## Title

Measurement: Perimeter and Area in Grades 3-5

## Target Audience

This course is intended for pre-service and in-service grades 3-5 teachers.

## Course Description

This course builds upon a general understanding of measuring the length of objects, including identifying measurable attributes and selecting appropriate units. It is intended to deepen and expand the learner's conceptual understandings of measurement and the application of measurement in real situations. Particular emphasis is placed on understanding the concepts of perimeter and area. Learners will solidify their understanding of these concepts by engaging in multiple investigations and by using concrete and virtual (or online) manipulatives. From these investigations, and also from online collaboration with others, learners develop strategies and formulas to efficiently calculate perimeters and teach students how to do so as well. As a final project, the learner will create a series of lessons with a Teacher's Guide that articulates mathematical goals and sequence the lessons, presents instructional strategies, includes example materials, and illustrates which NCTM Standards are met by the lesson plans. Learners will test and assess their lesson plans in a real classroom setting, and lastly, receive feedback from others as to necessary modifications. Throughout the course, learners will use new technologies and Internet resources to strategize teaching techniques, practice mathematical computations, and research concepts of perimeter and area.

## Instructor/Facilitator

See instructor/facilitator sheet

## Credits

To be determined by college or university

## Objectives

Learners will:

- Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute.
- Understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.
- Understand that measurements are approximations and see how differences in units affect precision.
- Explore what happens to measurements of a two-dimensional shape, such as its perimeter and area, when the shape is changed in some way.
- Apply appropriate techniques, tools, and formulas to determine measurements.
- Develop strategies for estimating the perimeters, areas, and volumes of irregular shapes.

- Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles.
- Select and use benchmarks to estimate measurements.
- Develop, understand, and use formulas to find the areas of rectangles and related triangles and parallelograms.

**Outline of Content and Assignments**

The content area contains six parts. After learners have previewed the Introduction and Goals, Schedule, Assignments, and Competency Map, they will begin reading Part 1 of the content. Each part includes assignments and discussion questions for learners to complete. The final project for the course is found in Part 6.

Part 1: Preparing for the Online Learning Environment and Examining the Importance of the Study of Measurement

Learners will:

Read
- "Adding it Up: Helping Children Learn Mathematics"

Explore
- Online learning environment
- Install necessary "plug-ins"

Watch
- Introductory "TeacherLine" video

Participate in the online discussion
- Introduce learners to one another
- Post on the Discussion Board the geometric figure you are most like and why you are most like that figure. Choose from the following figures: square, rectangle, trapezoid, triangle, or circle.

Part 2: Understanding Measurable Attributes: Length and Area

Learners will:

Read
- "Measurement of Length" newsletter, from *Mathematics for Parents* by the Cognitively Guided Instruction (CGI) program
- "Measurement of Area" newsletter, from *Mathematics for Parents* by the Cognitively Guided Instruction (CGI) program

Complete math activities
- "Measuring Length" activity, which uses nonstandard units of measure to determine length and perimeter.
- "Tangram Puzzles" activity to explore geometric thinking.
- "Four-Unit Shapes" activity to construct multiple shapes with the same area.
- "Filling Figures" activity

Use online interactive
- "Shape Tiles"

Record in online journal

- Review some key ideas in the readings and summarize misconceptions concerning length and area.

Participate in the online discussion

- Upon completion of all the assignments and readings, go to the Discussion Board and reflect on the advantages of using interactives, such as "Shape Tiles" or "Tangram Puzzles," to construct understandings of geometric and measuring concepts.

Part 3: Finding Areas and Perimeters of Complex Shapes

Learners will:

Read

- Excerpts drawn from “Issues in Mathematics Education: The Mathematical Education of Teachers,” which discusses some current thinking about critical content, pedagogy, and policy related to the professional development of mathematics teachers. The reading focuses on geometry and measurement in elementary classrooms.
- An assessment and sampling of student work from the Investigations in Number, Data, and Space curriculum unit “Flips, Turns, and Area,” which illustrates a range of student work dealing with the areas of complex shapes.

Complete Math Activities

- "Going Around"
- "Exploring Area with Online Manipulatives”

Record in online journal

- Review given assessment and the samples of student work.
- Explain how you would help sample students communicate their understanding of the relationship between certain shapes and measurement.
- Write three questions you might pose to a student to determine whether or not he or she has a clear understanding of the mathematical concept.

Watch videos

- “Finding Areas of Tangram Pieces”
- “A Common Misconception”
- “Finding Areas of Complex Figures”

Participate in an online discussion

After completing the readings, math activities, videos, and online journal entries, go to the Discussion Board and reflect on your observations of the students from the three videos. What misconceptions did you observe and what questions could you ask to clarify their misunderstandings or deepen their thinking?

Part 4: Exploring the Relationship Between Perimeter and Area

Learner will:

Read

- An excerpt from *Knowing and Teaching Elementary Mathematics* by Liping Ma. It investigates how teachers from the United States and China approached a scenario involving the relationship between the perimeter and area. Ma's investigation presents very interesting perspectives concerning both the teachers' content knowledge and the teachers' approaches with students.

Complete Math Activities

- "Using Shape Tiles to Explore Perimeter and Area"
- “Area Explorer”
- “Perimeter Explorer”
- “Rectangle Misconceptions”

Participate in the online discussion

- After completing all readings and activities, go to the Discussion Board and consider the student scenario presented in the reading; specifically, how do you think the tools and activities explored in this session could assist the student in determining whether the theory was true or not and why?

Part 5: Developing and Using Formulas

Learners will:

Read

- An excerpt from “Issues in Mathematics Education: The Mathematical Education of Teachers.” The reading focuses on the importance of the conceptual issues as well as the processes involved in measurement.

Complete math activities

- “Rectangle Formula”
- “Parallelogram Formula”
- “Triangle Formula”

Record in online journal

- Respond to following scenario: The "Parallelogram Formula" activity uses the "Shape Tiles" interactive to teach the formula for the area of a parallelogram. How could you use hands-on manipulatives to do the same thing?

Participate in the online discussion

- After completing all readings and activities, go to the Discussion Board and share your perspective as to whether to give students the formulas for calculating areas and perimeter of shapes, or to have them explore concepts before applying the formulas.

Part 6: Applying What You Have Learned

Learners will:

Read

- Excerpts from the NCTM's *Principles and Standards for School Mathematics* (PSSM 2000). This excerpt recommends that students in grades 3-5 understand attributes such as length and area; explore the effects on the perimeters and areas of two-dimensional shapes when the shapes are changed in some way; develop strategies for estimating the perimeters and areas of irregular figures; and begin to develop formulas for calculating the areas of rectangles, triangles, and parallelograms.
- "The Measurement Standard for Grades 3-5" and "The Measurement Standard for Grades 6-8," to see what is expected at these grade spans.
- "Improving Student Achievement in Mathematics, Part Two: Recommendations for the Classroom." This article provides research-based recommendations for effective teaching practices in mathematics.

Participate in the online discussion

- After completing all readings and activities, go to the Discussion Board and reflect on the goals and expectations of the "Measurement Standard" from the PSSM 2000 and the recommendations in "Improving Student Achievement in Mathematics." Reflect upon your experiences in the course.

Complete math activity

- Solve related sample state assessment problems.

Final Project:

Complete the following assignment and use the Digital Drop Box in the Student Tools area of the course to submit the project to the facilitator. Create a series of lessons with a Teacher's Guide that does the following:

- Articulates mathematical goals and sequence for the lessons
- Describes two lesson plans and example materials
- Includes instructional strategies and activities that address these problem areas
- Identifies which of the activities address the expectations of the PSSM 2000 standards for middle school.
- Presents assessment instruments (pre- and post-tests)
    - The handbook must include a pre- and post-test of student understanding. This pre- and post-test may include activities from the course, modified to measure student progress.

Record in Online Journal:

- Respond to the following question: What one or two ideas from this course will be of most use to you in your classroom, and why?

**Schedule**

This course is scheduled to take approximately 15-20 hours to complete readings, activities, video, assignments, reflections, and a final project.

**Requirements**

Learners are expected to:

- Complete all assignments
- Participate regularly in discussion boards

**Evaluation**

Pass/fail upon satisfactory completion of assignments and discussion board participation

**Materials (hardware, software, plug-ins)**

Technical Requirements

- Word processor
- Internet service provider
- Email

**Academic Dishonesty Policy**

To be inserted by university institution only