Unit Plan for Area   *[grade and subtopic]*

At [name of the school], [teacher's name]

This template is designed to help you record your ideas as you read the step-by-step support for area. When you finish, you will have a unit plan draft to share with Network members.   Red italicized text briefly describes what goes in each section, and can be deleted. Feel free to edit any text (regular or italicized) to fit your thinking and local situation.

1.   Goals for Student Mathematical Practices, and Theory of Action To Achieve Them
Select two of the first five <u>CCSS mathematical practice standards</u> *that you would particularly like to focus on. Note them in the right-hand column, along with any evidence you might expect to see if students are showing these mathematical practices.   In the left and middle columns, describe the classroom instruction that you think will help students develop these practices. Feel free to express your ideas in a different sort of diagram, if-then statements, or in some other way that makes sense to you. Notes from the Summer Institute should be useful in recalling your thoughts about the mathematical practices instructional elements you would like to try out in your own practice.*

Theory of Action

Classroom Instruction	So Students Learn/Feel	As a Result They Build Mathematical Practices :
Task that requires students to use mathematics to figure out something new (not just to practice something already learned)	Mathematical practices and prior knowledge help you figure out something new	**MP#1 Make sense of problems & persevere in solving them**
Emphasizes mathematical *practices*, not just answer	Their own partial ideas and mathematical practices are useful even if they don't immediately give the right answer–for example, writing numbers to go with a physical representation, asking a peer to explain an equation, making an orderly, labeled drawing	Students - write and discuss willingly, to make sense of problem, - are interested in finding & understanding different strategies
Board shows coherent story of lesson, so students can revisit and use make sense of mathematical ideas	Classmates may offer important ideas and strategies	- connect different representations (verbal, visual, numeric)
Teacher's questioning focuses on sense-making (Can you write a number sentence to go with this solution? Can someone explain why Pat did this?)	Math may require effort, revision, comparing different ideas	- use various resources to make sense of problems, such as peers' ideas, prior knowledge, board, etc.
Classmates' ideas are audible, visible, selected by teacher to help class build important mathematical ideas		

<u>Return to Step 2 of the Step-by-Step Support</u>

2.   Title of the Unit: Area: How to Measure and Express Area: Let's Investigate the Size of Space *Provide a unit title that captures what will be learned.*

3. Flow of the Unit (Lessons planned in detail designated by *)
Briefly describe the lessons that are part of your planned unit (whether or not you will actually teach these lessons). Feel free to use the ideas below, or to adapt as needed to reflect your students' prior learning, your local requirements, time devoted to the topic, and so forth. Choose two lessons that you would like to plan in more detail, and asterisk those. (Or come back and choose them later.) Note with a "T" any lessons you will actually teach. The unit plan example below draws from a plan developed by Bill Jackson.

Grade 3 Mathematics Unit Plan

Title of Unit: Area of Rectangles and Squares

Goals of Unit:
- To understand the meaning of area as the size of space a 2-dimensional object takes up.
- To measure the areas of squares and rectangles using both arbitrary and square units.
- To develop a formula to calculate the areas of rectangles
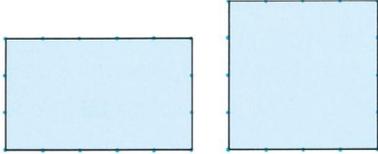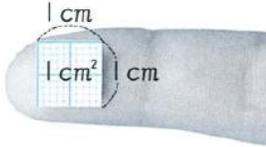- To measure the areas of squares and rectangles by using a formula.
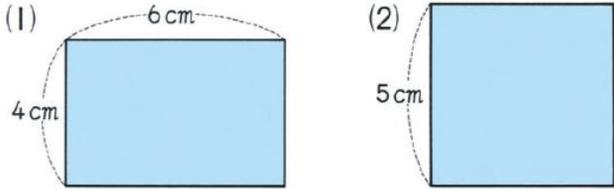
Plan of Unit (Total 5 lessons)
1. Recall prior knowledge (1 day)
2. Comparing areas using arbitrary units (1 day)
3. Comparing areas using square units (1 day)
4. Finding area by using a formula (2 days)

(Note: Resource is Tokyo Shoseki Mathematics for Elementary School textbook
http://globaledresources.com/products/books/mathematics-international/index.html

Lesson No.	Goal of Lesson	Learning Activities
1	To review prior knowledge needed to engage effectively in this unit of study. • Attributes of rectangles and squares • Perimeter of polygons • Multiplication involving arrays	1. What do you know about rectangles and squares? 2. These dots are arranged in a rectangular array. How can we find the number of dots? 3. Let's find the perimeter of rectangles and other polygons. Using the given dimensions. Using a ruler to measure the sides.
2	Understand that the size of space of the sheets can be compared directly by overlapping, and indirectly by tracing	1. Introduction Which of the two picnic sheets has the larger area? How can we find out? (Which takes up more space?) 2. Posing the problem

	the space and placing it on top of the other. Know that the term area is used for the size of the space that covers 2 dimensional shapes. Understand that area can be compared by using an arbitrary unit.	Which newsletter has the larger area? (Unlike the picnic sheets, we cannot move the newspaper to overlap the shapes.) 3. Discussion/Summary Students understand that the area can be compared by using an arbitrary unit.
3	Understand that area can be compared by using a square unit.	1. Posing the problem Which of the following shapes, the rectangle or the square, has the larger area, and by how much? Think about a way to express how large they are. 2. Discussion/Summary By contrasting students' solutions including the misunderstandings, teacher helps students understand the size of area can be expressed using numbers by setting up a unit square. Using numbers to express the area allows easy comparison and description of area. Measuring the perimeter does not help us compare the areas.
4	Understand square cm and square in. Deepen understanding of area units by creating shapes on a grid.	1. Introducing the formal unit of area measurement 3. Find area in cm^2 of shapes on a grid (worksheet); create shapes of 4 cm^2 4. Introduce square inch (in^2).

5	Derive the formula for finding the area of rectangles and squares.	1. Posing the problem Let's think about how to find the area of the rectangle and square without counting the number of unit squares one by one. 2. Discussion/Summary Multiplication can be used if we look at the number of square units that fit along the length (vertical side) of a rectangle as a group and how many groups will fit along the width (horizontal side). This is the same idea that we used multiplication to find the number of dots in an array.
6	Find the area of rectangles and the squares using linear dimensions (mm, cm, inch) and using a formula.	1. Give a variety of rectangle and squares in different sizes, orientations to find and compare the area. 2. Discussion/Summary We can find the area of shapes with linear measurements (mm cm, inch) by using the formula. Sometimes it is necessary to convert the unit in order to use the appropriate unit.

4. Goals of Instruction:
In addition to the lesson objectives included above, consider (a) your long-term goals for students' development of mathematical practice and (b) and your goals for learning about TTP. EXAMPLES:
    a. **Mathematical practice goals for students:**
        i. Students are motivated to construct viable arguments and critique the reasoning of others (CCSS MP3) as they solve challenging problems (such as figuring out how to compare the area of two rectangles).
    b. **Goals for teachers' learning about teaching through problem-solving ("TTP"):**
        i. Facilitate *neriage* discussion that allows students to compare solution methods and develop the big mathematical idea of the lesson (that area of a composite shape can be found by decomposing).
        ii. Use board organization that helps students understand the flow of the lesson and reflect on it in their own journals.

5. Relationship of the Lesson to the CCSS

This section describes how this lesson builds on what students previously learned, and how it supports development of new skills or concepts, in terms of the standards. It is often done graphically, as the following examples suggest.

Prior Learning

K.MD.1 Describe measurable attributes of objects, such as length or weight.   Describe several measurable attributes of a single object

K.MD.2 Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.

2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

This Unit

3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.

a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.

b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.

3.MD.6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units)

Future Learning

3.MD.7. Relate area to the operations of multiplication and addition

a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths *a* and *b+c*   is the sum of *a x b*   and *a x c*   side lengths *a* and *b+c*   is the sum of *a x b*   side lengths a and b and *a x c*. Use area models to represent the distributive property in mathematical reasoning.

d. Recognize area as additive.   Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.
world problems.

> **6.G.1** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

Background and Rationale

This section provides background and rationale for the flow of the unit and lessons, for example: what students understand currently about this topic, what they struggle with (based on past experience), and how the sequence of lessons in the unit will help them develop the understandings outlined in CCSS. Example:

Students have studied length in the past (and depending on your curriculum, perhaps volume and weight) and have experienced the four steps of measurement, "direct comparison," "indirect comparison," "measurement by arbitrary unit," and "measurement by standard unit." It will be important for them to recall these experiences as they think about what area is and how to measure it.

Once the lengths of two adjacent sides have been determined, the areas of rectangles and squares can be found by multiplying those two sides, and students may do this mechanically when a figure is presented with dimensions. However, some children struggle when they encounter a problem in which they must measure the lengths of the sides themselves, and some cannot provide an answer when asked why "length x width" allows them to find the area of a rectangle. The unit design should help students understand what area is and progress from measurement of area as counting the number of squares, to seeing how linear dimensions relate to area, to producing the formulas for area.

6. Research and *Kyouzaikenkyuu*

This section describes what you learned from looking at different curricula, reading CCSS-related documents, and learning about teaching through problem-solving. How are you are using that information in this lesson?

7. About the Lesson Design

For the two chosen lessons below, explain why you are designing them as shown.   For example, what is your rationale for choosing these activities, and for the particular choice and sequence of student responses you propose for the neriage?
Chosen Lesson #1

Chosen Lesson #2

8. Flow of the Lesson:

Chosen Lesson #1

The sections of this lesson plan are just a guide. "Anticipated student responses," however, should always be included.

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	Teacher's Support/Questioning	Points of Evaluation
This column shows the major events and flow of the lesson.	*This column shows additional moves, questions, or statements that the teacher may need to make to help students.*	*This column identifies what the teacher should look for to determine whether to proceed, and what observers should look for to determine the effectiveness of the lesson.*
1. Introduction and Posing the Task *This section describes a problem or task as it will be presented to students, as well as any introductory material (e.g., context-setting, remembering prior experiences).*		*How do we know if students understand the task and are motivated to solve it? What prior knowledge is sparked?*
2. Anticipated Student Responses *This section describes how students might respond to the task, including incorrect solutions and places where students might get stuck. It can be helpful to tag different responses in some way, e.g. "Dir" for "direct comparison by overlap", "In "for indirect comparison, "U-S" for Unit: standard, "U-NS" for Unit: non-standard, "L" for attention to linear dimension only, etc.*	*How will the teacher will handle the different student responses, especially incorrect solutions, students who get stuck, or students who finish early? What are the specific questions or comments the teacher will pose in each case?*	
3. Neriage: "Kneading" Discussion to Compare Solutions and Draw Out Key Mathematics *This section identifies the student solution methods that will be shared and in what order, and the questions that will help students understand and compare the solutions and draw out the key mathematical ideas.*	*What are the ideas to focus on during the discussion? Which student responses are essential to the discussion, and in what sequence will they be presented? What will be done if essential ideas don't emerge from students? What will students notice? What questions and teacher moves will help students notice, explain, understand*	*What will indicate that students are benefiting from the discussion?*
(If needed, repeat 2 & 3 for additional tasks.)		
4. Summing up *How will the teacher and/or students summarize the main ideas of the lesson? An assessment activity may also be given.*	*What prompts for discussion or journal-writing will help students summarize what they learned? Assessment activity, if any.*	*What comments or work will reveal student thinking and any changes in it?*

Chosen Lesson #2

The sections of this lesson plan are just a guide. "Anticipated student responses," however, should always be included.

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	Teacher's Support/Questioning	Points of Evaluation
This column shows the major events and flow of the lesson.	*This column shows additional moves, questions, or statements that the teacher may need to make to help students.*	*This column identifies what the teacher should look for to determine whether to proceed, and what observers should look for to determine the effectiveness of the lesson.*
1. Introduction and Posing the Task *This section describes a problem or task as it will be presented to students, as well as any introductory material (e.g., context-setting, remembering prior experiences).*		*How do we know if students understand the task and are motivated to solve it? What prior knowledge is sparked?*
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(*If needed, repeat 2 & 3 for additional tasks.)*		
4. Summing up *How will the teacher and/or students summarize the main ideas of the lesson? An assessment activity may also be given.*	*What prompts for discussion or journal-writing will help students summarize what they learned? Assessment activity, if any.*	*What comments or work will reveal student thinking and any changes in it?*

9. Board Plan

In this section provide a diagram for one of the lessons you plan in detail, showing how work on the blackboard will be organized to support the lesson flow above. A board plan template and examples are available (board plans, under Key Resources at right of TTP site).