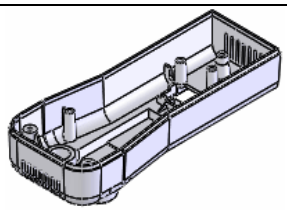
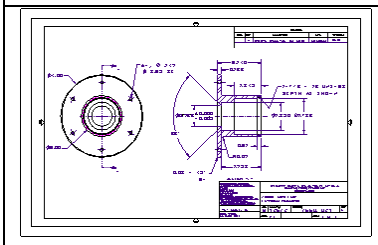
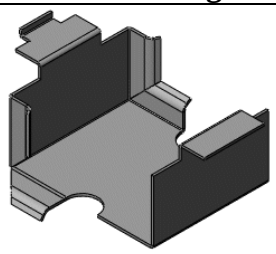
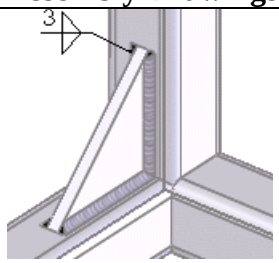
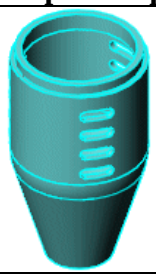
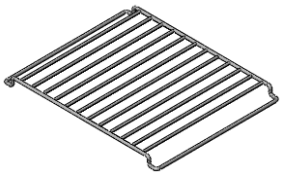
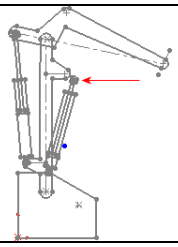
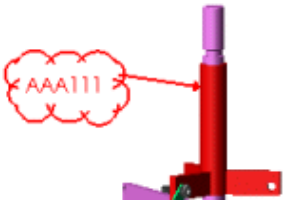
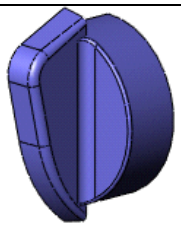
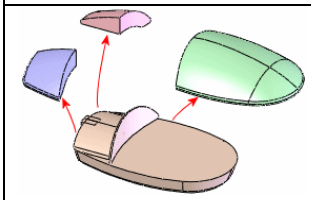
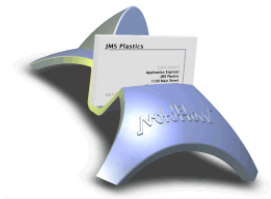
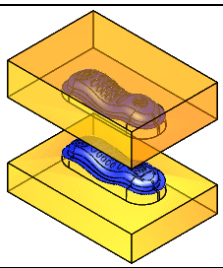
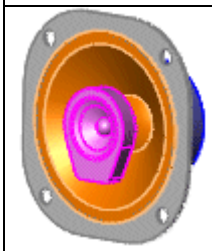
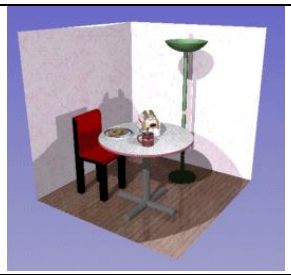
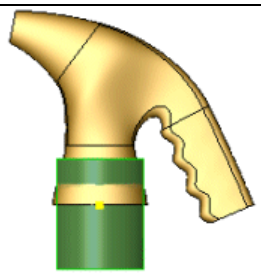
6	**Lesson 6: Drawing Basics** 	Understand basic drawing concepts Apply drawing standards to part and assembly drawings Create a drawing template. Create Tutor1 drawing for part and assembly.	5 minute assessment Vocabulary worksheet Lesson Quiz Additional Exercises: Create Tutor2 drawing. Create CD Storage Box assembly drawing. Create Switch Plate drawing	Engineering: Apply engineering drawing standards to part and assembly drawings. Apply concepts of Orthographic projection to 2D standard views and Isometric views. Technology: Explore associatively between different, but related file formats that change during the design process. Math: Explore how numeric values describe over all size and features of a part.
7	**Lesson 7: eDrawing Basics** 	Create eDrawings from existing SolidWorks files View and manipulate eDrawings Measure and markup eDrawings Create animations of eDrawings to display multiple views	5 minute assessment Vocabulary worksheet Lesson Quiz Additional Exercises: Email eDrawing Create eDrawing of different file formats.	Engineering: Mark up engineering drawings utilizing eDrawing comments. Understand how to communicate with manufacturing vendors. Technology: Work with different file formats including animations. Understand attachments for email.

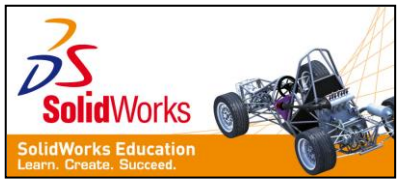
8	**Lesson 8: Design Tables** 	Develop a Design Table with Microsoft EXCEL to create families of parts Explore how values in an EXCEL spreadsheet automatically change dimensions and features of an existing part to create multiple parts of different sizes and shapes	5 minute assessment Vocabulary worksheet Lesson Quiz Additional Exercises: Create a Design Table for Tutor2, modify dimensions to create different configurations Create a Design Table for the Tutor assembly, modify dimensions to create different configurations Optional Materials: Cups, Beakers in different size and a ruler	Engineering: Explore family of parts with a Design Table. Understand how design intent can be built into a part to allow for changes Technology: Link an EXCEL spreadsheet with a part or an assembly and how they relate a manufactured component. Math: Work with numerical values to change overall size and shape of a part and assembly. Develop width, height and depth values to determine volume of the CD Storage box modifications.
9	**Lesson 9: Revolve and Sweep Features** 	Understand 3D features that add and remove geometry including Revolve and Sweep Explore Sketch tools such as ellipse, trim and centerline Create the Candlestick part	5 minute assessment Vocabulary worksheet Lesson Quiz Additional Exercises: Design a Candlestick Part, Cup Part. Optional Materials: Cup, Beaker, Candle and Ruler.	Engineering: Explore different modeling techniques that are utilized for parts molded or machined in a lathe process. Modify the design to accept a candle of different sizes. Technology: Explore the difference in plastic design for cups and travel mugs Math: Axis and a profile a revolution to create a solid, 2D ellipse, and arcs Science: Volume and unit conversion for a container

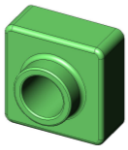
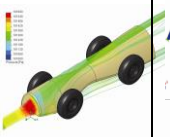
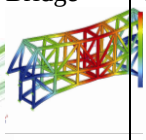


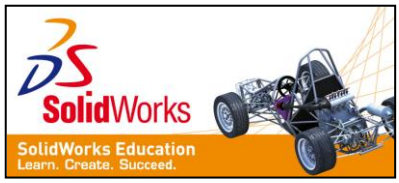
10	**Lesson 10: Loft Features** 	Understand the 3D Loft feature created from multiple profiles sketched on different planes Create the Chisel Part	5 minute assessment Vocabulary worksheet Lesson Quiz Additional Exercises: Create the Bottle Part Create a Screwdriver Design a Sports Bottle Optional Materials: Screwdriver and Simply Bottle	Engineering: Explore different design changes to modify the function of a product Technology: Knowledge of how thin wall plastic parts are developed from lofts Math: Understand tangency effects on surfaces Science: Estimate volume for different containers
11	**Lesson 11: Visualization** 	Understand how to apply materials, scenes and lights to create a photorealistic images in jpeg format Create an exploded view and develop an animation in .avi format	5 minute assessment Vocabulary worksheet Lesson Quiz Additional Exercises: Create a PhotoWorks rendering of Tutor1, Tutor2 and Tutor assembly Create Nested Slides assembly animation Optional Materials: Digital photographs and images	Engineering: Enhance a product market appeal with visualization and animation Technology: Work with different file formats to enhance presentation skills
Note: The time for weekly lessons is approximate, based on three-45minute class periods per week. Additional lessons are provided to encourage independent learning, imagination and problem solving skills. Instructors should also utilize Week 1 to set up folders for students, manage accounts and the student login process.				

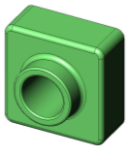
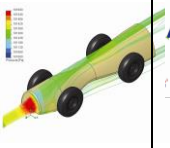
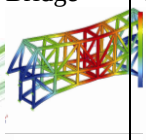
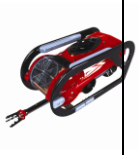
Additional Tutorials			
SolidWorks Tutorials, COSMOS Tutorials, Physics Verification Examples and Design Projects develop additional modeling and engineering design skill with real world components. COSMOS Tutorials and Verification examples develop engineering, math and science competencies. Design projects explore the engineering design process with an additional build component.			
			
Additional SolidWorks Tutorials Applications	**Additional COSMOS Tutorials Applications**	**COSMOS Verification Examples of Classic Physics and Engineering Theory**	**Design Projects**

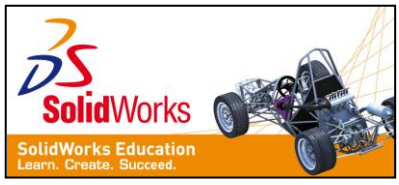
SolidWorks Tutorials			
			
Animation	**Advanced Design**	**Assembly Drawings**	**Import/Export**
			
Import AutoCAD	**Sheet Metal**	**Weldments**	**Patterns**
			
3D Sketching	**Blocks in an Assembly**	**eDrawings**	**Fillets**
			
Plastic Molded Parts	**Moldflow Xpress**	**Core/Cavity Molded Parts**	**Multibody Parts**
			
PDM Works	**Photo Realistic Imaging**	**Photo Realistic Imaging**	**Surfaces**



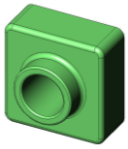
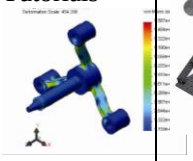
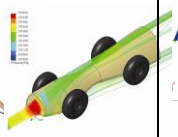
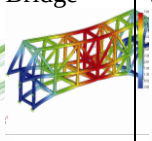
Key x: direct hands-on design activity w: indirect web-based activity i: independent design activity		PROJECTS					
		SolidWorks Tutorial  ls	COSMOS Tutorials 	Trebuchet 	CO2 Car 	Bridge 	Seabotix 
Nature of Technology							
1	Students will develop an understanding and scope of technology.	x	x	x	x	x	x
2	Students will develop an understanding of the core concepts of technology.	x	x	x	x	x	x
3	Students will develop an understanding of the relationships among technologies and the connection between technology and other fields of study.	w	w	w	w	w	w

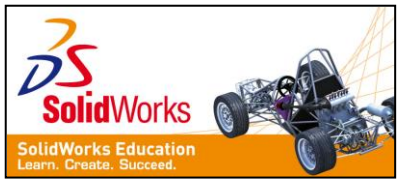


Key x: direct hands-on design activity w: indirect web-based activity i: independent design activity		PROJECTS					
		SolidWorks Tutorial 	COSMOS Tutorials 	Trebuchet 	CO2 Car 	Bridge 	Seabotix 
ITEA Standard							
Technology and Society							
4	Students will develop an understanding of the cultural, social, economic and political effects of technology.	w	w	w	w	w	w
5	Students will develop an understanding of the effects of technology on the environment.	w	w	w	w	w	w
6	Students will develop an understanding of the role of society in the development and use of technology.	w	w	w	w	w	w

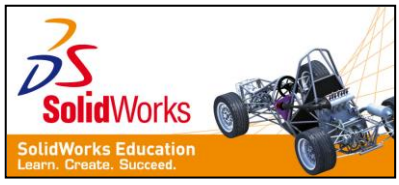


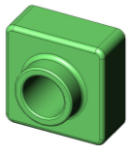
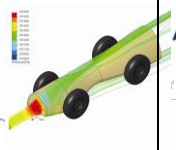
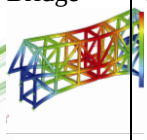
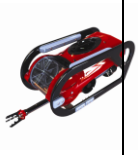
7	Students will develop an understanding of the influence of technology on history.	w	w	w	w	w	w

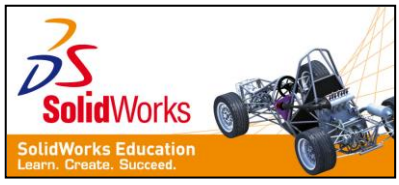
Key x: direct hands-on design activity w: indirect web-based research activity i: independent design activity		PROJECTS					
		SolidWorks Tutorial 	COSMOS Tutorials 	Trebuchet 	CO2 Car 	Bridge 	Seabotix 
ITEA Standard							
Design							
8	Students will develop an understanding of the attributes of design.	x	x	x	x	x	x
9	Students will develop an understanding of engineering design.	x	x	x	x	x	x



10	Students will develop an understanding of the role troubleshooting, research and development, invention and innovation and experimentation in problem solving.	x	x	x	x	x	x



Key x: direct hands-on design activity w: indirect web-based activity i: independent design activity		PROJECTS					
		SolidWorks Tutorial 	COSMOS Tutorials 	Trebuchet 	CO2 Car 	Bridge 	Seabotix 
ITEA Standard							
Abilities for a Technological World							
11	Students will develop the abilities to apply the design process.	x	x	x	x	x	x
12	Students will develop the abilities to use and maintain technological products and systems.	x	x	x	x	x	x
13	Students will develop the abilities to assess the impact of products and systems.	w	w	w	w	w	w



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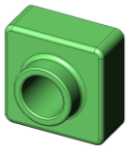
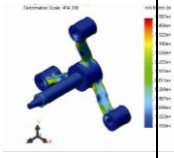
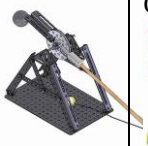
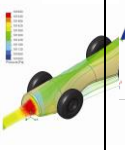
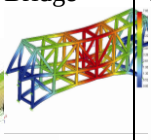
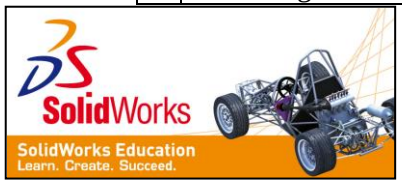
		SolidWorks Tutorial 	COSMOS Tutorials 	Trebuchet 	CO2 Car 	Bridge 	Seabotix 
ITEA Standard							
The Designed World							
14	Students will develop an understanding of and be able to select and use medical technologies.	i	i	i	i	i	i
15	Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.	i	i	i	i	i	i
16	Students will develop an understanding of and be able to select and use energy and power technologies.	i	i	i	i	i	i
17	Students will develop an understanding of and be able to select and use information and communication technologies	i	i	i	i	i	i
18	Students will develop an understanding of and be able to select and use transportation technologies.	i	i	i	i	i	i



19	Students will develop an understanding of and be able to select and use manufacturing technologies.	i	i	i	i	i	i
20	Students will develop an understanding of and be able to select and use construction technologies.	i	i	i	i	i	i