CAAI 2-Unit-Plan-1B-Orthographic (Multiview Drawings)

Content Area: **CTE**
Course(s): **CAD I**
Time Period: **September**
Length: **1**
Status: **Published**

Unit Overview

Orthographic Projection

Students will continue to explore the concepts and techniques involved in creating an orthographic drawings. The lesson will cover visualization techniques to help students understand the necessary views needed to properly present the interior and exterior of a building structures and the features that are unique.

Students will sketch by hand different architectural elements and apply the detailing necessary to fully describe a design in three, separate two-dimensional views based on the glass box theory.

Orthographic projection is a way of representing a 3-dimensional object in two dimensions. It is a form of parallel projection , here the view direction is orthogonal to the projection plane, resulting in each plane of the scene appearing in affine transformation on viewing surface. It is further divided into Multiview Orthographic projections and Axonometric projection.

This projection shows that the object as it looks from the front, right , left, top, bottom, or back, and are positioned relative to each other according to the rules of either first-angle or third-angle projection.

Enduring Understandings

The important ideas and core processes that are central to this lesson are:

1. The tools/functions of CAD/ BIM software can be used to produce an accurate and fully detailed orthographic architectural drawings. Generating hand sketches will also be part of this lesson.
2. The standard views of an orthographic drawing include the top (roof plan) , front (north elevation), left side (west elevation) and right side (east elevation).

Essential Questions

- Why are the views in an orthographic drawing arranged in a specific way?
- Why is it important to include the proper spacing between views of an Orthographic drawing?
- What is First-angle projection?
- What is Third-angle projection?

Standards/Indicators/Student Learning Objectives (SLOs)

ARCH.9-12.3	Maintenance and Operations
ARCH.9-12.9.4.12.B.(1).1	Demonstrate communication skills and strategies that are used to work effectively with potential clients and others.
ARCH.9-12.9.4.12.B.(1).2	Employ appropriate representational media to communicate concepts and design.
ARCH.9-12.9.4.12.B.(1).3	Integrate structural, environmental, safety, building envelope, and building service systems in the design of buildings and structures.
ARCH.9-12.9.4.12.B.(1).4	Review traditional project phases and various roles within them to plan for and implement phases within a project.
ARCH.9-12.9.4.12.B.(1).5	Evaluate and select suitable environmental impact practices to enhance project acceptance and quality.
ARCH.9-12.9.4.12.B.(2).4	Identify project turnover procedures needed to successfully manage construction projects.
ARCH.9-12.9.4.12.B.(2).5	Plan building in accordance with contracts to meet budget and schedule.
ARCH.9-12.9.4.12.B.(2).6	Describe testing and inspection procedures used to ensure successful completion of construction projects.
ARCH.9-12.9.4.12.B.(2).7	Assess the purpose for scheduling as it relates to successful completion of construction projects.
ARCH.9-12.9.4.12.B.(2).8	Identify closeout procedures needed to effectively complete construction projects.
ARCH.9-12.9.4.12.B.(2).9	Demonstrate understanding of risk management principles and other strategies and tactics used to maintain, increase, or decrease risk.
ARCH.9-12.9.4.12.B.(2).10	Create a jobsite safety program to ensure safe practices and procedures.
ARCH.9-12.9.4.12.B.(2).12	Describe procedures for jobsite security to prevent liability.
ARCH.9-12.9.4.12.B.(2).15	Demonstrate knowledge of proper changeover procedures for successful completion of a construction project.
ARCH.9-12.9.4.12.B.(2).16	Examine building systems and components to evaluate their usefulness to construction projects.
ARCH.9-12.9.4.12.B.(2).17	Use craft skills to meet or exceed teacher and/or employer expectations.
ARCH.9-12.9.4.12.B.(3).1	Recognize and employ universal construction signs and symbols to function safely.
ARCH.9-12.9.4.12.B.(3).2	Use troubleshooting procedures when solving a maintenance problem to maintain project.
ARCH.9-12.9.4.12.B.(3).3	Apply construction skills when completing classroom projects and/or repairing, restoring, or renovating existing worksite structures to ensure long-term use of buildings and structures.
ARCH.9-12.9.4.12.B.(3).4	Evaluate and assess an existing structure to determine the repairs or renovations required to restore operation of the structure.
ARCH.9-12.9.4.12.B.(3).5	Plan and practice preventive maintenance activities to service existing structures.
ARCH.9-12.9.4.12.B.1	Demonstrate language arts knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
ARCH.9-12.9.4.12.B.2	Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
ARCH.9-12.9.4.12.B.3	Demonstrate science knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
ARCH.9-12.9.4.12.B.4	Perform math operations, such as estimating and distributing materials and supplies, to complete classroom/workplace tasks.

ARCH.9-12.9.4.12.B.5	Apply principles of physics, as they relate to worksite/jobsite situations, to work with materials and load applications.
ARCH.9-12.9.4.12.B.7	Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.
ARCH.9-12.9.4.12.B.8	Locate, organize, and reference written information from various sources to communicate with others.
ARCH.9-12.9.4.12.B.9	Evaluate and use information resources to accomplish specific occupational tasks.
	Roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment impact business operations. Key organizational systems impact organizational performance and the quality of products and services. Understanding the global context of 21st-century industries and careers impacts business operations.
	All clusters rely on effective oral and written communication strategies for creating, expressing, and interpreting information and ideas that incorporate technical terminology and information.
	Academic concepts lay the foundation for the full range of career and post-secondary education opportunities within the career cluster.

Lesson Titles

- Understanding the various techniques for viewing objects.
- Understanding the orthographic projection process for developing multi-view drawings.
- Understanding the process of producing proportional two- and three-dimensional sketches and designs.

Career Readiness, Life Literacies, & Key Skills:

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.7	Plan education and career paths aligned to personal goals.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Equity Considerations

12.9.3.IT.1	Demonstrate effective professional communication skills and practices that enable positive customer relationships.

LGBTQ and Disabilities Mandate

Topic: Increasing LGBT members in construction

Materials Used: https://buildoutalliance.org/

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Climate Change

Topic: Green building

Materials Used: https://worldgbc.org/news-media/sustainable-construction-face-climate-change

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Holocaust Mandate

Topic: Bias against women in construction

Materials Used: https://www.constructyourfuture.com/blog/breaking-the-bias-women-in-construction

Addresses the Following Component of the Mandate:

- Bias
- Bigotry
- Bullying
- Holocaust Studies
- Prejudice

Asian American Pacific Islander Mandate

Topic: AAPI contributions to infrastructure

Materials Used: https://www.captechu.edu/blog/aapi-heritage-month-contributions-infrastructure

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

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Inter-Disciplinary Connections

- Applied **Mathematics**
- **Arts** Related to Product "Form"
- **Historical** References & Perspectives
- Technical **Literacy**
- Applied **Sciences**

0x		Connections to Equations.
0x		During high school, students begin to formalize their geometry experiences from elementary a develop Euclidean and other geometries carefully from a small set of axioms.
0x		In real world problems, the answers are usually not numbers but quantities: numbers with unit commonly used attributes such as length, area, and volume. In high school, students encounter person-hours and heating degree days, social science rates such as per-capita income, and rate which they themselves must conceive the attributes of interest. For example, to find a good me driver, or fatalities per vehicle-mile traveled. Such a conceptual process is sometimes called q important variable in evaporation. Quantification is also important for companies, which must
0x	LA.9-10.RH.9-10.3	Analyze in detail a series of events described in a text; draw connections between the events, t

0x LA.9-10.RH.9-10.9	Compare and contrast treatments of the same topic, or of various perspectives, in several prim
0x LA.9-10.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (

9.3.12.AR.1	Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.
9.3.12.AR.3	Analyze the lifestyle implications and physical demands required in the arts, audio/visual technology and communications workplace.
9.3.12.AR.5	Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
12.9.3.IT.1	Demonstrate effective professional communication skills and practices that enable positive customer relationships.
STEM.9-12.9.4.12.O.3	Demonstrate science knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
STEM.9-12.9.4.12.O.9	Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.
STEM.9-12.9.4.12.O.12	Develop and interpret tables, charts, and figures to support written and oral communications.
STEM.9-12.9.4.12.O.15	Prepare science, technology, engineering, and mathematics material in oral, written, or visual formats to provide information to an intended audience and to fulfill the specific communication needs of that audience.
STEM.9-12.9.4.12.O.16	Apply active listening skills to obtain or clarify information pertaining to plans, processes, projects, or designs.
STEM.9-12.9.4.12.O.17	Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.
STEM.9-12.9.4.12.O.18	Employ critical thinking and interpersonal skills to resolve conflicts.
STEM.9-12.9.4.12.O.20	Conduct technical research to gather information necessary for decision-making.
STEM.9-12.9.4.12.O.21	Effectively develop and apply the skills inherent in systems engineering in which requirements, configuration, integration, project management, quality assurance, and process applications are necessary.
STEM.9-12.9.4.12.O.46	Employ leadership skills to accomplish goals and objectives.
STEM.9-12.9.4.12.O.47	Employ organizational skills to foster positive working relationships and accomplish organizational goals.
STEM.9-12.9.4.12.O.48	Employ teamwork skills to achieve collective goals and use team members' talents effectively.
STEM.9-12.9.4.12.O.55	Identify and demonstrate positive work behaviors and personal qualities needed to succeed.
STEM.9-12.9.4.12.O.56	Develop a Personalized Student Learning Plan to meet career goals and objectives.

Anticipatory Set

Possibilities of short activities that will focus the student's attention before the actual lesson begins:

1. **Vocabulary connections-** terms and definitions in a short game of "Trash-ketball"
2. **Challenge**- Offer students sketching task and let them try to solve it as a group then present it to the class.
3. **Challenge**- Offer a volunteer student a CAD task and let him/ her solve it on the board.

4. **Use manipulatives or models**

- **Description:** Teacher will use physical models to prepare students to learn a specific concept or better highlight the critical attributes of new concepts. Teacher will use a variety of models of two or three-dimensional shapes.

1. **Show & Tell**: Use a prop from an article students are about to read related to industry. Examples: Professional drawings - Architectural, Interior Design, Engineering.
2. **Use a visual**- Teacher will use visual aides to encourage students to better connect to new concepts. Examples: Real drawings used in industry- Architectural, Interior Design, Engineering. The teacher will tell students that they have thirty seconds to remember everything they can about the drawing. After the thirty seconds, the teacher will remove the drawings and ask students to recall all they can about them. The teacher will solicit ideas and use this to introduce distinguishing between main idea and supporting details.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

Direct Instruction

- **Possibilities include**
  - Structured Overview
  - Lecture
  - Explicit Teaching
  - Drill & Practice
  - Compare & Contrast
  - Didactic Questions
  - Demonstrations
  - Guided & Shared - reading, listening, viewing, thinking

Interactive Instruction

- **Possibilities include**
  - Debates
  - Role Playing
  - Panels
  - Brainstorming
  - Peer Partner Learning
  - Discussion
  - Laboratory Groups
  - Think, Pair, Share
  - Cooperative Learning Groups
  - Jigsaw
  - Problem Solving
  - Structured Controversy
  - Tutorial Groups
  - Interviewing

- Conferencing

Indirect Instruction

- **Possibilities include**
  - Problem Solving
  - Case Studies
  - Reading for Meaning
  - Inquiry
  - Reflective Discussion
  - Writing to Inform
  - Concept Formation
  - Concept Mapping
  - Concept Attainment
  - Cloze Procedure

Independent Study

- **Possibilities include**
  - Essays
  - Computer Assisted Instruction
  - Journals
  - Learning Logs
  - Reports
  - Learning Activity Packages
  - Correspondence Lessons
  - Learning Contracts
  - Homework
  - Research Projects
  - Assigned Questions
  - Learning Centers

Experiential Learning

- **Possibilities include**
  - Field Trips
  - Narratives
  - Conducting Experiments
  - Simulations
  - Games
  - Storytelling
  - Focused Imaging
  - Field Observations
  - Role-playing
  - Model Building
  - Surveys

Instructional Skills

- **Possibilities include**
  - Explaining
  - Demonstrating
  - Questioning
  - Questioning Technique
  - Wait Time
  - Levels of Questions

Modifications

Instructor implements the following teaching strategies with students who need special accommodations. Instructor also implements specific requirements from the students' individual reports.

- Classroom:
  - Seat student near instruction, avoid distracting stimuli
  - Clarify that student understands directions
  - Cuing student to refocus (verbal/nonverbal)
  - Praise for positive behaviors.
  - Study guides provided, when available. Prior knowledge to upcoming quizzes/tests.
- Standardized Testing:
  - Extra Time
  - Repeating, clarifying, or rewording directions.
- Delsea One – Students benefit from increased opportunities for enrichment and tutoring during Delsea One Tutoring.

At risk modification

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments .
- Adjusted assignment timelines .
- Agenda book and checklists .
- Answers to be dictated .
- Assistance in maintaining uncluttered space .
- Books on tape .
- Concrete examples .

- Extra visual and verbal cues and prompts .
- Follow a routine/schedule .
- Graphic organizers .
- Have students restate information .
- No penalty for spelling errors or sloppy handwriting .
- Peer or scribe note-taking .
- Personalized examples .
- Preferential seating .
- Provision of notes or outlines .
- Reduction of distractions .
- Review of directions .
- Review sessions .
- Space for movement or breaks .
- Support auditory presentations with visuals .
- Teach time management skills .
- Use of a study carrel .
- Use of mnemonics .
- Varied reinforcement procedures .
- Work in progress check .

ELL Modifications

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests
- Read directions to the student
- Read test passages aloud (for comprehension assessment)
- Vary test formats

IEP & 504 Modifications

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes .
- Assign fewer problems at one time (e.g., assign only odds or evens) .

- Differentiated center-based small group instruction .
- Extra time on assessments .
- Highlight key directions .
- If a manipulative is used during instruction, allow its use on a test .
- Opportunities for cooperative partner work .
- Provide reteach pages if necessary .
- Provide several ways to solve a problem if possible .
- Provide visual aids and anchor charts .
- Test in alternative site .
- Tiered lessons and assignments .
- Use of a graphic organizer .
- Use of concrete materials and objects (manipulatives) .
- Use of word processor .

G&T Modifications

- Alternate assignments/enrichment assignments
- Enrichment projects
- Extension activities
- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

Formative Assessment

- Observations during in-class activities; of students' non-verbal feedback during lecture.
- Homework exercises as review for exams and class discussions.
- Reflections journals that are reviewed periodically during the semester.
- Question and answer sessions, formal—planned and informal—spontaneous.
- Conferences between the instructor and student at various points in the semester.
- In-class activities where students informally present their results.
- Student feedback collected by periodically answering specific question about the instruction and their self-evaluation of performance and progress.

Summative Assessment

- Quiz, Test, MP Assessments about the specified lesson: **HandSketches-Orthographic-Projection**
- Final examination (a truly summative assessment) about the specified lesson.
- Projects (project phases submitted at various completion points could be formatively assessed) about the specified lesson.
- Portfolio that include all class assignments.
- Student evaluation of the lesson (teaching effectiveness).
- Instructor self-evaluation about the current lesson
- By Rubric shown below.

Computer Aided Design Evaluation Rubric

Category	1 Does Not Meet Expectations (0-25% of points)	2 Attempted to Meet Expectations (25-50% of points)	3 Meets Expectations (50-75% of points)
Defining the Problem	Offers an unclear statement of the problem. There is no support, documentation, or need for development. Little or no work is evident.	A short description and explanation is offered to the problem without any support and specifications for development pursuits.	A good statement and support/documentation is given to suggest the need to develop the product. Design specifications and constraints are also noted.
Research, Brainstorming, and Developing Ideas	Little research and brainstorming accomplished. Ideas generated are not original.	Research is evident as an outcome of brainstorming. Ideas generated are a result of the brainstorming process and not original.	Ideas generated are new and original as an outcome of brainstorming and research. Little suggestions are offered for the rest of the design process if any.
Conceptual Design and Sketching	Only one sketch is offered for a design review.	At least two sketches are offered for a review. The sketches offer no design specifications or annotation.	More than two sketches are offered for a review. The sketches include design specifications and annotation for developing the design.

Category	1	Does Not Meet Expectations (0-25% of points)	2	Attempted to Meet Expectations (25-50% of points)	3	Meets Expectations (50-75% of points)
Developing the Design	A set of sketched working drawings without an assembly drawing. 3D representations of each part of the assembly on the working drawings are missing. Annotations, dimensioning and blocks are not accurate.		A set of production drawings with an assembly and working drawings. Each orthographic drawing includes a 3D representation. Annotations, notations, blocks, and dimensioning are inaccurate.		A set of production drawings with an assembly and workin drawings. Mulitview drawings are added additiona to orthographic drawings. A 3D representation is included on all multiview drawings. Annotations, notations, blocks, and dimensioning are slightly inaccurate.	
Making a Model or Prototype	Model is missing or does not look like concept sketches.		Model is proportional to sketches, inaccurate in scale, and dimensioning does not follow industry standards.		Model is accurate in proportion and dimensioning according to concept sketche and industry standards.	
Engineering Testing and Evaluating the Design	Testing and evaluating designs/model are missing or not checked/approved.		Testing and verification attempted by checks and approvals without results.		Testing and verification are complete with checks/approvals and detailed results are not following industry standards.	

Category	1	Did Not Meet Expectations (0-25% of points)	2	Attempted to Meet Expectations (25-50% of points)	3	Meets Expectations (50-75% of points)
Revising the Design	No attempt made to revise the design. Revision blocks not completed.		Designs revised without revision blocks completed.		Designs revised according to change requests and revision blocks filled out appropriately, but no approva or checking sought after the first revision.	
Creating a Final Model, Prototype, or Mockup	Missing prototype model or mockup.		Mockup or prototype model is not accurate according to production drawings		Prototype model or mockup i accurate according to production drawing and created out of materials not specified.	
Presentation	A presentation given without		A presentation given without		An organized outlined	

	preparation and an outline.	a professional presence, good public speaking and a well thought out organized outline.	presentation with a professional presence, a written proposal, good public speaking and visual aids.

Resources & Materials

- Residential Housing and Interiors, 4th Edition b**y:** Clois E. Kicklighter, Ed. D. and Joan C. Kicklighter
- Housing and Interior Design By: Evelyn L. Lewis, Ed.D., Carolyn Turner Smith, Ph.D
- Interior Design By : Stephanie Clemons
- Glencoe Mechanical Drawing: Board and CAD Techniques, Student Edition: 1st (First) Edition by Glencoe McGraw-Hill
- Basic Technical Drawing by Spencer, Dygon, Novak Glencoe McGraw-Hill
- Exploring Drafting, Instructor's Manual Instructor's Manual, 10th Edition by John R. Walker (Author), Bernard D. Mathis

Technology Materials and Standards

Specific technology resources include:

- AutoDesk Software
- REVIT Software
- Google SketchUp Software
- Smart boards
- Computers
- Chrome Books
- 3D printer
- Large format Printer (plotter)

9.3.12.AR-VIS.1	Describe the history and evolution of the visual arts and its role in and impact on society.
9.3.12.AR-VIS.2	Analyze how the application of visual arts elements and principles of design communicate and express ideas.
9.3.12.AR-VIS.3	Analyze and create two and three-dimensional visual art forms using various media.
12.9.3.IT-SUP.9	Employ technical writing and documentation skills in support of an information system.
12.9.3.IT-WD.9	Perform maintenance and customer support functions for digital communication products.
ARCH.9-12.9.4.12.B.24	Employ technological tools to expedite workflow.
ARCH.9-12.9.4.12.B.25	Operate electronic mail applications to communicate.
ARCH.9-12.9.4.12.B.26	Operate Internet applications to perform tasks.
ARCH.9-12.9.4.12.B.27	Operate writing and publishing applications to prepare business communications.
ARCH.9-12.9.4.12.B.72	Employ information management techniques and strategies to assist in decision-making.
ARCH.9-12.9.4.12.B.75	Use and maintain appropriate tools, machinery, equipment, and resources to accomplish project goals.

Computer Thinking and Design Standards

CS.K-2.8.1.2.CS.3	Describe basic hardware and software problems using accurate terminology.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.CS	Computing Systems
	Describing a problem is the first step toward finding a solution when computing systems do not work as expected.
	A computing system involves interaction among the user, hardware, application software, and system software.
	A computing system is composed of software and hardware.