GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ACCT—ARCHITECTURAL DRAWING

PATHWAY: Architectural Drawing and Design

COURSE: Introduction to Engineering Drawing and Design

UNIT: Multiview Drawings – Unit 5

INTRODUCTION

Annotation: This unit introduces students to multiview drawings through demonstration and practice in orthographic projection.

Grade(s):

X	9th
X	10th
X	11th
X	12th

Time: Ninety (90) 50-minute periods.

Author: Liz Pharr

Additional Author(s):

Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

FOCUS STANDARDS

GPS Focus Standards:

ACT-IED-11. Students will use orthographic projection to create and dimension multiview drawings.

Explain and apply nominal size, basic size, tolerance, unilateral tolerances, bilateral tolerances, fit, actual fit, clearance fit, interference fit, transition fit, allowance, maximum material limit, minimum material limit, basic-hole system, and basic-shaft system.

Draw an object that is described with two views.
Draw an object that is described with three views.
Select proper drawing scale, views, and layout.
Draw an object that has an inclined surface.
Draw an object containing circles and arcs.
Change view, view names and multiview views.
Create orthographic projections utilizing the necessary views.

GPS Academic Standards:

MM1G1. Students will investigate properties of geometric figures in the coordinate plane.
MM1G3. Students will discover, prove, and apply properties of triangles, quadrilaterals, and other polygons.
MM4G1. Students will understand the properties of circles.
MM1P4. Students will make connections among mathematical ideas and to other disciplines.
MM1P5. Students will represent mathematics in multiple ways.

National / Local Standards / Industry / ISTE:

ADDA: Fundamental drafting skills
ADDA: Basic CADD skills

UNDERSTANDINGS & GOALS

Enduring Understandings:

- The basis for all drawing is the clear representation of the object through standard layouts of views to best fully describe the object. Multiview drawings are the backbone of working drawings.

Essential Questions:

- Why is standardization of drawing practices important with the globalization of commerce?

Note: Depending on when or whether traditional (board) drafting is going to be taught in addition to CAD systems, activities may need to be supplemented or changed accordingly.

Knowledge from this Unit:

- Understand that working drawings include shape description, measurements, symbols and annotations.

- See the relationship between two-dimensional views and a three-dimensional object.
- Use the shape of the object to determine the correct views to show.
- Understand the vocabulary for multiview and pictorial drawing.
- See the relationship between dimension placement and iease in reading and understanding drawings.
- Understand the difference in size and location dimensions.
- Recognize different types of holes and their purposes.
- Understand tolerancing.

Skills from this Unit:

- Determine appropriate views to use to best describe an object.
- Lay out views using standards procedures.
- Construct and dimension multiview drawings from pictorials.
- Supply missing views in three-view drawings and dimension.
- Place dimensions according to standards and conventions to make drawing most easily read.
- Dimension where an object shows its true shape.
- Read blueprints of multiview drawings.
- Apply annotations, symbols and shop notes.
- Draw all types of holes.
- Use symbols and annotation correctly.
- Apply tolerances correctly.

ASSESSMENT(S)

Assessment Method Type: Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

____ Pre-test
_x_ Objective assessment - multiple-choice, true- false, etc.
  _x_ Quizzes/Tests
  _x_ Unit test
____ Group project
____ Individual project
____ Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
  __ Self-check rubrics
  __ Self-check during writing/planning process
  __ Journal reflections on concepts, personal experiences and impact on one's life
  __ Reflect on evaluations of work from teachers, business partners, and competition judges
  __ Academic prompts
  __ Practice quizzes/tests

_____ Subjective assessment/Informal observations
__ Essay tests
__ Observe students working with partners
__ Observe students role playing
_____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
x___ Dialogue and Discussion
__ Student/teacher conferences
__ Partner and small group discussions
_x_ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners
_____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
__ Application of skills to real-life situations/scenarios
_____ Post-test

Assessment(s) Title:

- Drawing rubric
- Hole Quiz
- Holes and dimensioning quiz
- Multiview Quiz
- View dimensions quiz

Assessment(s) Description/Directions:

Attachments for Assessment(s):

- Hole Quiz
- Holes and dimensioning Quiz
- Multiview Quiz
- View dimensions quiz
- Hole Quiz - key
- Holes and dimensioning Quiz - key
- Multiview Quiz - key
- View dimensions quiz –key

LEARNING EXPERIENCES

Instructional planning: Include lessons, activities and other learning experiences in this section with a brief description of the activities to ensure student acquisition of the knowledge and skills addressed in the standards. Complete the sequence of instruction for each lesson/task in the unit.

Sequence of Instruction

Notes:

The choice of activities is determined by whether the students are doing traditional (board) drafting or starting on a CAD system. (The directions for the CAD activities are based on Autodesk's AutoCAD 2009 software but can be modified for other programs.) The instructor should choose the appropriate instruction to support either board or CAD drafting.

Dimensioning is not in the sequence as a separate unit but is embedded in all the lessons for each particular kind of construction taught within the lesson.

Specific drawings are not given for the assignments but suggestions as to the kind of drawing to assign. Instructors should choose examples to support the skills being taught from their course texts.

Blueprint reading assignments should be chosen from a text also. One of the best books to use for blueprint reading for an introduction class is any edition of "Basic Blueprint Reading and Sketching" by Dr. C. Thomas Olivo and Thomas P. Olivo. New and used editions are available on Amazon. Each short unit has an explanation and examples followed by a drawing with questions. The units cover most skills taught in an introduction class.

See "Drawing and problems sources" for additional sites to get drawing exercises.

Enter autodesk in the search window at www.youtube.com to find several videos and tutorials for use in this unit.

Snagit is software for capturing images,videos and webpages. Download a free 30-day trial at http://www.techsmith.com/screen-capture.asp, but when you see its value in preparing lessons, PowerPoints, tutorials, and handouts, you'll buy it at the end of your 30 days. It is very reasonable and easy to learn.

A great source for materials is at www.schroff.com. Schroff provides texts for several kinds of software including Autodesk, SolidWorks, MicroStation, ProEngineer and others. They also have the books for earlier releases and versions for older software.They offer up to five examination copies for instructors. Most of the books are accompanied by CD's with projects, videos, and tutorials.

1. Identify the Standards. Standards should be posted in the classroom for each lesson.

ACT-IED-11. Students will use orthographic projection to create and dimension multiview drawings.

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Draw an object that has an inclined surface.
Draw an object containing circles and arcs.
Change view, view names and multiview views.
Create orthographic projections utilizing the necessary views.

2. **Review essential questions.**
3. **Identify and review vocabulary. (Some terms may not be applicable based on whether you're using a CAD system or teaching on the board.)**
4. **Interest approach - mental set** Explain how multiview drawings and working drawings are the final step for the designer to present his work for production.

LESSON 1 MULTIVIEW PROJECTION

Discussion

Ask students whether they remember examples used in unit on Graphic Communication to show the difference in pictorials and orthographics. Go through same exercise again.

1. **See "Prep for orthographic projection."**
2. **Sketch a person as a pictorial and then a person as a multiview.**
3. **Do the same thing with a common object such as a chair. Explain what determines whether orthographics or pictorials are to be used.**
4. **Explain why pictorials work for drawing people but not for working drawings to be used for production.**
5. **Explain the three dimensions. Ask which dimension (width, depth, and height) would show on the sketch of the person.**
6. **Continue to sketch common objects such as a cell phone, a car, and a house to get the concept of views.**
7. **Show a standard brick and ask how many views are possible. Ask how many views are needed to describe the brick. Explain and emphasize the three dimensions needed to describe a figure.**
8. **Sketch some pictorials with dimensions. Then sketch the views with dimensions not filled in and ask students to tell you which dimensions go in the blanks. Emphasize each view sharing one dimension with every other view. Give handout "Glass box."**
9. **Give students an exercise from your text that gives and isometric and the multiviews and have them fill in the dimensions on the orthos.**
10. **Work with them through several exercises to get them to understand the relationship of 3-D dimensions to their placement on orthos before starting on orthographic projection.**
11. **Give them a quiz with dimensioned isometrics and have them fill in the dimensions on orthos.**

12. **Give quiz "View Dimensions."**

LESSON 2 ORTHOGRAPHIC PROJECTION

1. **Introduce students to orthographic projection.**

   Standard of placement of views, not labeling views, shows which view it is.

   Determine which view to use as the front view.

   Show examples of correct alignment of views based on 6 views of a solid, taking out 3 repetitive views. (Can still use the person sketch for this.)

2. **Show "Projection" PPT (Also as a handout) An additional source is the PPT Orthographic Projection** 2 Dimensional View of an object at www.engr.sjsu.edu/youssefi/me19/notes/Ortho**Projection**.ppt.

3. **Show a common object such as a brick. Explain how some features are shown as hidden lines. Review the alphabet of lines again and emphasize hidden lines. Explain the need to show "hidden" features in orthos but not in pictorials.**

4. **Again, ask how many views are generally needed and why. Ask what kind of thing you draw that would only need two dimensions to fully describe. Get them to finally come up with objects that are symmetrical, such as a screwdriver or a bike wheel. Explain center line as basis for symmetry.**

5. **Project or show an isometric and show the multiviews. Demonstrate on the board or project the process of projecting the lines and points and features between the views. Use a simple object with only horizontal and vertical planes. Explain use of projection lines to set up drawing.**

6. **Explain the use of the 45 degree (miter line) to project from top to side.**

7. **Use appropriate sections of "Ortho. Examples and Exercises" for support.**

8. **Give students files or drawings with layout set up to practice drawing a three-view. If using CAD, see "Constructing Multiview Drawings in AutoCAD."**

9. **Explain centering multiview drawings. See "Centering three-view drawings – prep notes," if applicable. See also "Tips for working with fractions" for math support.**

10. **Choose simple horizontal and vertical planed drawings for students to copy to learn layout.**

11. **Give exercises from text with a dimensioned isometric and two views drawn. Have them draw the two given views and supply the missing view.**

12. **Give exercises with dimensioned isometrics to draw as three views.**

13. **Go through basic dimensioning rules for multiviews. See "Dimensioning notes." See http://courses.washington.edu/me123lab/Files/Lecture/Slides/Giesecke_Ch9-dimensions.pdf and/or** Microsoft PowerPoint - dimensioning06.pps This is a good PPT from Texas.
www.texastandi*.unt.edu/curriculum/lessons/drafting_trades/dimensioning06/dimensioning06_handout.pdf*
Show slides from this PPT that are applicable for each dimensioning set of skills to teach.
Good general rules can be found at
http://www.maelabs.ucsd.edu/mae_guides/cad/dimensioning/dimensioning_fundementals.htm**.**

14. **Give blueprint reading exercises such as "Three-View Drawings" and "Two-View Drawings" in "Basic Blueprint Reading and Sketching" by Dr. C. Thomas Olivo and Thomas P. Olivo.**

15. **Give Multiview Projection quiz.**

LESSON 3 – PROJECTING INCLINED SURFACES AND CIRCULAR ELEMENTS

1. **Introduce inclined surfaces in orthographic projection. Show again "Projection – PPT" slides 14-18.**
2. **Give exercises with dimensioned isometrics with oblique surfaces to draw as three views.**
3. **Go through dimensioning rules for correct placement of dimensions for angles (offset, angular, which view to place, etc.).**
4. **Introduce circular concepts. Show circles in isometrics and their placement in views. Teach dimensioning practices for circles only.**
5. **Give exercises with drawings with circles.**
6. **Show arcs and their views in multiviews. Emphasize showing no line at the point of tangency in views where arc is projected.**
7. **Show dimensioning practices for arcs (R not diameter, leader lines vectored toward center point, etc.).**
8. **Give exercises with drawings with arcs.**
9. **Give blueprint reading exercises such as "Size and Location Dimensions" and "Dimensioning Cylinders, Circles, and Arcs" in "Basic Blueprint Reading and Sketching" by Dr. C. Thomas Olivo and Thomas P. Olivo.**

10. **Explain fillets and rounds. See "Fillets, rounds, and runouts – PPT" or handout of same name. See "Intersections and runouts" handout.**
11. **Give exercises with fillets and rounds.**
12. **Show how to dimension or add shop notes.**
13. **Explain chamfers.**
14. **Give exercises with chamfers and show how to dimension if other than standard angle.**
15. **Introduce different kinds of holes. Show "Holes and hole notes" PPT and "Holes" PPT (also as a handout.) Explain annotation, symbols, dimensioning for each.**
    Through drilled or reamed
    Blind holes
    Counter bored holes
    Counter sunk holes
    Spot face holes
16. **Give drawings using various types of holes and have students apply annotation according to standards.**
17. **Give blueprint reading exercises such as "Size Dimensions for Holes and Angles" and "Location Dimensions for Points, Centers, and Holes" in "Basic Blueprint Reading and Sketching" by Dr. C. Thomas Olivo and Thomas P. Olivo.**
18. **Give Holes Quiz.**

LESSON 4 TOLERANCING

1. **Explain tolerancing.**
2. **Show "Tolerancing – PPT" (Also as a handout)**
3. **Give out worksheets to add correct tolerances to dimensions.**
4. **Give blueprint reading exercises such as "Tolerances: Fractional and Angular Dimensions" ,"Tolerances: Unilateral and Bilateral Tolerances, and Decimal Dimensioning", and "Dimensioning Tapers and Machined Surfaces" in "Basic Blueprint Reading and Sketching" by Dr. C. Thomas Olivo and Thomas P. Olivo.**
5. **Give drawings with various types of tolerances to add.**
6. **Give "Holes and Dimensioning Quiz."**

Attachments for Learning Experiences:

- Centering three-view drawings – Prep notes
- Constructing Polygons – handout
- Creating Multiview Drawings – handout
- Dimensioning notes
- Drawing rubric
- Drawings and problems sources
- Fillets, rounds and runouts – PPT
- Fillets, rounds and runouts – handout
- Glass box
- Hole Quiz
- Hole Quiz – key
- Holes – PPT
- Holes – handout
- Hole and hole notes – handout
- Holes and dimensioning quiz
- Holes and dimensioning quiz - key
- Intersections and tangencies – handouts
- Multiview examples
- Multiview layout – handout
- Multiview Quiz
- Multiview Quiz – key
- Ortho examples and exercises
- Prep. for Orthographic Projection
- Projection – PPT
- Projection – handout
- Tips for Working with Fractions – handout
- Tolerancing – PPT
- Tolerancing – handout
- View dimensions quiz
- View dimensions quiz - key

Notes & Reflections:

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title:

Multiview Drawing test

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Attachments for Culminating Performance Task:

Instructor should choose a problem as the final performance test that included oblique surfaces, different kinds of holes, and tolerances to draw as a working drawing with all annotation.

UNIT RESOURCES

Web Resources:

Attachment(s):

Materials & Equipment:

What 21st Century Technology was used in this unit:

☐	Slide Show Software	☐	Graphing Software	☐	Audio File(s)
☐	Interactive Whiteboard	☐	Calculator	☐	Graphic Organizer
☐	Student Response System	☐	Desktop Publishing	☐	Image File(s)
☐	Web Design Software	☐	Blog	☐	Video
☐	Animation Software	☐	Wiki	☐	Electronic Game or Puzzle Maker
☐	Email	☐	Website	x	CAD software