

Verona Public School District Curriculum Overview

CAD I



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Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

This pre-engineering and pre-architectural course is designed to provide students with both hand drafting and computer skills. This course will guide students from basic perspective, orthogonal and isometric drawing to complex 3-dimensional modeling and design. The software used in this class is the same utilized by professionals in the fields of Engineering and Architecture. The bulk of this course utilizes extended drawing and computer time.

Prerequisite(s):

C+ Previous Math Course



Standard 8: Technology Standards

8.1: Educational Technology: <i>All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.</i>	8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming: <i>All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.</i>
<ul style="list-style-type: none"> X A. Technology Operations and Concepts X B. Creativity and Innovation X C. Communication and Collaboration D. Digital Citizenship E. Research and Information Fluency X F. Critical thinking, problem solving, and decision making 	<ul style="list-style-type: none"> X A. The Nature of Technology: Creativity and Innovation X B. Technology and Society X C. Design X D. Abilities for a Technological World E. Computational Thinking: Programming

SEL Competencies and Career Ready Practices

Social and Emotional Learning Core Competencies: <i>These competencies are identified as five interrelated sets of cognitive, affective, and behavioral capabilities</i>	Career Ready Practices: <i>These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.</i>
Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.	<ul style="list-style-type: none"> X CRP2. Apply appropriate academic and technical skills. CRP9. Model integrity, ethical leadership, and effective management. X CRP10. Plan education and career paths aligned to personal goals.
Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.	<ul style="list-style-type: none"> CRP3. Attend to personal health and financial well-being. X CRP6. Demonstrate creativity and innovation. X CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.
Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.	<ul style="list-style-type: none"> X CRP1. Act as a responsible and contributing citizen and employee. CRP9. Model integrity, ethical leadership, and effective management.
Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.	<ul style="list-style-type: none"> X CRP4. Communicate clearly and effectively and with reason. CRP9. Model integrity, ethical leadership, and effective management. CRP12. Work productively in teams while using cultural global competence.
Responsible decision making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.	<ul style="list-style-type: none"> CRP5. Consider the environmental, social, and economic impact of decisions. CRP7. Employ valid and reliable research strategies. X CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership, and effective management.

Standard 9: 21st Century Life and Careers

9.1: Personal Financial Literacy: <i>This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.</i>	9.2: Career Awareness, Exploration & Preparation: <i>This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.</i>	9.3: Career and Technical Education: <i>This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.</i>
<ul style="list-style-type: none"> X A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting 	<ul style="list-style-type: none"> A. Career Awareness (K-4) B. Career Exploration (5-8) X C. Career Preparation (9-12) 	<ul style="list-style-type: none"> A. Agriculture, Food & Natural Res. X B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services K. Information Technology L. Law, Public, Safety, Corrections & Security X M. Manufacturing N. Marketing X O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log.

Course Materials

Core Instructional Materials: <i>These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.</i>	Differentiated Resources: <i>These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.</i>
<ul style="list-style-type: none"> ● Hand Drawing Pre-Assessment ● Interpretation Vs. Construction Exercises I., II., & III ● Drafting Tools for Technical Drawing Exercise ● Lineweights Exercise ● Shade & Shadow Exercise ● Single Point Perspective Exercise ● 5 Methods of Showing Depth Quiz ● Two Point Perspective Exercise ● Growth Based Final Drawing Test ● CAD BASICS Exercise ● Drawing, Modify & 1 Point Perspective Exercises in CAD ● CAD Plotting Exercise ● CAD Isometric Drawing Exercise 	<ul style="list-style-type: none"> ● Modified Drawing Exercises Reducing Complexity & Quantity of Work ● Modified Single Point Perspective Quiz Reducing Complexity & Quantity of Objects Depicted ● Video Resource: 5 Tips for Drawing Depth ● Video Resource: Changing Shapes into Forms ● Video Resource: Single Point Perspective Drawing ● Single Point Drawing Exemplars ● Video Resource: Two Point Perspective Drawing ● Two Point Drawing Exemplars ● Growth Based Final Drawing Test ● CAD basics Google Slide Show ● Modified CAD Isometric & Multiview Drawing Exercise including reduced layer requirements, complexity and number of drawings.



- CAD Multiview Drawing Exercise
- Architectural Floor Plan Pre-Assessment
- Public Vs. Private Exercise
- Use & Group Exercise
- Survivalists Retreat Project Brief and Rubric

- Teacher Notes Provided for Public Vs. Private Exercise & Use & Group Exercises
- Exemplar Project Brief and Rubric
- Teacher Notes on nominal Room sizes and typical dimensions.



Unit Title / Topic: Intro to CAD	Unit Duration: 18 Weeks
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Stage 1: Desired Results

Established Goals:

2014 New Jersey Core Curriculum Content Standards - Technology

- 8.2.12.A.2**
Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
- 8.2.12.A.3**
Research and present information on an existing technological product that has been repurposed for a different function.
- 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.C.7**
Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.

21st Century Life and Career Skills

Architecture & Construction Career Cluster

- 9.4.12B.24**
Employ technological tools to expedite workflow.
- 9.4.12.B.(1).2**
Employ appropriate representational media to communicate concepts and design.
- 9.4.12.B.(1).3**
Integrate structural, environmental, safety, building envelope, and building service systems in the design of buildings and structures.
- 9.4.12.B.(1).7**
Identify objective construction guidelines for the accommodation of people with different physical abilities to meet accessibility requirements.
- 9.4.12.B.(1).9**
Develop technical drawings drafted by hand and computer-generated plans to design structures.
- 9.4.12.B.(1).10**
Demonstrate understanding of principles, conventions, standards, applications, and restrictions pertaining to the manufacture and use of construction materials, components, and assemblies, and incorporate this understanding into project design.
- 9.4.12.B.(1).11**
Apply basic organizational, spatial, structural, and constructional principles to the design of interior and exterior space so that design plans are effective.

New Jersey Core Curriculum Content Standards for Visual and Performing Arts

- 1.3.12.D.2**
Produce an original body of artwork in one or more art mediums that demonstrates mastery of visual literacy, methods, techniques, and cultural understanding.
- 1.3.12.D.5**
Identify the styles and artistic processes used in the creation of culturally and historically diverse two- and three-dimensional artworks, and emulate those styles by creating an original body of work.
- 1.4.12.B.1**
Formulate criteria for arts evaluation using the principles of positive critique and observation of the elements of art and principles of design, and use the criteria to evaluate works of dance, music, theatre, visual, and multimedia artwork from diverse cultural contexts and historical eras.

Transfer Goal:

Students will be able to independently use their learning to...Accurately communicate 3Dimensional conditions using a Hierarchy of Lineweight through selection of Orthographic, Isometric and Perspective Views.

Students will understand that:

- There are differences between how we imagine things, how we perceive things and how things really are... spatially speaking.
- Great drawings can be rationally constructed with consistency and predictability by using tools and processes, rather than an innate "ability to draw".
- Visual Communication is Critical to Engineering and Fabrication
- Proportion and Massing are the most important factors in object recognition.
- Drawing can be stylistic and there can be more than one correct solution.
- Using *both* lineweight hierarchy *and* shade and shadow is not a best practice.
- The horizon line can be equated to a sight line in 1 and 2 point perspective drawings.
- Improvement in drawing *requires* careful observation and critical reflection
- The legibility of text/notes in drawings is critical to understanding
- AutoCAD commands only work when all steps are executed in order
- Visual/Spatial Intelligence is fluid and improves with practice

Essential Questions:

- What is the difference between how we imagine things, how we perceive things, and how they are...spatially speaking?
- What information is necessary to faithfully create something we imagine?
- How can visual communication skill and knowledge of AutoCAD software be applied in other disciplines/endeavors?

Students will know:

- There are five methods of displaying depth for line drawings: Lineweight, Scale, Overlap, Linear Perspective & Aerial Perspective
- Orthographic images depict only one plane, perpendicular to the sight line.
- Pictorial drawings are any drawings that show more than one dimensional plane.
- Axonometric drawings depict all 3 dimensional planes, and are drawn at actual size about a 90 degree grid.
- Isometric drawings depict all 3 dimensional planes, are drawn at actual size, and are drawn about a 120 degree grid.

Students will be able to:

- Accurately Complete Top, Front or Side drawings from an Axonometric view.
- Accurately Complete Isometric or Axonometric drawings from Top, Front & Side views. Use 3-5 lineweights to demonstrate a translation of a 3Dimensional Object into a 2Dimensional planar view.
- Construct a 1 Point Perspective Drawing
- Construct a 2 Point Perspective Drawing
- Show improvement in each of the 5 methods of displaying depth to create a drawing from observation.



- Multiview drawings typically contain three views: Top, Front, & Side
- All Horizontal Surfaces are drawn toward a vanishing point in a perspective drawing
- There are three different ways to activate an AutoCAD command: icons, commands, abbreviations
- Methods for optimizing the display screen in CAD to include: crosshair size and color, line thickness, and layer color.
- CAD has different workspaces that are customized to different types of drawing
- The most efficient input for CAD commands Relative Input
- A line in CAD is a disconnected from other objects, but a Polyline is connected by communal vertices
- A Spline in CAD is a series of connected curves with vertices that control the contour of each segment.
- Object Snap controls how objects are drawn in relation to other objects
- Ortho Snap controls how objects are draw in relation to User Coordinate System
- Polar Snap controls how objects are drawn in relation to preselected angles

- Use a T square, triangle and architects scale to accurately draw a scaled drawing by hand.
- Use a 45 degree reflection line to translate measured lines from top to side views in a digital drawing.
- Strategically manipulate Basic AutoCAD commands such as: Line, Polyline, Shape, Copy, Move, Rotate, Scale, Array, Erase, Text, Offset, Fillet, Boundary, Mirror, Polyline Edit, Hatch, & Hatch Edit
- Control the appearance of lineweights on printed drawings through proper layer management and setup of plot styles in AutoCAD
- Fill in a closed boundary with a solid or patterned hatch
- Import, Rotate, Move and Scale an Image to be used as a background template in AutoCAD
- Utilize different AutoCAD commands to faithfully duplicate and/or improve an illustration
- Accurately dimension Multiview drawings from parts to whole without redundancy
- Accurately fabricate a 3Dimensional part from 2-Dimensional drawings

Stage 2: Acceptable Evidence

Transfer Task

Puzzle Me This-Students create Multiview Drawings (Top, Front, Side) as well as Isometric drawings that include: scale, dimensions and differentiated lineweights.

Eco Retreat- Students design a sustainable off the grid retreat, including full Plans, Elevations, and part drawing files to create a 3 dimensional model.

Other Evidence of Learning

Digital Portfolio- Students will compose a visual presentation of their work throughout the course. Portfolio will be graded both on function and design.

Performance Assessments- Students design, construct, and test solutions to various technological challenges. Student work cooperatively to complete design activities and deliver presentations. Students are evaluated using performance and process rubrics.

Summative Assessments- Students complete minor pre/post content knowledge assessments, as well frequent do nows and closing exercises to target immediate critical knowledge.



Stage 3: Activities to Foster Learning

Learning Activities

Week 1: CAD.... What is it Good For? / Purpose of Technical Drawings / Pre-Assessment / Interpretation Vs. Construction

Students discover what CAD is, how it can be used, the purpose of a technical Drawing and the 3 elements necessary for a drawing to be a technical drawing.

Students complete a Pre-Assessment Sketch to determine their ability to communicate a spatial condition from observation.

Students complete a series of exercises that demonstrate through process, the quality anyone's drawing can improve as learn to move from Interpretations of Space, to Spatial Construction.

Week 2: Drawing Basics: Layout, Tools, & Techniques of Lineweight Differentiation

Critique of Selected Pre-Assessment Sketches

Students design a graphic organizer to document drawing tool names, sketches & uses.

Students complete a lineweight exercise to learn fine motor control and how to create 5 lineweights of increasing width and value

After watching a tutorial, students use shade and shadow to spatialize a sphere, a cylinder, and a cube.

Week 3: 5 Methods of Depicting Depth

Students are introduced to 5 Methods of Depicting Depth: Lineweight, Scale, Overlap, Linear Perspective & Aerial Perspective

In a series of analytical comparisons: Students identify the differences between an Orthogonal Drawing & a Pictorial Drawing. Students determine the differences between Axonometric Drawings Perspective Drawings. Students identify the difference between 1 and 2 Point Perspective Drawings.

After seeing exemplars and video tutorials, students complete 1 & 2 Point Perspective Drawings incorporating.

Week 4: Post-Assessment Drawing to Demonstrate Improvement in Ability to show Depth

Students are given 3 class periods to: frame & construct a full page drawing from observation that demonstrates improvement in the 5 methods of depicting depth.

Week 5: Intro to CAD & Basic Layout

Students learn the basic drawing functions of CAD through a Name exercise and a Title Block Drawing

Students learn organization and printing procedures

Week 6: Intro to CAD & Multiview Drawing

Students apply lineweights to top, front, and side views from a depicted Axonometric Drawing.

Students learn about linetypes and utilize hidden lines where required.

Week 7: Intro to CAD & Dimensioning

Students learn Dimensioning theory, conventions and commands in AutoCAD, applying dimensions to all drawings completed to date.

Week 8: Puzzle Me This! *Puzzle Competition* (Construction of Multi View & Isometric Drawings by Observation)

Students study physical puzzle parts, complete dimensioned multiview and isometric drawings of the puzzle and construct a piece of the puzzle to compete in a team competition.

Week 9: Illustration Competition

Students are given a skill level and tasked with finding a digital line drawing of an appropriate complexity to the student, for the purpose of importing, scaling, rotating, moving, tracing, and improving.

Students being instruction and experimentation on curved line manipulation.

Week 10: Hatch, Lineweight & Illustration Improvement

Students identify areas that can be improved in the illustration. This includes the addition of multiple lineweights to demonstrate depth, hatching to show show texture or shading, or the creation of new elements to the illustration.

Week 11: Laser Etching

Selected works of high achievement are laser etched on students choice of wood or acrylic.

Week 12: Eco Retreat

Students will conduct research on sustainable technologies such as solar panels, composting toilets, ground source heat pumps & green building materials.

Students will work collectively to create a digital resource that summarizes and archives the web pages of at least 25 different green buildings.

Students are then tasked with designing a small vacation home/retreat for seasonal use, and incorporating elements of sustainable design to make it "off the grid".

Week 13: Organization / Floor Plan Development

Students will learn the basic concepts of room organization and connectivity as well as conventions for communicating a floor plan.

Working in groups, students will allocate work during 3 Stages: Floor Plans, Elevations, & Laser Cut Plans, & Model

Week 14: Elevations & Laser Cut Development

Students learn strategies for creating great elevations, and laser cut plans.

Students break up and work on elevations

Week 15: Benchmark Critique & Optimization

Students use the

Week 16: Laser Cut Model Construction

Week 17 Laser Cut Model Completion

Week 18 Eco Retreat Critique