

CURRICULUM

FOR

COMPUTER AIDED

DRAFTING

GRADES 9-12

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

ACKNOWLEDGMENTS

Dr. Susan Dube, Program Supervisor of Science/Technology Education

The Board acknowledges the following who contributed to the preparation of this curriculum.

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Subject/Course Title:
Computer Aided Drafting
Grades 9-12

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DRAHWAY PUBLIC SCHOOLS CURRICULUM
Computer Aided Drafting – Grades 9-12

PACING GUIDE

Unit	Title	Pacing
1	Pattern Making	4 weeks
2	Architectural Drafting	6 weeks
3	Architectural Design Project	10 weeks

ACCOMMODATIONS

<p>504 Accommodations:</p> <ul style="list-style-type: none"> • Provide scaffolded vocabulary and vocabulary lists. • Provide extra visual and verbal cues and prompts. • Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. • Provide links to audio files and utilize video clips. • Provide graphic organizers and/or checklists. • Provide modified rubrics. • Provide a copy of teaching notes, especially any key terms, in advance. • Allow additional time to complete assignments and/or assessments. • Provide shorter writing assignments. • Provide sentence starters. • Utilize small group instruction. • Utilize Think-Pair-Share structure. • Check for understanding frequently. • Have student restate information. • Support auditory presentations with visuals. • Weekly home-school communication tools (notebook, daily log, phone calls or email messages). • Provide study sheets and teacher outlines prior to assessments. • Quiet corner or room to calm down and relax when anxious. • Reduction of distractions. • Permit answers to be dictated. • Hands-on activities. • Use of manipulatives. • Assign preferential seating. • No penalty for spelling errors or sloppy handwriting. • Follow a routine/schedule. • Provide student with rest breaks. • Use verbal and visual cues regarding directions and staying on task. • Assist in maintaining agenda book. 	<p>IEP Accommodations:</p> <ul style="list-style-type: none"> • Provide scaffolded vocabulary and vocabulary lists. • Differentiate reading levels of texts (e.g., Newsela). • Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. • Provide extra visual and verbal cues and prompts. • Provide links to audio files and utilize video clips. • Provide graphic organizers and/or checklists. • Provide modified rubrics. • Provide a copy of teaching notes, especially any key terms, in advance. • Provide students with additional information to supplement notes. • Modify questioning techniques and provide a reduced number of questions or items on tests. • Allow additional time to complete assignments and/or assessments. • Provide shorter writing assignments. • Provide sentence starters. • Utilize small group instruction. • Utilize Think-Pair-Share structure. • Check for understanding frequently. • Have student restate information. • Support auditory presentations with visuals. • Provide study sheets and teacher outlines prior to assessments. • Use of manipulatives. • Have students work with partners or in groups for reading, presentations, assignments, and analyses. • Assign appropriate roles in collaborative work. • Assign preferential seating. • Follow a routine/schedule.
<p>Gifted and Talented Accommodations:</p> <ul style="list-style-type: none"> • Differentiate reading levels of texts (e.g., Newsela). • Offer students additional texts with higher lexile levels. • Provide more challenging and/or more supplemental readings and/or activities to deepen understanding. • Allow for independent reading, research, and projects. • Accelerate or compact the curriculum. • Offer higher-level thinking questions for deeper analysis. • Offer more rigorous materials/tasks/prompts. • Increase number and complexity of sources. 	<p>ELL Accommodations:</p> <ul style="list-style-type: none"> • Provide extended time. • Assign preferential seating. • Assign peer buddy who the student can work with. • Check for understanding frequently. • Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc...). • Have student repeat directions. • Make vocabulary words available during classwork and exams. • Use study guides/checklists to organize information. • Repeat directions. • Increase one-on-one conferencing.

<ul style="list-style-type: none"> • Assign group research and presentations to teach the class. • Assign/allow for leadership roles during collaborative work and in other learning activities. 	<ul style="list-style-type: none"> • Allow student to listen to an audio version of the text. • Give directions in small, distinct steps. • Allow copying from paper/book. • Give student a copy of the class notes. • Provide written and oral instructions. • Differentiate reading levels of texts (e.g., Newsela). • Shorten assignments. • Read directions aloud to student. • Give oral clues or prompts. • Record or type assignments. • Adapt worksheets/packets. • Create alternate assignments. • Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted. • Allow student to resubmit assignments. • Use small group instruction. • Simplify language. • Provide scaffolded vocabulary and vocabulary lists. • Demonstrate concepts possibly through the use of visuals. • Use manipulatives. • Emphasize critical information by highlighting it for the student. • Use graphic organizers. • Pre-teach or pre-view vocabulary. • Provide student with a list of prompts or sentence starters that they can use when completing a written assignment. • Provide audio versions of the textbooks. • Highlight textbooks/study guides. • Use supplementary materials. • Give assistance in note taking • Use adapted/modified textbooks. • Allow use of computer/word processor. • Allow student to answer orally, give extended time (time-and-a-half). • Allow tests to be given in a separate location (with the ESL teacher). • Allow additional time to complete assignments and/or assessments. • Read question to student to clarify. • Provide a definition or synonym for words on a test that do not impact the validity of the exam. • Modify the format of assessments. • Shorten test length or require only selected test items. • Create alternative assessments. • On an exam other than a spelling test, don't take points off for spelling errors.
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RAHWAY PUBLIC SCHOOLS CURRICULUM

UNIT OVERVIEW

Unit Title: Unit 1 - Pattern-Making

Target Course/Grade Level: 9-12

Unit Summary: Students will learn about the process behind designing and creating a two-dimensional pattern which adheres defined constraints and design elements of vertical, horizontal and/or radial symmetry, as well as color harmony.

Approximate Length of Unit: 4 Weeks

LEARNING TARGETS

NJ Student Learning Standards:

- 8.2.2.A.3 Identify a system and the components that work together to accomplish its purpose.
- 8.2.12.D.3 Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.8.C.2 Explain the need for optimization in a design process.

21st Century Life and Career Skills:

- 9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.
- 9.3.ST-ET.4 Apply the elements of the design process.

Interdisciplinary Connections and Standards:

Mathematics:

- G-CO.A4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- G-CO.A5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Fine Arts:

- 1.1.2.D.1 Identify the basic elements of art and principles of design in diverse types of artwork.

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

- RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Unit Understandings:

Students will understand that...

- technical design requires competency in measurement and craft
- color harmony abides by defined rules
- design software enables efficiency of effort in design creation after mastery of hand-design tools
- computer made designs can be exported for rapid production

Unit Essential Questions:

- What is symmetry in design and how is it constructed?
- How is measurement essential to technical design?
- How does design software streamline effort in the design process?
- How do dimensions form flat objects?

Knowledge and Skills:

Students will know.....

- the definition of horizontal, vertical and radial symmetry
- the definition of color harmony
- elements of technical design, such as constraints and limitations
- the value of computer-aided design

Students will be able to ...

- construct symmetrical designs by hand through repetition, reflection, and rotation of a single design element using rulers and pencils and paper
- create a composite symmetrical image which identical duplicate patterns by hand that satisfies a chosen color harmony
- re-create previous symmetrical design with AutoCAD and generate various scales of that design through prototyping



Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment: Performance Assessment:**
 - Students will create hand-constructed 2D pattern and computer-generated 2D pattern
- Student participation in class discussions
- Culminating process booklet

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Various/repeated presentations of content in small groups or at the individual level
- Individual guided video learning in AutoCAD
- Individual guided video learning in Samira Mian's Udemy radial geometry course
- reduced/increased complexity of required output per on-going informal classwork assessment

	<i>RESOURCES</i>	
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Teacher Resources:

- Teacher developed worksheets
- Teacher developed note sheets
- Samira Mian online udemy radial geometry guided video lessons
- AutoCAD tutorials

Equipment Needed:

- Classroom computers
- AutoCAD
- cutting mats
- exacto knives
- Card Stock
- Printers
- PowerPoint
- Class projector

	<i>UNIT OVERVIEW</i>	
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Content Area: Introduction to Computer Aided Design

Unit Title: Unit 2 - Architectural Drafting

Target Course/Grade Level: 9-12

Unit Summary: Students will learn the process of surveying an existing architectural space and producing measured, scaled and dimensioned plan and elevation drawings of that space, both by hand and using AutoCAD.

Approximate Length of Unit: 6 Weeks

	<i>LEARNING TARGETS</i>	
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NJ Student Learning Standards:

- 8.2.12.C.5 Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
- 8.2.2.A.3 Identify a system and the components that work together to accomplish its purpose.
- 8.2.12.D.3 Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.8.C.2 Explain the need for optimization in a design process.

21st Century Life and Career Skills:

- 9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
- 9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

Interdisciplinary Connections and Standards:

Mathematics:

- 7.G.A.1: Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

- RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Unit Understandings:

Students will understand that...

- technical documentation requires competency in measurement and craft
- architectural drawing requires use of various, industry-defined line-weights and symbols to be universally legible within the design community
- computer made drawings can be exported for rapid production

Unit Essential Questions:

- Why does technical drawing require mathematics knowledge?
- How are multiple 2-dimensional views required to represent a 3-dimensional space?
- How does design software streamline effort in the design process?

Knowledge and Skills:

Students will know.....

- the definition of architectural plan
- the definition of architectural elevation
- elements of technical design, such as constraints and limitations
- the value of computer-aided design

Students will be able to ...

- survey dimensions of their classroom
- create a plan drawing at a defined scale of the classroom by hand and in AutoCAD
- create an elevation drawing at a defined scale of one wall of the classroom by hand and in AutoCAD
- produce a corresponding panorama photo of the drawn wall and create a multi-media presentation of both representations of that wall at a corresponding scale



Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment: Performance Assessment:**
 - Students will create a slide presentation that contains classroom drawings and the corresponding panorama.
- drawing set of plan and elevation at the same scale with accurate dimensioning of classroom components

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Various/repeated presentations of content in small groups or at the individual level as required
- Individual guided video learning
- reduced/increased complexity drawing of required output per on-going informal classwork assessment
- elimination of either hand or computer drawing per on-going informal assessment
- Use of Edmentum software to assist learning of drawing conventions

	<i>RESOURCES</i>	
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Teacher Resources:

- Teacher developed worksheets
- Teacher developed note sheets
- AutoCAD tutorials
- Edmentum technical drawing tutorials

Equipment Needed:

- Classroom computers
- AutoCAD
- Architectural scales
- Slide rules
- Graph paper
- Printers
- Class projector

RAHWAY PUBLIC SCHOOLS CURRICULUM

UNIT OVERVIEW

Content Area: Introduction to Computer Aided Design

Unit Title: Unit 3 - Architectural Design Project

Target Course/Grade Level: 9-12

Unit Summary: Students will create an original architectural design under given material and site constraints and produce a portfolio of their design process and final product. Possible projects include: on-site RHS Courtyard design, on-site RHS/Madison Elementary playground design, treehouse design.

Approximate Length of Unit: 10 Weeks

LEARNING TARGETS

NJ Student Learning Standards:

- 8.2.12.C.5 Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
- 8.2.2.A.3 Identify a system and the components that work together to accomplish its purpose.
- 8.2.8.C.2 Explain the need for optimization in a design process.
- 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 trade-off made, and present the solution for peer review.
- 8.2.5.C.1 Collaborate with peers to illustrate components of a designed system

21st Century Life and Career Skills:

- 9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
- 9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

Interdisciplinary Connections and Standards:

Mathematics:

- 7.G.A.1: Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

- RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Unit Understandings:

Students will understand that...

- Effective verbal and visual communication are required to produce an architectural design within a team setting
- Successful design requires repeated testing and iteration of ideas
- Site conditions and constraints are critical considerations to architectural design

Unit Essential Questions:

- Why is design an iterative process?
- How are multiple 2-dimensional views required to represent a 3-dimensional space?
- How does design software streamline effort in the design process?
- How much precision is required at each stage of the design process?
- What skills are needed for effective teamwork within a design team?

Knowledge and Skills:

Students will know.....

- the stages of the design cycle
- appropriate level of detail to consider at each stage of the design cycle
- the value of computer-aided design to aid in efficient production of design documentation

Students will be able to ...

- apply all stages of the design process to create an original design
- produce corresponding models and architectural drawings of their designs
- create a portfolio of the entire design process, including final design documents.



Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment:**
 - Students will complete design models and technical drawings.
 - Students will create a culminating slide presentation/portfolio containing images of precedent inspirations, drawings, models, self-critique, and teammate critique.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Various/repeated demonstrations of design skills in small groups or at the individual level as required on

- Presentations of design solutions to similar problems for inspiration
- reduced/increased complexity drawing of required output per on-going informal classwork assessment
- elimination of either hand or computer drawing per on-going informal assessment

	<i>RESOURCES</i>	
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Teacher Resources:

- Teacher developed worksheets
- Teacher developed notesheets
- Previous student projects for inspiration

Equipment Needed:

- Classroom computers
- AutoCAD
- Architectural scales
- Slide rules
- Graph paper
- Printers
- Class projector
- Cardboard
- Matte knives
- Matte boards
- Modeling basswood
- Elmer's Glue-all