

# Dominican University of California

## Constructing Geometry Learning Centers EDUO 9583 1-4 Semester Credit(s) Unit(s)

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### Course Syllabus

#### Course Overview

Construct geometry learning centers for future use that will turn your students into mathematicians, carrying out independent explorations of math concepts at the concrete level. Games that require the application of geometry concepts are also included. These centers are most appropriate for primary through middle school. Select from the provided abundance of “ready-to-use” learning centers and construct activities that will engage students in open-ended explorations.

#### Course Objectives:

Construct at least five learning centers for geometry that present mathematics as a branch of science, involving students in open-ended explorations that result in data collection, posting and organizing that data, and pattern seeking in the organized data to find missing solutions.

- Construct five or more mathematics learning centers related to geometry
- Collect manipulatives and equipment needed for each center
- Prepare consumable materials required for each exploration
- Write a reflection evaluating the construction process for each learning center

#### Course Relation to CCS or other Professional Standards:

- *The Superintendent’s Quality Professional Learning Standards*, California Department of Education, revised March 2015: Content and Pedagogy: Element B: Pedagogy:
  1. Builds educators’ repertoires of evidence-based instructional approaches for various content areas and diverse student learning needs. (The focus in this course is on small group activities.)
- *2010 K-12 California’s Common Core Standards for Mathematics*  
Following are examples of some of the standards that are related to the learning center activities in this course. (Please see the introduction to each learning center activity in the course content for the standards specific to that activity.)

Kindergarten Geometry

3. Identify shapes as two-dimensional (lying in a plane, “flat”) or three-dimensional (solid).

Grade 1 Measurement and Data

1. Order three objects by length.

Grade 2 Geometry

1. Recognize and draw shapes having specified attributes, such as a given number of angles.

Grade 3 Geometric measurement: understand concepts of area and relate area to multiplication

6. Measure area by counting units squares (square cm, square in, square ft, and improvised units).

#### Grade 4 Geometry

##### **Draw and identify lines and angles.**

1. Draw points, lines, line segments, rays, angles (right, acute, obtuse) and perpendicular and parallel lines.

#### Grade 5 Measurement and Data

##### **Geometric measurement: understand concepts of volume and relate volume to multiplication and addition.**

- 5.c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts.

#### Grade 6 Geometry

4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures.

#### Grade 7 Geometry

3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

### **Course Assignments**

**Assignment 1** – Completing the Staff Training Component: “Why Geometry?”

**Objective:** Explore the rationale for including concrete experiences in the geometry curriculum.

**Activity:** Read a four page illustrated section on the importance of engaging children in hands-on activities that make geometric concepts meaningful to them. Then respond in writing on the worksheet to give feedback on the rationale.

**Assignment 2** – Completing Math Learning Centers for Geometry

**Objective:** Construct *five* mathematics learning centers for **each credit**.

**Activity:** Each center has its own specific set of directions for construction. All will include:

- Glue the two copies of the instruction pages in a file folder, or enlarge the instruction pages and use them as posters in the center.
- Collect and prepare the manipulatives listed under, *Materials Needed*, in the teacher’s notes.
- If there are consumable worksheets required for recording solutions, use the black-line masters provided and make the appropriate number of copies.
- Set up the center as shown in the illustration in the teacher’s notes.
- Document the completion of each center by photographing it set up on a table or countertop with all of the manipulatives, equipment, and consumables arranged as shown in the illustration.

**Assignment 3** – Writing Reflections

**Objective:** Write a reflective paragraph on each completed learning center.

**Activity:** For each reflection include any problems with collecting manipulatives or, share an idea for an equivalent substitute for a manipulative that worked well. Was there a need to modify the center so that it was more appropriate for the needs of the students? Also include any mathematical insights that were gained during the preparation of the center.

## How to Submit Coursework

At the top of each photo-documentation of a completed learning center and your related reflection, please include the title of the center. Then mark the appropriate box on the checklist.

When all of the assignments have been completed please deposit the files in the Dropbox provided. (For larger submissions you may also need to use the overflow Dropbox.) Please submit the completed checklist first, with all of the assignments following in the order of the checklist. You have nine months from the date of enrollment to complete the course. If you are unable to complete the coursework in the time allotted you may request an extension of the due date.

## Appendix

Geometry Learning Centers (Including construction directions and teacher's notes)

1. **Seeing Shapes** (Identify shapes as two-dimensional, lying in a plane, "flat")
2. **Geo-Shape Race** (Game – Correctly name shapes regardless of their orientation or overall size)
3. **Patten Block Shapes** (Compose simple shapes to form larger shapes)
4. **Cube Puzzles** (Stack cubes to match cube arrangements in drawings)
5. **Cube Puzzles 2** (Use top, front, and side views of a cube construction to reproduce it)
6. **Finding Length** (Measure and order three prisms by length, shortest to the longest)
7. **Build it Bigger** (Use Pattern Blocks to construct similar, but larger shapes)
8. **Toothpick Geometry** (Construct plane figures using toothpicks)
9. **Soda Straw Triangles** (Construct a variety of triangles using pieces of soda straw and pipe cleaners)
10. **Pattern Block Dodecagons** (Use Pattern Blocks to compose a dodecagon)
11. **What's My Line?** (Game – Estimate lengths of lines drawn by other players)
12. **Filling Rectangles** (Fill in a rectangle with rows and columns of paper squares and count how many)
13. **RecTANGLES** (Game – build rectangles using square tiles)
14. **Discovering Pentominoes** (Explore how many different ways five squares can be arranged)
15. **Pentomino Puzzles** (Construct rectangles whose areas are multiples of five)
16. **Pentomino Art** (Cover or tile an area by repeatedly tracing the same pentomino)
17. **Geo-Morphs** (Construct a "morph" using strips of cardboard and brads. Move the sides to change shapes)
18. **Pattern Block Muggins** (Game – Find the perimeter of composite shape that is a multiple of five)
19. **Tetrahedral Complexes** (Build a tetrahedral kite using soda straws, scotch tape, and wax paper)
20. **Bubble Mosaics** (Trace bubble walls in a bottle to create a non-regular mosaic)
21. **Rectangular Spirals** (Draw line segments parallel to the edges of a rectangle to form a spiral)
22. **Geometric Constructions** (Use a compass and a straightedge to inscribe plane figures in a circle)
23. **Diagonal Webs** (Draw all of the diagonals for a given polygon, creating a "web")
24. **Intersecting Lines** (Use a straightedge to draw intersecting lines and identify the points of intersection)
25. **Partitioning Squares** (Draw lines to partition squares and identify the shapes that are formed)
26. **What's Your Angle?** (Game – Estimate the size of angles drawn by others. Verify with a protractor)
27. **Symmetry of Letters** (Use a mirror to explore lines of symmetry for the letters of the alphabet)
28. **Mirror Puzzles** (Use a mirror to make a symmetrical figure from a portion of a letter)
29. **Packing Rectangular Prisms** (Construct a prism using  $\text{cm}^2$  grid paper and fill it with  $\text{cm}^3$  cubes)
30. **Compound Prisms** (Cut and paste a diagram of a compound prism and find its volume)
31. **Coordinate Plane Tic-Tac-Toe** (Game – Play Tic-Tac-Toe using dice to generate ordered pairs)
32. **Angle Sums** (Prove the sum of the angles of a triangle is  $180^\circ$  and a quadrilateral is  $360^\circ$ )
33. **Nets and Surface Area** (Trace all the faces of a polyhedron, forming a net, then find its surface area)
34. **Finding Polyiamonds** (Find multiple arrangements of equilateral triangles)
35. **Folding Polyiamonds** (Explore which polyiamonds can be folded into tetrahedrons or hexahedrons)
36. **Apple Pi** (Measure the diameter and circumference of an apple and find the value of pi)
37. **Pattern Block Mosaics** (Use Pattern Blocks to compose several types of periodic tilings)
38. **No Matter How You Slice It** (Identify 2-D figures that result from slicing 3-D figures)

## Course Assessment Rubric

EXCELLENT	ACCEPTABLE	NOT ACCEPTABLE
Meets or Exceeds Course Objectives: <b>A to A-</b>	Majority of Work Meets Course Objectives: <b>B+ to B-</b>	Needs Considerable Improvement: Resubmit Work Suggested: <b>C+ or below</b>
Excellent documentation of completed learning centers with clear photographs showing detail of center components.	Fair to good documentation of completed learning centers, but some photographs do not show all of the center components clearly.	Some of the learning centers do not have photo-documentation, and those that are photographed reveal missing components.
Clear, relevant, detailed, and thoughtful, reflections showing evidence of growth in mathematical fluency.	Reflections are relevant, but lacking in detail and insight. Growth in mathematical fluency is not obvious.	Some reflections are missing, or if present, are not relevant, showing lack of insight and detail. No evidence of mathematical fluency.
Correct heading at the top of each completed assignment.	Incomplete or incorrect heading at the top of several assignments.	Missing heading at the top of most assignments.
Submission is free of spelling and/or grammatical errors. Presentation is neat and shows great care.	Submission has several spelling and/or grammatical errors. Shows some lack of neatness.	Submission has numerous spelling and/or grammatical errors. Presentation shows lack of care.
Course checklist completed and neatly marked.	Course checklist completed.	Course checklist incomplete or missing.
All completed assignments organized Following the order of the checklist, with the checklist included at the top of the submission.	Poor to fair organization of completed assignments. Checklist not placed at the top of the submission.	Unorganized submission – did not follow directions. No checklist included.

- You are allowed 9 months to complete the course. Course questions? Contact your instructor by email.
- For questions involving your registration please contact us at [support@dominicanCAonline.com](mailto:support@dominicanCAonline.com)
  - Or call (800) 626-5080. To change your address, link your Dominican Store account at [https://www.dominicancaonlinestore.com/store/index.php?main\\_page=login](https://www.dominicancaonlinestore.com/store/index.php?main_page=login)
    - For Dominican Self-Guided course information, link to <http://dominicancaonline.com/Dominican-CA-Online-FAQ>