William Paterson University
College of Education
Educational Leadership and Professional Studies

Theme: Preparing Inquiring Educators for Diverse Settings:
Developing Knowledge, Applications, Dispositions

COURSE OUTLINE

1. **Course Number and Title:** ELCL 6070  Exploration of Number and Geometry
   (3 Graduate Credits)

2. **Course Description:** This course prepares teachers to enhance their students’ spatial skills and visualization abilities. It introduces the van Hiele levels of geometric reasoning and explores activities at levels appropriate to curriculum. Geometric manipulatives including geoboards, pattern blocks, and tangrams are explored and connected to appropriate concepts. Central to the course is the identification and investigation of number patterns in geometry, number patterns in sequencing, ratios, and percent. This course meets 3 credits toward the Middle School Mathematics endorsement.

3. **Pre – Requisites:** NONE

4. **Course Objectives:**

   1. Introduce teachers to inquiry- based lessons and to broaden their perspectives and deepen their understanding of basic principles of geometry
   2. Become familiar with current Common Core State Standards (CCSS) and NCTM standards for the teaching and assessment of Geometry
   3. Become familiar with the use of content specific manipulatives, Web sites and technology to enhance teaching and learning.
   4. Support a deeper understanding of geometry content needed in K-8 curricula and develop understanding of geometry as an axiomatic system.

5. **Student Learning Outcomes:**

   Candidates will be able to:
   1. Use geometric constructions and manipulative to develop geometric concepts
   2. Describe the vision of mathematics education put forth in the NCTM and CCSS and the characteristic of effective elementary geometry program.
   3. Identify and describe ways the Internet and various websites and manipulatives can be used to locate information of instructional value for planning geometry instruction and provide students with appropriate interactive experiences in content knowledge.
   4. Apply and understand fundamental topics of Euclidean Geometry for
      - Congruence
      - Similarity
- Coordinates
- Constructions
- Measurements
- Areas, perimeter, and volumes of geometric shapes
- Transformation
- Formal Proofs and Axiomatic System and use their knowledge to create appropriate and effective lessons and curricula.

<table>
<thead>
<tr>
<th>Student Learning Outcome</th>
<th>Concentration-Specific Outcomes</th>
<th>COE Advanced Programs Outcomes</th>
<th>NJ Professional Standards for Teachers and Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply Inquiry-based Geometry knowledge (SLO #1)</td>
<td>1. Knowledge of essential geometry</td>
<td>knowledge 1b</td>
<td>subject matter knowledge 1i, 1ii</td>
</tr>
<tr>
<td>Identify NCTM and NJ geometry content standards (SLO #2)</td>
<td>1. Knowledge of essential geometry</td>
<td>1 a. demonstrate contemporary trends 5j disposition</td>
<td>knowledge 1i</td>
</tr>
<tr>
<td>Effective use of Geometric Websites (SLO #3)</td>
<td>8. Employ technology in teaching geometry</td>
<td>Knowledge 1d</td>
<td>Subject matter knowledge 1i, ii, iii</td>
</tr>
<tr>
<td>Understand fundamental geometry (SLO #4)</td>
<td>1. Essential geometry knowledge</td>
<td>1b. Demonstrate knowledge</td>
<td>Knowledge 1iii</td>
</tr>
</tbody>
</table>

6. Course Content:

1. Basic ideas using inquiry –based problems as building blocks of elementary geometry
2. Current content standards for geometry and their implications for teaching in grades K-8 ( include NCTM Standards)
3. Technology tools and websites for enhancing teaching and learning geometry
4. Understand fundamental topics of Euclidean Geometry
   - Congruence
   - Similarity
   - Coordinates
   - Constructions
• Measurements
• Areas, perimeter, and volumes of geometric shapes
• Transformation
• Formal Proofs and Axiomatic Systems

7. **Teaching and Learning Method:**

Some of the required readings for this course will consist of a series of articles and chapters made available to students either as PDF documents or accessible links posted online through Blackboard (BB) [http://bb.wpunj.edu].

- Complete all inquiry-based activities distributed in class
- Students are required to do all assigned homework activities in advance of the class session for which they are assigned.
- Group discussions and discovery exercises

8. **Assessment Methods:**

- Active participation in class discussions about geometry standards, and geometric constructions (SLO #1, #2)
- Completed weekly homework assignments on Euclidean Geometry topics (SLO #1, #4)
- Take home assignment projects on polyhedrons (SLO #1, #2, #4)
- Written Midterm and Final exam (SLO #1, #2, #4)
- BB forum to identify Geometric websites relevant to instruction of Geometric topics in K-8 curricula (SLO #3)

9. **Recommended References:**


10. **Bibliography:**


10. **Online Resources:**

- **Area Tools**
  There are three separate applets that explore how changes in the base and height of these shapes affect the area.

- **Clockwise.**
  http://www.shodor.org/interactivate/activities/clockwise
  A clock face is shown and the user enters the digital time. Four difficulty levels.
• Cubes  
An excellent interactive applet that illustrates the volume of a rectangular prism. Units of single cubes, rows of cubes, or layers of cubes, can be used to fill a prism.

• Geoboard  
http://nlvm.usu.edu/en/nav/frames_asid_279_g_4_t_3.html  
This electronic geoboard measures the area and perimeter of any shape made. What is nice is that the measures are not shown until the user clicks the measure button. Students can be challenged to make shapes with specific area and/or perimeters.

• How High  
http://nlvm.usu.edu/en/nav/frames_asid_275_g_3_t_4.html  
Two cylinders are shown along with the area of the base, shown as a grid of a square. One cylinder is filled to a specified height. The task is to determine the height of this same liquid when it is poured into a second container.

• Image Tool  
http://www.shodor.org/interactivate/activities/imagetool/index.html  
The user can measure angles, distance, and areas in several different imaginaries (choices include maps, aerial photos, and others). A scale feature allows the user to set the scale used for measuring distances and areas. Unique!

• Money  
http://nlvm.usu.edu/en/nav/frames_asid_325_g_2_t_4.html  
This site gives students an opportunity to make a dollar, find an exact amount, or fill in how much money is shown.

• Perimeter Explorer  
http://www.shodor.org/interactivate/activities/PerimeterExplorer  
The user sets a fixed number of square units and the applet randomly creates a shape on a grid with this area. The object is to determine the perimeter. There is also an Area Explorer (fixes the perimeter) and Shape Explorer, which asks the user for both the area and perimeter of the randomly produced shapes.

• What Time Will it Be?  
http://nlvm.usu.edu/en/nav/frames_asid_318_g_2_t_4.html  
Elapsed-Time problems are presented in word format. Two clocks are shown, one with a start time and the other to be set. Some problems are digital, others are analog.

• Cutting Corners  
http://illumations.nctm.org/tools/CutTool.asp  
A cutting tool allows any one of three simple shapes to be sliced into parts along any straight line. Shapes can be rearranged, rotated, and flipped.
• Geoboards  
http://nlvm.usu.edu/en/nav/category_g_2_t_3.html
The NVLM library has four geoboards. The first measures areas and perimeters. The circular board has pins in a circular arrangement. The isometric board has pins in a triangular arrangement (like isometric dot paper). The coordinate board shows coordinates for each peg when the cursor is on it. It measures the slope and distances between two points joined by a band and then the perimeter and area of banded shapes.

• GeoGebra  
www.geogebra.org/cms
This is a free downloadable dynamic geometry software that emphasizes geometry and algebra. Like Geometer’s Sketchpad, you can construct with points, segments, and lines.

• Maze Game  
The maze game provides practice with coordinates. The user plots points to guide a robot through a mine-field.

• Mirror Tool  
http://illuminations.nctm.org/ActivityDetails.aspx?ID=24
A nice tool for early investigations for mirror and line symmetry.

• Space Blocks  
http://nlvm.usu.edu/en/nav/frames_asid_195_g_3_t_3.html?open=activities
This applet allows the users to create “buildings” made of cubic blocks rather easily. Use it to explore surface area.

• Tangrams  
http://nlvm.usu.edu/en/nav/frames_asid_268_g_1_t_3.html
These visual tangrams can be manipulated freely. Plus, there are fourteen puzzle shapes to fill with all seven tangrams.

• Visualizing Transformations  
This four-part applet provides an excellent exploration of the three rigid-motion transformations including composition of two transformations.

11. **Preparer's Name and Date:** Althea Hylton-Lindsay, Fall 1996

12. **Department Approval Date:** Fall 1996

13. **Reviser’s Name and Date:** Sandra Alon, Fall 2010, Fall 2011

14. **Department Revision Approval Date:** Fall 2010, Fall 2011