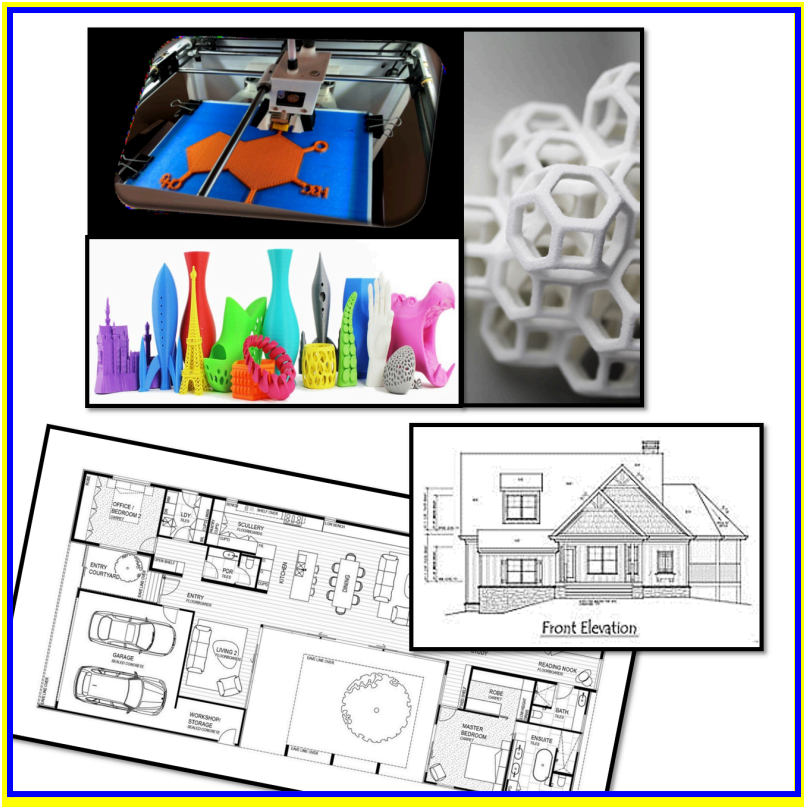
COMPUTER AIDED DRAFTING CURRICULUM



Grade Level(s): 9-12

Curriculum Author(s): Kristen Pisano

Course Description: Computer-aided drafting and design system are used by designers and manufacturers in virtually every industry to create engineering design solutions. In this course, students are learning the basics of CAD software called AutoCAD: creating geometric forms, multiview drawings, 3D models and architectural technical drawings. They learn how to translate initial concepts into accurate, functional designs and explore career options in this hands-on introductory-level course.

(Software: AutoCAD) Prerequisite: Geometry(can be concurrent with*) College Prep *Semester 2 only

Year At A Glance			
Unit Title	**Overarching Essential Question**	**Overarching Enduring Understanding**	**Vision of A Learner "I Can" Statements**
Unit 1: History of CAD, Types of CAD and Employment Opportunities	How has the evolution of CAD technology transformed design practices and career opportunities in various industries?	Students will gain a comprehensive understanding of both the historical development of CAD and its influence on career opportunities, preparing them to navigate and contribute to the evolving field of design technology.	TI4(9-12); TCC4(9-12) ; CCE1(9-12); TCC3(9-12)
Unit 2: Multiview Technical Drawings, Design & 3D Printing	How can CAD be used to accurately represent three-dimensional geometries in multiple views, ensuring clarity and precision with technical drawings?	Students will demonstrate a proficient use of AutoCAD for creating multiview technical drawings requiring a mastery of spatial visualization, precision in dimensioning, and adherence to industry standards to effectively communicate detailed design information.	CCE2(9-12); P2(9-12); TCC3(9-12); TI2(9-12)
Unit 3: Architectural Drafting & Design	How does the process of drafting architectural floor plans integrate design principles, technical skills, and real-world considerations to create accuracy and clarity?	Students will translate architectural ideas and concepts into technical drawings including floor and elevation plans. They will create technical drawings with accuracy, completeness, and adhere to project requirements, including scale, notation and detail.	TCC1(9-12); CCE2(9-12); P3(9-12)

Unit 1 - History of CAD, Types of CAD and Employment Opportunities

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Technology Education CT State Standards
CADD.01 Demonstrate an understanding of the historical and current events related to CADD and the impact on society.
CADD.01.01 Develop a timeline showing important periods that have significance to CADD and explain the impact on society.
CADD.01.02 Evaluate current events that have relevance to process digital information.
CADD.01.03 Describe the development of graphic language in a digital age.
CADD.01.04 Explain the significance of the development Computer Aided Drafting and Design had on society.
CADD.02 Analyze the use of current CADD design technology.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- TI4(9-12): I can apply my strengths and anticipate challenges to reach my current and future goals.
- TCC4(9-12): I can integrate my learning to adapt to experiences in the classroom, career and life.
- CCE1(9-12): I can initiate discussions with my peers and teachers about a variety of topics, respecting differing viewpoints, actively listening to others, and responding thoughtfully with peer-reviewed evidence that is free of bias.
- TCC3(9-12): I can integrate relevant information to produce multiple valid solutions.

Understandings: Students will understand that…

- The historical context of CAD, its evolution, and its profound impact on various industries.
- CAD had an impact on manufacturing.
- There are several different types of career paths that can be taken with CAD training including design, drafting, art, landscaping, architecture etc.

Essential Questions:

- How has CAD technology transformed design and manufacturing processes, and how emerging trends may shape the future of design technology.
- In what ways is CAD being utilized today in both manufacturing industries and across other fields?
- What are some employment opportunities involving CAD?

Students will know…

- What technical drawings are.
- The terminology used to describe the process of creating technical drawings.
- The stages in which technical drawings are produced.

Students will be able to…

- Explain the training needed to become an engineer, architect, designer, or drafter.
- Describe the process of obtaining employment in the technical drawing field and the qualities that employers seek.

• The development of CAD and their impact on manufacturing. • Several types of drafting (aeronautical, mechanical, civil architectural, etc.) • Possible careers involving CAD as well as be able to identify the fastest growing/declining jobs.	• Describe what career prospects and opportunities, including salary ranges, are available in the field of technical drawing.
Key Vocabulary: Aeronautical or Aerospace Drafters; American Institute of Architects; American Society of Mechanical Engineers; Architectural Drafters; Civil Drafters; Computer-Aided-Design/Drafting (CAD); Design Technicians; Drafters; Drafting; Electrical Drafters/mechanical Drafters/ Electronic Drafters/ Engineering Drawings; National Society of Professional Engineers	
Assessment Evidence	
Performance Tasks: • **Performance based assessment:** Job search activity: Students will through web based research and the provided text, answer prompts to allow them to learn about career prospects and opportunities, including salary ranges, and training needed. Students will write a paper describing a possible future career path in detail. **TI4(9-12), TCC4(9-12)** • Class research project/presentation: Timeline of the history and future of CADD. Students collaborate in small groups given a decade to create a slideshow explaining significant advancements of drafting and computer aided drafting development. **CCE1(9-12)**	**Other Evidence:** • **Interim:** Students will answer questions about types of drafting and titles of drafters based on lecture, notes and text reading throughout unit 1. **TCC3(9-12)**
Learning Plan	
• Students will answer questions, research college/trade school or any training expenses for a possible future career. They will answer questions and research the cost of living as well as potential future income. They will research job force opportunities & pay while also looking at jobs that are on the rise as well as declining. They will write a summary of where they see themselves in 10 years.**TCC4(9-12)** • Students will collaborate in small groups, given a decade to research the history of CAD. The class will then create slides for their research and will present their findings for their peers creating a timeline. **CCE1(9-12)**	
Teacher Resources: Technical Drawing 101 with AutoCAD 2023, Douglas Smith, Anotnio Ramirez, Jana Schmidt, SDC Publications.; AutoCAD 2023 Tutorial First Level 2D Fundamentals, Randy H. Shih, SDC Publications; Autodesk: AutoCAD Architecture 2023 Fundamentals, Elise Moss, SDC Publications	

Unit 2 - Multiview Technical Drawings, Design & 3D Printing

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Technology Education CT State Standards

CADD.02.02 Describe physical objects as geometric entities.*
CADD.02.04 Describe and demonstrate the use of graphic communication skills through sketching.*(A3)
CADD.02.05 Evaluate and select appropriate methods of communication for a given problem.*
CADD.02.06 Send and access information through a network.*(A4)
CADD.02.07 Express a design of an object as a 3D model.*(A5)
CADD.02.08 Export and import images/files in a variety of file formats*(A6)
CADD.02.09 Evaluate the choice and placement of dimensions, notes and annotations clearly to communicate design intent.*(A7)
CADD.02.10 Revise a design and update finished drawings appropriately.* (A8)
CADD.02.11 Identify basic geometric elements (e.g., line, circle, rectangle, sphere, and cube).* (A9)
CADD.02.12 Describe objects as geometric entities.*(A1)
CADD.02.13 Describe and apply the following basic geometric concepts to building 3D models: tangent and parallel concentric.*(A10)
CADD.05.10 Place and edit text and fonts.*(E24)
CADD.05.11 Explain and demonstrate the process for creating orthographic, isometric, section views, and auxiliary view.*
CADD.05.12 Place and edit dimensions.*(E26)
CADD.05.13 Generate a 2-D multiview drawing.*(E27)
CADD.05.15 Scale and print hard copy of an output device.*(E29)
CADD.05.16 Explain the use and need for scaled drawings.*(E30)
CADD.06 Demonstrate use and application of alternate view applications and functions.
CADD.06.01 Identify the function of alternate views.
CADD.06.03 Create and edit construction planes through reference geometry.*(G35)
CADD.06.04 Generate/modify geometric components on construction planes.*
CADD.06.05 Create a 2-D drawing from a 3-D model.*(G34)
CADD.06.06 Create a 3-D model from a 2-D drawing.*(G35)
CADD.07 Create assemblies and views in 3-D format.
CADD.07.01 Create an assembly in 3-D geometry.*(F31)
CADD.07.02 Create an exploded view of a 3-D assembly.*(F32)
CADD.08 Explain and Utilize the concepts of sketching and the sketching process used in preliminary design and development.
CADD.08.01 Produce proportional two- and three-dimensional sketches and designs.

CADD.08.02 Use sketching techniques as they apply to a variety of objects.
CADD.08.03 Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.
CADD.08.04 Explain the purpose of sketching and how it applies to design.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- CCE2(9-12): I can give and receive actionable and relevant feedback with openness to be able to determine meaningful revisions for success.
- P2(9-12): I can strengthen my weaknesses by identifying, initiating, and practicing appropriate strategies to become confident in my ability to overcome my challenges.
- TI2(9-12): I can evaluate my objectives and a variety of credible resources to find the best solutions for any challenge.

Understandings: Students will understand that…

- There are industry standards and practices for creating multiview drawings, including layout conventions, symbol usage, and documentation requirements for manufacturing and assembly.
- Multiview drawings use orthographic projection techniques to represent a 3D object in multiple 2D views (such as front, top, side) simultaneously.
- AutoCAD allows for precise dimensioning and annotation of multiview drawings, including adding dimensions, notes, and symbols to convey specific measurements, tolerances, and other design requirements.
- AutoCAD enables the organization of different views and layers within a drawing, facilitating clarity and ease of editing without affecting other parts of the design.
- Each view (front, top, side, etc.) in a multiview drawing shows the object as if viewed along a different plane, providing comprehensive information about its shape, size, and features from various angles.
- They must maintain accuracy in aligning views and dimensions to ensure that the drawing represents the 3D object without distortion or ambiguity.
- Multiview drawings serve as a communication tool between designers, engineers, and manufacturers to convey design

Essential Questions:

- What was it like for drafters before computer technology including software such as AutoCAD or Solidworks?
- How does isometric projection differ from other types of projections (e.g., orthographic) and why do we use it?
- How many and which views are necessary for representing a 3D object with a technical drawing?
- What are the essential tools and features in AutoCAD for creating a multiview drawing?
- How do professionals use CAD software to create and modify isometric drawings efficiently?
- What are the fundamental principles of 3D printing?
- How can 3D printing be used in various industries and applications?
- What are the advantages and limitations of 3D printing?

details, specifications, and assembly requirements effectively. ● 3D printing is a form of additive manufacturing where objects are created layer by layer from digital models, contrasting with traditional subtractive manufacturing methods. ● CAD (Computer-Aided Design) software is essential for creating and preparing 3D models for printing, allowing for precise control over dimensions, geometry, and features. ● Parameters such as layer height, infill density, print speed, and temperature settings are adjusted to optimize print quality, strength, and time efficiency based on the object's requirements.	
Students will know... ● How to differentiate between visible lines and hidden lines and use projection lines to align the drawing. ● How to draw a complex 3-D Isometric shape with proper markings and labels. ● Industry standards and conventions for technical drawings (e.g., ANSI, ISO standards). ● Properly setup a drawing area on AutoCAD. ● How to effectively use the GRID and SNAP options. ● How to create geometric entities such as: lines, circles, arcs, ellipses, and splines. ● Create parallel geometric entities ● When to use the different types of lines. ● The importance of iterative design, revisions, and documentation. ● The capabilities of the 3-D printer and how it works. ● Knowledge of different materials used in 3D printing, their properties and suitability for various applications. ● The fundamental design concepts specific to 3D printing such as tolerances, supports and orientation for optimal print quality. ● Safety protocols when handling 3D printing equipment and materials. ● How to operate a 3D printer, including steps, calibration and maintenance procedures. ● How to work collaboratively involving 3D printing, sharing ideas and integrating different perspectives.	**Students will be able to...** ● Draw basic 2-D Orthographic shapes ● Draw complex 2-D Orthographic shapes w/ hidden lines ● Draw basic 3-D Isometric shapes ● Draw complex 3-D Isometric shapes w/ hidden lines ● Draw basic geometric shapes ● Trim/extend line segments ● Trim/extend circles ● Understand Cartesian and Polar coordinates ● Understand the difference between hidden lines and object lines ● Send drawing to printer/plotter ● Create parallel geometric entities ● Generate a 2-D multiview drawing ● Produce orthographic projects of simple geographic parts. ● Create their own basic 3-D model ● Print their model using the 3-D printer ● Make cavalier, normal and cabinet oblique drawings ● Manipulate 3D models in AutoCAD to achieve isometric, oblique, and perspective views ● Prepare 3D models in AutoCAD to modify for printing, considering factors like scale, orientation and support structures. ● Operate 3D printing equipment including optimizing printer settings, troubleshooting issues, and implementing safety protocols.

Key Vocabulary:

- Isometric shape
- Orthographic shape
- Line
- Hidden line
- Dynamic Input
- Fillet
- Trim
- Extend
- Pedit
- Construction line
- Short break line
- Section line
- Extension line
- Leader line
- Phantom line
- Circle
- Arc
- Precision
- Proportion
- Pictorial sketches
- Oblique
- One point perspective
- Two point perspective
- Cavalier drawing
- Normal drawing
- Cabinet oblique drawing
- Shading: stipple, straight line
- Ellipse
- Spline
- World space
- Origin
- Coordinate system
- Layers
- Model space
- Paper space
- Blocks

Assessment Evidence

Performance Tasks:

- **Performance Task 1: The Guide Plate:** Create a technical drawing by hand of the guide plate provided. This performance task will give students an introduction to drafting prior to the use of computers. Students will use the tools properly including rulers, sharpened pencil and a compass/stencils as needed. They will maintain consistent line weights and spacing, keep the drawing neat and use the educational drafting standards for symbols, line types and dimensioning. **CCE2(9-12),**

- **Performance Task 2: The Bracket:** Technical drawing created on AutoCAD. This performance task involves time management, standard compliance and precision to maintain accuracy throughout the drawing process. They will need to use advanced tools when needed such as Trim, Extend, Offset, and Fillet. To ensure accuracy they will use Object Snaps and Polar Tracking. They will finally add details including dimensions and text annotations of the title block and print.

- **Summative: Design project:** Students will design an object

Other Evidence:

- **Interim:** Sketching (no dimensioning) geometric solids creating multiview drawings using graph paper and a ruler and the proper use of all types of lines. **P2(9-12)**

- **Interim:** Students will answer questions based on lecture and text reading during the unit 2 based on dimensioning and line use.

- **Interim: The Spacer Design:** Students will create a drawing with AutoCAD using new tools learned such as offset, trim, extend.

- **Interim: The Bracket Design:** Students will create a multiview drawing utilizing the new learning about dimensioning and title blocks. Students will have an opportunity afterwards to revise the project through AutoCAD and update the drawing if needed.

that they will 3D print. They will come up with the idea, and create the technical drawing with AutoCAD. This performance task involves time management, standard compliance and precision to maintain accuracy throughout the drawing process. When 3D printing students will work collaboratively and teach the student following them how to use the printer if needed. **TI2(9-12)**	

Learning Plan

- Students will be learning about and producing technical drawings that increase in difficulty level and skill level throughout the unit. As they learn about new tools they will be able to create drawings for more elaborate objects/geometries.
- Students will find and apply resources to identify solutions and manage projects.**CCE2(9-12)**
- Students will ask questions to direct learning and self-advocate while working on drawings.**P2(9-12)**
- Students will design a three dimensional object that they will 3D print and they will operate the 3D printer for their finished product.**TI2(9-12)**

Teacher Resources: Technical Drawing 101 with AutoCAD 2023, Douglas Smith, Anotnio Ramirez, Jana Schmidt, SDC Publications.; AutoCAD 2023 Tutorial First Level 2D Fundamentals, Randy H. Shih, SDC Publications; Autodesk: AutoCAD Architecture 2023 Fundamentals, Elise Moss, SDC Publications

Unit 3 - Architectural Drafting and Design

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Technology Education CT State Standards

- ARCH.01 Identify significant historical events and trends that have impacted architecture.
- ARCH.01.01 Discuss current trends in commercial and residential architecture.
- ARCH.01.02 Research and differentiate between design periods that shaped today's structures.
- ARCH.06 Develop technical drawings drafted by hand and computer aided drafting and design(CADD)
- ARCH.06.01Identify,research, develop and explain architectural and construction plans, drawings, diagrams and specifications.
- ARCH.06.02 Draw and sketch by hand to communicate ideas effectively.
- ARCH.06.03 Utilize CADD software to produce technical drawings and architectural proposals.
- ARCH.07 Employ appropriate media to communicate concepts and design.
- ARCH.07.01 Convey information using multi-dimensional drawings.
- ARCH.07.02 Create effective working drawings, and presentation drawing.
- ARCH.07.03 Employ basic model building techniques.
- ARCH.08 Maintain a portfolio to document knowledge, skills and experience in architecture.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- TCC1(9-12): I can ask purposeful, insightful questions to find a variety of innovative solutions.
- CCE2(9-12): I can give and receive actionable and relevant feedback with openness to be able to determine meaningful revisions for success.
- P3(9-12): I can accept constructive feedback and use setbacks to adjust my learning journey in order to reach my goals.

Understandings: Students will understand that…

- Architectural floor plans are fundamental tools used to represent the layout, functionality, and spatial relationships of a building, serving as a blueprint for construction and design.
- Different symbols and elements in floor plans, such as doors, windows, and walls, are standardized representations that convey specific information about the physical structure and layout of a space.
- Various drafting techniques and tools, including hand-drafting

Essential Questions:

- What are the fundamental purposes of architectural floor plans?
- How do different elements and symbols in floor plans represent physical spaces and structures?
- What are the steps involved in creating a comprehensive and detailed floor plan with accuracy and clarity.

and digital CAD software, impact the accuracy, precision, and clarity of floor plans, each offering unique advantages and challenges. • CAD software enhances the drafting process by providing advanced tools for creating, modifying, and visualizing floor plans, which helps in improving precision, efficiency, and presentation.	
Students will know... • How floor plans contribute to the overall design and functionality of a building. • What role floor plans play in communication between architects, builders, and clients. • How various drafting tools and techniques contribute to precision and detail in floor plans. • How to create blocks and use blocks to speed up the process when utilizing multiple of the same element such as windows into their drawing. • How to incorporate details such as dimensions, materials, and layout into a floor plan and elevation plan.	**Students will be able to...** • Be able to calculate square footage of a structure with AutoCAD. • Create a basic floor plan according to local building codes. • Identify stairs, walls, doorways, and windows. • Create door and window openings according to uniform sizes. • Create interior and exterior walls with multiline and hatching tools. • Create blocks for uniform items such as windows, doors, ceiling fans, etc… • Create layers including floor plan, plumbing and electrical. • Identify and utilize blocks for switches, outlets, lights, ceiling fans. • Identify sill, floor plate, stud, corner post, top plate, floor joist and ceiling joist. • Identify header, king stud, jack stud and cripple stud. • Be able to calculate rise, run, span and roof pitch. • Identify tread, riser nosing and stringer of steps. • Consult local building codes for appropriate stair sizes and be able to divide the rise to calculate the number of steps.
Key Vocabulary: • Chamfer • Open tee • Open cross • Closed cross • Multiline • Floor plan • Elevation plan • Blocks • Layers • Freeze • Hide • Drawing limits • Offset • Trim • Mline • Medit • Ellipse	

Assessment Evidence	
Performance Tasks: ● **Project Task 1: The Guest Cottage:** Students will be drafting a drawing for a guest cottage through short video lessons, class lectures and readings from chapter 4 of AutoCAD Architecture 2023 Fundamentals, Elise Moss, SDC Publications. Throughout this drawing they will use new learning to produce the floor plan and plumbing layers with accuracy and precision. They will use architectural style dimensioning and create a window schedule as part of their title block. **TCC1(9-12)** ● **Project Task 2:The Cabin Floor Plan:** Students will be drafting a larger more complex floor plan. This plan will include the use of blocks and an electrical layer in addition to the floor plan and plumbing layers. ● **Project Task 3: The Cabin Elevation Plan:** Students will be drafting a drawing of the vertical elevation of the cabin. Throughout this drawing they will use new learning to produce the siding, roof pitch and exterior details of the side and front view of the cabin. **TCC1(9-12)** ● **Summative Final Project:** Students will create their own unique design and draft of a floor plan and elevation of a one story house (including floor plan, plumbing, electrical and dimensioning layers). After creating a title block they will use the plotter to print their plans to submit professional style drawings of their home. **CCE2(9-12)**	**Other Evidence:** ● **Interim:** Students will answer questions based on lecture and text reading of 4.1 based on drafting architecture and design. ● **Interim:** Students will answer questions based on lecture and text reading for unit 4 based on the creation of walls and new tools such as open tee, open cross, ellipse, arcs and chamfer. **P3(9-12)**

Learning Plan
In this unit students will learn about architectural drawings and how to create a basic floor and elevation plan. They will have a broader understanding of architecture and design and will learn about career paths involving architectural drafting in fields such as architecture, engineering, and construction. ● Students will create drawings through new learning based on the understanding of the basics of architecture and the role of drafting in

building design. **TCC1(9-12)**

- Students will develop fundamental drawing skills necessary for drafting floor plans. They will learn the components and symbols used in architectural floor plans. **CCE2(9-12)**
- Students will explore more complex aspects of floor plan drafting including scaling, dimensioning, and annotation.
- Students will design a complete floor plan for a specific scenario (e.g., family home, community center). They will prepare and present the final floor plan to the class and receive and incorporate feedback from peers and instructors. **P3(9-12)**

Teacher Resources: Technical Drawing 101 with AutoCAD 2023, Douglas Smith, Anotnio Ramirez, Jana Schmidt, SDC Publications.; AutoCAD 2023 Tutorial First Level 2D Fundamentals, Randy H. Shih, SDC Publications; Autodesk: AutoCAD Architecture 2023 Fundamentals, Elise Moss, SDC Publications