

SHORE REGIONAL HIGH SCHOOL DISTRICT

A Regional Collaborative of the Communities Served by the Monmouth Beach, Oceanport, Shore Regional, and West Long Branch School Districts

Aligned to the New Jersey Student Learning Standards as Applicable

Course Title: Technical Drawing

Content Area: Technology/Industrial Arts

Grade Level(s): 9-12

Course Description: This course is a one year, five-credit course designed for students who may be considering post-secondary training in the areas of engineering or architecture. The course is focused on the introduction, concepts, and use of the autocad program used in the fields of engineering and architecture for structural systems and in the construction trades. This course will provide an understanding of design methods and basic drawing fundamentals, using the autocad program. The students will prepare working drawings including engineering product designs, floor plans, foundation plans, basic roof plans, wall sections, and elevation drawings using computer-assisted design (CAD) methods. The students learn by developing plans and constructing models/prototypes. This course will increase the students' awareness of construction and design. Students will be able to communicate design ideas in an understandable, efficient, and accurate manner. The classroom being used for this course is evolving into a fully functioning CAD lab. The latest version of software has been installed on 25 computer workstations that were put in place specifically to support the CAD software being used in the program. While the goals established are relevant to any drafting or CAD curriculum, the computer program being used in the course is Autodesk Autocad Architectural and Engineering. The lab also has a plotter, color printer, and a 3D printer for student use.

Curriculum Writer(s): Gregg Malfa

Date Created: December 2017

Date Approved by Board of Education: April 2018

Pacing Guide

Unit 1	(3-4 weeks)
Unit 2	(4-5 weeks)
Unit 3	(4-5 weeks)
Unit 4	(4-5 weeks)
Unit 5	(4-5 weeks)

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Unit 6 Unit 7	(4-5 weeks)
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Unit 1 Self-management and Teamwork

Unit Summary:

Self-management is a key to efficient productivity, preventing accidents, and ensuring accuracy of assigned projects. Collaborating is also an important skill for life and the workplace.

Interdisciplinary Connections/Content Area Integrations Including Technology:

All students will use digital media, computers, and autocad software to access, manage, evaluate, and synthesize information in order to solve problems individually, collaborate, and create and communicate knowledge. Printers, plotters, 3D printers, and overhead projectors will also be used by students.

Summative Assessments:

- Portfolios, Self and Peer Assessment
- Performance Assessment
- Midterm/Final Exam
- Projects
- Rubric Assessment

Formative Assessments:

- Oral Presentations
- Observations (Peer and Teacher)
- Participatory Rubrics

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- Student Drawing Projects

Enduring Understandings:

- Self-management is a key to efficient productivity, preventing accidents, and ensuring accuracy of assigned projects. Collaborating is also an important skill for life and the workplace.

Essential Questions:

- What are some organizational skills?
- How are organizational skills beneficial to an employee/employer relationship?
- Why is time management important?

Instructional Outcomes:

- Students will be able to properly save and open documents located in the student online folder.
- Students will be able to recognize the importance of time management in relation to daily classwork, participation, and project deadlines.
- Students will be able to recognize the importance of having an organized portfolio/file folder on the computer desktop.

Suggested Learning Activities:

- Students will follow criteria guidelines for acceptable levels of performance.
- Teacher to demonstrate tool and equipment operation via video of equipment features (overhead projector). Students to mimic use.
- Teacher to demonstrate with examples of organized drawing file folders.

Suggested Differentiation:

- Tier 1 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts, and one on one mentoring during the question and answer section of the class time
- Tier 2 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts
- Tier 3 Learners: follow basic instruction by following teacher instruction on video projector

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- Teachers can set expectations for drawings of various difficulty levels, assisting students during discussion and guided practice.

Curriculum Development Resources:

- Freehold Regional High School District
- Bloomfield High School

Notes/Comments:

Unit 2 Introduction to Autocad Software

Unit Summary:

The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work.

Interdisciplinary Connections/Content Area Integrations Including Technology:

All students will use digital media, computers, and autocad software to access, manage, evaluate, and synthesize information in order to solve problems individually, collaborate, and create and communicate knowledge. Printers, plotters, 3D printers, and overhead projectors will also be used by students.

NJSLS Number	NJSLS Content
8.1.12.A.2	Produce and edit a multipage digital document for a commercial or professional audience and present it to peers and/or

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	professionals in that related area for review.
8.1.12.C.1	Develop an innovative solution to a real-world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal, and/or social needs.
8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic, or political need and publish for review.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
8.2.12.C.1	Explain how open source technologies follow the design process.
8.2.12.C.2	Analyze a product and how it has changed or might change over time to meet human needs and wants.
8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
8.2.12.D.1	Design and create a prototype to solve a real-world problem using a design process, identify constraints addressed during the creation of the prototype, identify tradeoffs made, and present the solution for peer review.
8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
8.2.12.F.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).

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Summative Assessments:

- Portfolios, Self and Peer Assessment
- Performance Assessment
- Midterm/Final Exam
- Projects
- Rubric Assessment

Formative Assessments:

- Observations (Peer and Teacher)
- Participatory Rubrics
- Student Drawing Projects

Enduring Understandings:

- The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work.

Essential Questions:

- What are the components of the design/engineering process?
- How is the design/engineering process carried out, and what are the steps?
- How is a final product affected by the design/engineering process?
- How does a CAD program help you create a design?
- What part of the CAD editing program helps you create the changes?
- How can one navigate through the various options of a CAD program?
- What is the difference between using your hand to draw a design as opposed to a computer?
- What is the difference between using your hand to alter a design as opposed to altering it digitally?
- Who is known as a major contributor in CAD?

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- What are the benefits of digital CAD technology in product development?

Instructional Outcomes:

- Students will be able to create multiple 2D and 3D objects that when put together, comprise a working product or drawing/design.
- Students will be able to explain the basic concepts of how autocad supports the design process.
- Students will be able to use the basic commands of the autocad software.

Suggested Learning Activities:

- Students will design/draw 2D and 3D objects using teacher prepared worksheets and handouts.
- Students will use a variety of commands needed to complete the design/drawing.

Suggested Differentiation:

- Tier 1 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts, and one on one mentoring during the question and answer section of the class time
- Tier 2 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts
- Tier 3 Learners: follow basic instruction by following teacher instruction on video projector

- Teachers can set expectations for drawings of various difficulty levels, assisting students during discussion and guided practice.

Curriculum Development Resources:

- Freehold Regional High School District
- Bloomfield High School

Notes/Comments:

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Unit 3 Creating a Simple Model

Unit Summary:

Autocad requires knowledge of proper technique including icons and commands needed to complete designs/drawing projects.

Interdisciplinary Connections/Content Area Integrations Including Technology:

All students will use digital media, computers, and autocad software to access, manage, evaluate, and synthesize information in order to solve problems individually, collaborate, and create and communicate knowledge. Printers, plotters, 3D printers, and overhead projectors will also be used by students.

NJSLS Number	NJSLS Content
8.2.12.F.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
8.2.12.F.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).

Summative Assessments:

- Portfolios, Self and Peer Assessment
- Performance Assessment
- Midterm/Final Exam
- Projects
- Rubric Assessment

Formative Assessments:

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- Observations (Peer and Teacher)
- Participatory Rubrics
- Student Drawing Projects

Enduring Understandings:

- Autocad requires knowledge of proper technique including icons and commands needed to complete designs/drawing projects.

Essential Questions:

- What are the basic CAD terminologies for creating models?
- What are some of the key features that should be understood when designing a product?
- Why is it important to follow proper procedure in creating a model?
- How does proper dimensioning affect a product?
- How do various parts come together to form sub-assemblies?
- What are the key features in renderings?
- Why is it important to know various file types?

Instructional Outcomes:

- Students will be able to create a measured drawing/design prior to creating a solid.
- Students will be able to explain the concept of parametric modeling and shape before size.
- Students will be able to select the appropriate drawing plane.
- Students will be able to identify the primary extrude feature.
- Students will be able to troubleshoot common errors.

Suggested Learning Activities:

- Students will design/draw 2D and 3D objects using teacher prepared worksheets and handouts.
- Students will use a variety of commands needed to complete the design/drawing.

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Suggested Differentiation:

- Tier 1 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts, and one on one mentoring during the question and answer section of the class time
- Tier 2 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts
- Tier 3 Learners: follow basic instruction by following teacher instruction on video projector

- Teachers can set expectations for drawings of various difficulty levels, assisting students during discussion and guided practice.

Curriculum Development Resources:

- Freehold Regional High School District
- Bloomfield High School

Notes/Comments:

Unit 4 Engineering Drawing

Unit Summary:

The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work. Autocad programs allow products to be presented to clients prior to production. Students will be producing engineering drawings based on 2D and 3D models and parts.

Interdisciplinary Connections/Content Area Integrations Including Technology:

All students will use digital media, computers, and autocad software to access, manage, evaluate, and synthesize information in order to solve problems

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individually, collaborate, and create and communicate knowledge. Printers, plotters, 3D printers, and overhead projectors will also be used by students.

NJSLS Number	NJSLS Content
8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic, or political need and publish for review.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
8.2.12.C.1	Explain how open source technologies follow the design process.
8.2.12.C.2	Analyze a product and how it has changed or might change over time to meet human needs and wants.
8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
8.2.12.D.1	Design and create a prototype to solve a real-world problem using a design process, identify constraints addressed during the creation of the prototype, identify tradeoffs made, and present the solution for peer review.
8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.

Summative Assessments:

- Portfolios, Self and Peer Assessment
- Performance Assessment

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- Midterms/Final Exam
- Projects
- Rubric Assessment

Formative Assessments:

- Observations (Peer and Teacher)
- Participatory Rubrics
- Student Drawing Projects

Enduring Understandings:

- The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work. Autocad programs allow products to be presented to clients prior to production.

Essential Questions:

- What are the components of the design/engineering process?
- How is the design/engineering process carried out, and what are the steps?
- How is a final product affected by the design/engineering process?

Instructional Outcomes:

- Students will be able to produce engineering drawings based on 2D and 3D models and parts to create a final working design/drawing.
- Students will be able to use a variety of icons and commands to design/draw parts/pieces of the final project.

Suggested Learning Activities:

- Students will design/draw 2D and 3D objects using teacher prepared worksheets and handouts.
- Students will use a variety of commands needed to complete the design/drawing, moving parts/pieces into place.

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Suggested Differentiation:

- Tier 1 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts, and one on one mentoring during the question and answer section of the class time
- Tier 2 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts
- Tier 3 Learners: follow basic instruction by following teacher instruction on video projector

- Teachers can set expectations for drawings of various difficulty levels, assisting students during discussion and guided practice.

Curriculum Development Resources:

- Freehold Regional High School District
- Bloomfield High School

Notes/Comments:

Unit 5 Understanding 2D and 3D Commands (Extrude, Sweep, Revolve)

Unit Summary:

The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work. Autocad programs allow products to be presented to clients prior to production. Students will be producing engineering drawings based on 2D and 3D models and parts.

Interdisciplinary Connections/Content Area Integrations Including Technology:

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NJSLS Number	NJSLS Content
8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic, or political need and publish for review.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
8.2.12.C.1	Explain how open source technologies follow the design process.
8.2.12.C.2	Analyze a product and how it has changed or might change over time to meet human needs and wants.
8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
8.2.12.D.1	Design and create a prototype to solve a real-world problem using a design process, identify constraints addressed during the creation of the prototype, identify tradeoffs made, and present the solution for peer review.
8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.

Summative Assessments:

- Portfolios, Self and Peer Assessment

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- Performance Assessment
- Midterm/Final Exam
- Projects
- Rubric Assessment

Formative Assessments:

- Observations (Peer and Teacher)
- Participatory Rubrics
- Student Drawing Projects

Enduring Understandings:

- The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work. Autocad programs allow products to be presented to clients prior to production.

Essential Questions:

- What are the components of the design/engineering process?
- How is the design/engineering process carried out, and what are the steps?
- How is a final product affected by the design/engineering process?

Instructional Outcomes:

- Students will be able to duplicate and mirror visual objects within their design to create patterns and several instances of the same shape.
- Students will be able to identify the relationship between a profile and the axis it is rotated about using revolve or a similar feature.
- Students will be able to project a profile along a given path to create a new solid object that may be of an irregular shape.
- Students will be able to apply materials and textures to a designed product to give it a realistic appearance for presentation.
- Students will be able to take multiple designed components and join them together within the program to make a complete final product.

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Suggested Learning Activities:

- Students will design a product's parts/pieces similar to an illustration but enhancing to include more geometric shapes and colors.
- Students will design/draw 2D and 3D objects using teacher prepared worksheets and handouts.
- Students will use a variety of commands needed to complete the design/drawing.
- Students will move parts/pieces into place using a variety of commands.

Suggested Differentiation:

- Tier 1 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts, and one on one mentoring during the question and answer section of the class time
- Tier 2 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts
- Tier 3 Learners: follow basic instruction by following teacher instruction on video projector
- Teachers can set expectations for drawings of various difficulty levels, assisting students during discussion and guided practice.

Curriculum Development Resources:

- Freehold Regional High School District
- Bloomfield High School

Notes/Comments:

Unit 6 Dimensions and Annotations

Unit Summary:

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The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work.

Interdisciplinary Connections/Content Area Integrations Including Technology:

All students will use digital media, computers, and autocad software to access, manage, evaluate, and synthesize information in order to solve problems individually, collaborate, and create and communicate knowledge. Printers, plotters, 3D printers, and overhead projectors will also be used by students.

NJSLS Number	NJSLS Content
8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic, or political need and publish for review.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
8.2.12.C.1	Explain how open source technologies follow the design process.
8.2.12.C.2	Analyze a product and how it has changed or might change over time to meet human needs and wants.
8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
8.2.12.D.1	Design and create a prototype to solve a real-world problem using a design process, identify constraints addressed during the creation of the prototype, identify tradeoffs made, and present the solution for peer review.

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8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
Summative Assessments: <ul style="list-style-type: none">● Portfolios, Self and Peer Assessment● Performance Assessment● Midterm/Final Exam● Projects● Rubric Assessment	
Formative Assessments: <ul style="list-style-type: none">● Observations (Peer and Teacher)● Participatory Rubrics● Student Drawing Projects	
Enduring Understandings: <ul style="list-style-type: none">● The design/engineering process is a series of steps taken in order to create a product/project. Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work.	
Essential Questions: <ul style="list-style-type: none">● Why are drawings/designs dimensioned or measured?	
Instructional Outcomes: <ul style="list-style-type: none">● Students will be able to explain the importance of dimensioning and tolerances.● Students will be able to describe the interaction between annotations, dimensioning, and the resulting solid mode, in relation to 2D and 3D geometric shapes.	

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<p>Suggested Learning Activities:</p> <ul style="list-style-type: none">• Students will design all of a product’s parts/pieces similar to an illustration but dimension, with all geometric shapes to size from the original drawing/design.
<p>Suggested Differentiation:</p> <ul style="list-style-type: none">• Tier 1 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts, and one on one mentoring during the question and answer section of the class time• Tier 2 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts• Tier 3 Learners: follow basic instruction by following teacher instruction on video projector • Teachers can set expectations for drawings of various difficulty levels, assisting students during discussion and guided practice.
<p>Curriculum Development Resources:</p> <ul style="list-style-type: none">• Freehold Regional High School District• Bloomfield High School
<p>Notes/Comments:</p>
<p style="text-align: center;">Unit 7 Rapid Prototyping</p>
<p>Unit Summary:</p> <p>Innovation in digital tools and products is utilized to aid and simplify work. CAD programs are fundamental to the development of technological products.</p>
<p>Interdisciplinary Connections/Content Area Integrations Including Technology:</p>

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NJSLS Number	NJSLS Content
8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, tradeoffs, and risks, related to the use of the innovation.
8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic, or political need and publish for review.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

Summative Assessments:

- Portfolios, Self and Peer Assessment
- Performance Assessment
- Midterm/Final Exam
- Projects
- Rubric Assessment

Formative Assessments:

- Observations (Peer and Teacher)
- Participatory Rubrics
- Student Drawing Projects

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<p>Enduring Understandings:</p> <ul style="list-style-type: none">• Innovation in digital tools and products is utilized to aid and simplify work. CAD programs are fundamental to the development of technological products.
<p>Essential Questions:</p> <ul style="list-style-type: none">• How is rapid prototyping used in the development of a product?
<p>Instructional Outcomes:</p> <ul style="list-style-type: none">• Students will be able to create a design and then use a rapid prototyping 3D printer to create a working 3D model.
<p>Suggested Learning Activities:</p> <ul style="list-style-type: none">• Using a teacher prepared design/drawing, students will replicate the design and print out a prototype with the 3D printer.
<p>Suggested Differentiation:</p> <ul style="list-style-type: none">• Tier 1 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts, and one on one mentoring during the question and answer section of the class time• Tier 2 Learners: follow basic instruction by following teacher instruction on video projector, use of additional handouts• Tier 3 Learners: follow basic instruction by following teacher instruction on video projector • Teachers can set expectations for drawings of various difficulty levels, assisting students during discussion and guided practice.
<p>Curriculum Development Resources:</p> <ul style="list-style-type: none">• Freehold Regional High School District• Bloomfield High School

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Notes/Comments:
