Table 1: Content included in this lesson

Topic	Content
Angles	This Lesson: ● Associating an angle with a certain amount of turning **(Big Idea of Measure)** ● Identifying angles in the classroom and environment ● Forming a right angle using a mix of manipulatives (paper, AngLegs, virtual Geoboard)

Lesson Plan for Mixed-Ability Primary 3 Students

Lesson Subject	Lesson Title	Grade Level
Angles	Introduction to Identifying Angles	Primary 3
		Duration of Lesson:
		1 hour

Student Academic Learning Objectives

At the end of the lesson, students will be able to:

- Associate an angle with a certain amount of turning **(Big Idea of Measure)**
- Identify angles in the classroom and environment
- Form a right angle using a mix of manipulatives (paper, AngLegs, virtual Geoboard)

Materials

- Objects that show angles (e.g. a pair of scissors, a fan)
- AngLegs manipulative
- Colored paper
- Learning Device/Computer
  - virtual Geoboard
- Worksheet on right angles

Key Ideas	Sequence of Development	Resources
10:30 am - 10:35 am Introduce the concept of angles.	Textbook Chapter Opener p. 2-3 Ask: ● "What do you see in this picture?" ● "Can you see some corners in the structure?" ● "Can you see different angles in the picture?" "What do you notice about these angles compared to the corners?" ● "Do you know how an angle is formed?"	Textbook p. 2-3

10:35 - 10:55 am
 	
Activate prior knowledge with meaningful objects and key questions to connect the objects to the subject matter of angles.
 	
Students need to understand that an angle is:
1) formed when two straight lines meet at a point
2) an amount of turning
3) not dependent on the lenghts of its two arms
	Activity 1: Students learn to associate an angle with a certain amount of turning and identify angles in objects around them.
	Powerpoint Slides -
	Slide 1) Textbook Chapter Opener
	Slide 2) Define angle - an angle is formed when two straight lines meet at a point.
	Slide 3) Angles around us - seesaw, scissors, arm, fan
	- Ask students to come up to the board and highlight where an angle is being formed in each of these examples (when two straight lines meet)
	Slide 4) Do you notice something about the angles when…
	- Seesaw - the seesaw goes up and down?
	- Scissors - the pair of scissors opens and closes (Get a responsible student to open and close a pair of scissors. **The size of an angle will vary depending on the amount of turning.**)
	- Arm - you flex your arm? (Get students to hold his/her arms out to make an angle. **The size of an angle will vary depending on the amount of turning.**)
	- Fan - you open the fan? (Highlight as the fan opens wider, the size of the angle increases, and as the fan closes, the size of the angle decreases.)
	- Define angle - an angle is an amount of turning
	  - Smaller turning = smaller angle
	  - Larger turning = larger angle
	Slide 5) Let's use a virtual Geoboard to make angles.
	- Teacher will demonstrate with the virtual Geoboard that:
	  - 1) an angle is formed when two straight lines meet at a point
	  - 2) an angle is an amount of turning
	  - 3) the size of an angle is not dependent on the lengths of its arms (demonstrate using different colored bands with different lengths)
	Slide 6) Challenge 1: Use AngLegs to make angles.
	***Students need to be able to identify angles before finding angles around the room.**
	● Have students define what an angle is.
	  ○ An angle is formed when two straight lines meet at a point.
	  ○ An angle is the amount of turning made by the two lines.
	● Each student will manipulate two AngLegs
	  ○ Highlight the size of an angle is not dependent on the lengths of its arms. (Student will get pairs of different length AngLegs.)
		Powerpoint Slides
		
		Define Angle on Whiteboard
		1. An angle is formed when two straight lines meet at a point.
		2. An angle is an amount of turning.
		
		AngLegs

10:55 - 11:15 am Identify right angles in the classroom and environment using	**Activity 2:** Concrete Experience Making Angles 1. Introduce right angles. ● Demonstrate how to make a right angle using Paper Folding.	Colored paper

mixed media (paper, AngLegs, and virtual Geoboard).	○ "The right angle is a special angle." ○ "It is called a right angle because you all got it right no matter how you folded your paper." ● Have students explore making right angles using AngLegs. ○ "Now, I want you to work with your partner to make a right angle using the three AngLegs on your table. You can use your paper right angle to assist you." ○ Keep one side fixed, and rotate the other side until it points up straight. The last leg (hypotenuse) will be used to snap the right angle in place. ○ This is called a right angle. ○ Which items do you come across daily that have right angles? ● Have students go around the room to find right angles (using the AngLegs to measure). ○ Slide 7) Teacher example of clock hands ○ Have students share some of the places they found right angles (e.g. door corners, math notebooks, learning devices, Smartboard) ○ Have students **use sentence frames** to explain their thinking: ■ The reason this is a right angle is because… ■ I agree/disagree with you because… ■ I used to think…,but now I think.. ■ Please explain to me how… ○ Have students think about their house. (Abstract ○ thinking involved) ■ Where might students find right angles in their house? ○ **Goal:** Engage students with content through objects relevant to their lives. Students will apply their knowledge and skills that help them make sense of the world around them.	AngLegs
11:15 - 11:30 am Identify right angles in the classroom and environment using mixed media (paper, AngLegs, and virtual Geoboard).	**Activity 3:** V-P-A of the C-V and V-P-A approach 1. Now, students will use a virtual Geoboard to consolidate their learning. ● Students will sign into Brainingcamp. They all have the same username, password, and share code. ○ *Username*: jyps ○ *Password*: jyps ○ *Share Code:* (whatever the generated code is) ○ Ask students to make an object (e.g. house, sailboat, shirt) and highlight at least one right angle (formative assessment). ■ Teacher example ■ Pair-share	Learning Device/Computer Brainingcamp *Username*: jyps *Password*: jyps *Share Code:* (whatever the generated code is)

	■ Students are encouraged to use their Paper manipulative or AngLeg manipulative to explain their reasoning. ○ **Final Discussion:** The teacher will project and share two student examples with all the correct features above. ■ What do you notice? ■ How many right angles do you see? How do you know that is a right angle? Can you prove it and explain your reasoning? **Homework:** Identify Right Angles Worksheet	Identify Right Angles Worksheet
Next Lesson: 15 minutes Complete student survey.	**Activity 4:** Student Survey Students will complete individual surveys.	Student Survey Sheet

Reflection

This is the first time students were exposed to the concept of angles. There was no prerequisite knowledge of identifying or forming angles.

Students gained many practical experiences, such as forming angles using paper and AngLeg manipulatives and identifying angles in the classroom and environment. The key objective was to have students see that angles are all around them and an angle can be formed with a certain amount of turning. By the end of the first lesson, students were able to:

- Associate an angle with a certain amount of turning **(Big Idea of Measure)**
- Identify angles in the classroom and environment
- Form a right angle using a mix of manipulatives (paper, AngLegs, virtual Geoboard)

Why is the C-P-A approach particularly useful for introducing angles in Geometry?
The C-P-A approach encouraged students to develop initial awareness of angles, specifically right angles, through purposeful concrete experiences. Once students were secure in their understanding of how angles were formed, they moved towards pictorial based problem solving (homework worksheet).

I used a mixed media approach to demonstrate the idea of right angles because I wanted students to have **multiple entry points** in discovering right angles:

- In paper (familiar, life-relevant object found in nature)
- In AngLegs (new concrete manipulative)
- In virtual Geoboards

During the concrete activity, students showed high enjoyment and interest when discussing their reasoning with peers because they were able to link new, abstract information (a right angle) to already solidified networks of knowledge. Students were engaged through a relevant object in their daily lives (a piece of paper) and applied their knowledge and skills to make sense of the abstract concept of right angles. Then, they connected their understanding of right angles in the paper folding activity to the formation of right

angles in the concrete manipulative, AngLegs. Afterwards, they took the AngLegs to reason, communicate, and justify right angles around the classroom. For metacognition, students had the opportunity to communicate with their peers and reflect/elaborate on their problem-solving processes of finding right angles around the classroom.

Each medium played a critical role in student understanding and discovery, and students built new understandings at each step that bridged the three media. In the end, students used AngLegs to communicate and demonstrate their reasoning of right angles within their virtual Geoboard designs and their pictorial based homework worksheet. The versatility of the mixed-media design of this lesson encouraged students to expand their learning environment beyond the classroom and in the environment (Objective 2).

Benefits of the C-V and V-P-A approach?
I had students create a real life object/idea with one or multiple right angles on virtual Geoboards. Students came up with many creative ideas, such as a house, a shirt, a tank, and a cube. This activity leveraged students' diverse interests, talents, and perspectives and steered them towards the learning objective of identifying and justifying angles, specifically right angles, in the classroom and environment (concept visualization). If possible, I would encourage teachers to plan for a longer period of exploration (30 minutes minimum) and discourse so **every student** can get the opportunity to express their ideas, reasoning, and thinking behind their creations.

a. Effectiveness
Students were **only able to construct polygons** on virtual 11x11 Geoboards. In addition, the virtual Geoboards encouraged students to be creative and have fun in meaning-making. There was **student choice** and **student-driven discovery** based on individualized needs (e.g. drawing simple polygons vs. more complicated designs).

b. Efficiency
The Geoboard was accessed quickly on the iPads by typing in one code. There was no logistical time spent distributing and retrieving physical Geoboards and rubber bands. In addition, the construction of the polygons was less time-consuming since there was no fine motor skill requirement to apply/take-off rubber bands. Students used supplies appropriately and focused on the task at hand (instead of playing around with physical rubber bands).

The virtual Geoboard allowed students to create dynamic angles, in which students could drag, sweep, rotate a line to make an angle. Many students created and highlighted right angles in different orientations, rather than the typical horizontal "L" angle orientation. Students were able to demonstrate a variety of right angles and gain a deeper understanding of angle measures, hopefully leading to connections between later angle concepts (i.e. acute and obtuse angles).

Most importantly, the virtual Geoboard had embedded annotation and shading tools for the students to use alongside mathematical language to justify their choices. The application encouraged students to get immediate feedback from peers and the teacher. The teacher was also able to share student examples and creations to the entire class with a simple push button.