The Greedy Triangle
Grade: 5

Strand:
Geometry and Spatial Sense

Curriculum Expectations:

Overall:

- identify and classify two-dimensional shapes by side and angle properties, and compare and sort three-dimensional figures;

Specific:

- distinguish among polygons, regular polygons, and other two-dimensional shapes;

Learning Goal:

- We are learning to use sides and angles to construct, represent and classify polygons.

Underlying Math Big Idea:

- Different attributes of shapes and figures can be used to sort and classify these shapes and figures in different ways.
- Any shape or figure can be represented in many ways. Each way highlights something different about the shape or figure
- Composing and decomposing a shape or figure can provide information about the shape or figure.
  - Marian Smalls

Connections:
By taking on a kinesthetic approach to mathematics in this lesson, students are able to deepen their understanding of geometric relationships and their relationship to location and movement by translating their knowledge of shapes into coding that can be understood by a robot. This lesson promotes 21st century thinkers.

Materials:
"The Greedy Triangle" by Marilyn Burns
An ozobot for each group of students
An Ipad for each group of students
White paper
Pencils
Black markers
Rulers
Compass'
Protractors
Printed Challenge Cards (attached)
Chart Paper

Prior Knowledge:

- Students already have knowledge on how to use the ozobot robot within the classroom and are familiar with coding the robot to achieve different results.
- Students have experience with identifying, describing, drawing and creating 2d and 3d shapes.
- Students have been using math tools such as compass, protractor and rulers to create shapes for several weeks.
- Students follow a Tribes approach to collaborative learning which is centred on 4 principles: mutual respect, attentive listening, the right to pass, and appreciations/no put downs. https://tribes.com/
- Students have been working in collaborative levelled math groups all year and are familiar with working as a team to solve problems
- Students are familiar with their role and responsibility when engaging in technology

Vocabulary:

· Ruler
· Protractor
·Compass
· Geometric shapes
· Parallel lines
· straight line
· Line segments
· Intersecting line
· Quadrilaterals
· Square
· Rectangle
· Rhombus
· Trapezoid
·Polygons
· Heptagons
· Hexagons
· Octagons
· Angle

Differentiated Instruction/Modifications/Accommodations:

This lesson incorporates the six out of the seven types of intelligences.

This lesson provides linguistic learners with the ability to verbalize their thinking and learning to their group members. It provides logical learners with a word problem that is solved through using logic and previous knowledge. Logic is called on again when students are asked to translate their geometric shape to the ozobot.

This lesson is kinaesthetic because students are able to physically create geometric shapes, physically program their robot to react a certain way, and visually see the robot physically represent their shape through movement.

Students are given opportunities to work in whole group independently and in small groups with their peers which fosters both interpersonal and intrapersonal learning styles.

	Students are able to use math tools to physically create geometric shapes which acts as a manipulative to assist the students in solving the problem. By integrating technology into this lesson, students are able to make connections between geometric shapes and their impact on the real world. The Challenge Cards vary in difficulty but provide the same big idea. Therefore, students at different mathematical levels of thinking can all participate.
Minds-On Goal: o Identifying and exploring shapes in the polygon family o Predicting how a shape will change by attribute o Changing attributes changes a shape o Providing a way for students to share their thinking.	**Part 1: <u>Minds-On Activity: (10 min)</u>** o Read "The Greedy Triangle" by Marilyn Burns to students. o As you read ask students to predict what will happen next to the triangle as it shifts into a new shape? o Before the triangle becomes a circle, ask students to try and think of a polygon with as many sides as possible. Ask students: what might happen next in the book? o Take a few ideas from students. o Read the ending. o Ask students if their predictions were correct. What happened to the shape? Why?

Part 2: <u>Working On It</u>

<u>Open Task:</u>

Divide students into their math working groups and provide each with pencils, protractor, compass, ruler, white paper, an ozobot and a black marker.
Review the co-constructed math learning group contract with students which includes: mutual respect, attentive listening, participation and have student groups work together to draw 3 different quadrilaterals with one side of each drawing being at least 10 cm long using material of choice: protractor, ruler or compass.
When the group completes this task, ask them to trace over the pencil outline of their shapes with a black marker.
Review rules of using ozobot, coding and technology in the classroom emphasizing digital citizenship- students' responsibilities to themselves and each other.
Have students place their ozobot on a straight line to see which shapes they created will allow ozobot to go all the way around.
When this task is complete have the groups draw a line to segment each of the quadrilaterals into 2 halves.
Ask students to place the ozobot close to the intersecting line and have students observe which intersections the Robot can turn on.
Ask them to think about why ozobot can move on certain lines and intersections but not on others?
Have students try this with each quadrilateral they created.
Finally, provide each group of students with an Ozobot Geometry Challenge Card which provides a written problem using math language and attributes to distinguish between polygons to create a shape, chart paper and markers.
Students will work together on chart paper to problem solve solutions to their challenge through discussion, trial and error and using key math terminology to determine their shape.
Students will explain their thinking on the chart paper using visuals, words, equations, or symbols.
Once students solve their challenge they must use coding to have their ozobot robot create the shape.
The Challenge Cards vary in difficulty which allows the outcome of the lesson and task to be the same but the process different depending on the groups thinking capacities.
Challenge Example: Code your ozobot to trace out a quadrilateral that has 2 sets of parallel sides with all equal lengths but no right angles. What name could your shape have?
Challenge Example: Code your ozobot to trace out a polygon that can be called a quadrilateral, a rectangle and a rhombus. Add a spin code. What name could your shape have?
**(I have not updated the challenge cards yet but I like the open ended side of this way of looking at the challenges suggested by you.*)

<u>Groupings:</u>

Whole Group
Levelled Small Groups

Teacher Guide: **<u>Scaffolding Questions:</u>**	**Problem Solving Strategies:**
o What strategies do you already know that can help you solve this problem? o Can a polygon be a quadrilateral?	o Students will be asked to use predictive strategies to make guesses about what shape the

- Can a quadrilateral be a polygon?
- What happens as the sides of the polygon increase?
- Can a circle be a polygon? Why or Why not?
- Is there another way to solve this problem?
- How does your understanding of geometric shapes help you when coding ozobot?
- Did you achieve the learning goal for this lesson?
- How well did your group do collaborating? Discuss with your group and determine a number for today's collaboration out of 5. (Self-assessment)

Probing Questions:

- What strategy did you use to solve the problem?
- Did you use a model?
- How did you use the math tools to help you solve the problem?
- Can you explain your thinking?
- Does your group agree with your thinking? Why? Why Not?
- What type of lines and shapes can ozobot follow? How do you know?
- Does ozobot have any boundaries? What are they? How do you know?
- Do you notice anything interesting?
- Do you see any types of patterns?

triangle will become when visiting the shapeshifter.
- This knowledge will be consolidated by having students draw their own quadrilateral with as many sides as possible to predict what might happen next in the book.
- Students will be provided with math tools to help them in solving the math problem they are presented. Through trial and error (guess and check) students will discover what happens if they do not use a tool properly and will have the opportunity to try solving the problem in a new way/with a new strategy.
- Students may have assumptions about the answer to their problem without using steps to solve it. Students need to be open to many different possibilities and answers.
- Students are asked to use logical reasoning to explain their thinking throughout all areas of the lesson.
- Students are provided with time to ask questions, experiment and make mistakes.
- Students are provided with manipulatives to create tracks for their robots to follow
- Do students connect geometric shapes and attributes to their importance in the way shapes moves and change?
- Engage students in 21st century thinking by asking how understanding of geometric shapes helps when coding ozobot? Why? Why not? What are the boundaries of ozobot when it comes to line and shapes?
- Students are given opportunities to look for patterns when translating their shape to the ozobot.
- Students will record their thinking using chart paper- symbols, pictures, words, diagrams, etc.
- Students will reflect on their learning individually and their collaboration as a group.
- Students will communicate their learning and justify their choices.

(Marian Small, Chapter 5, "Making Math Meaningful to Canadian Students")

Part 3: Consolidation

Key Concepts:

- Identifying and exploring shapes in the polygon family
- Predicting how a shape will change by attribute
- Changing attributes changes a shape
- Providing a way for students to share their thinking.

To consolidate student knowledge math groups with gather together and participate in what Fosnot and Dolk (2002) refer to as a Congress. Through observation, the teacher will select certain members of a group to share the strategy they used to solve their math problem.
Try to select 3 very specific and different strategies that will assist the entire class with their mathematical thinking and problem solving skills. (http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/CBS_Communication_Mathematics.pdf)

Students come together with their work.

Productive Talk Moves:

- Revoicing
- Asking students to apply their own reasoning to someone else's
- Prompting students for further participation
- Opportunity to ask questions

Further Extensions:

Have students solve a new problem and see if they come to the same answer as their peers. Why or why not?
Have students continue to explore 2d shapes using the ozobot by exploring

Call on certain groups to present their work to the class and demonstrate their work using the ozobot. "Revoice" student ideas. Ask if students have anything to add onto a groups work or any questions. Ask consolidating questions. Collect Ipads/ozobots/materials Have students reflect as a group on their collaboration and rate their work out of 5 (this is done consistently to help students evaluate their work). . **Consolidation Questions:** ○ How does your understanding of geometric shapes help you when coding ozobot? ○ How did you use the math tools to help you solve the problem? Did you think you achieved the learning goal for this lesson? (Self-assessment)	different shapes (triangles, ovals, circles). Culminate by having students draw a variety of geometric shapes to create a city map that ozobot will follow with specific coding requirements. Assessment: Assessment will take place through observations, discussions, hands on experience, scrap work and problem solving strategies used, demonstration of learning, participation, collaboration, explaining thinking, peer/self-evaluation and providing a justification for specific thinking and reasoning.

Math Part 1 AQ Assignment 2 Emily Wright

Ozobot Shape Exploring
Grade: 5

Strand: Geometry and Spatial Sense	
Curriculum Expectations: **Overall:** ● identify and classify two-dimensional shapes by side and angle properties, and compare and sort three-dimensional figures; **Specific:** ● distinguish among polygons, regular polygons, and other two-dimensional shapes;	
Learning Goal: ● We are learning to use sides and angles to construct, represent and classify polygons.	
Underlying Math Big Idea: ○ Different attributes of shapes and figures can be used to sort and classify these shapes and figures in different ways. ○ Any shape or figure can be represented in many ways. Each way highlights something different about the shape or figure ○ Composing and decomposing a shape or figure can provide information about the shape or figure. ○ Marian Smalls	**Connections:** By taking on a kinesthetic approach to mathematics in this lesson, students are able to deepen their understanding of geometric relationships and their relationship to location and movement by translating their knowledge of shapes into coding that can be understood by a robot. This lesson promotes 21st century thinkers.
Materials: An ozobot for each group of students An Ipad for each group of students White paper Pencils Ozobot markers Rulers Compass' Protractors Chart Paper Task Sheet Coding	Prior Knowledge: ○ Students already have knowledge on how to use the ozobot robot within the classroom and are familiar with coding the robot to achieve different results. ○ Students have experience with identifying, describing, drawing and creating 2d and 3d shapes. ○ Students have been using math tools such as compass, protractor and rulers to create shapes for several weeks. ○ Students follow a Tribes approach to collaborative learning which is centred on 4 principles: mutual respect, attentive listening, the right to pass, and appreciations/no put downs. https://tribes.com/ ○ Students have been working in collaborative levelled math groups all year and are familiar with working as a team to solve problems ○ Students are familiar with their role and responsibility when engaging in technology
Vocabulary: · Ruler · Protractor ·Compass · Geometric shapes	Differentiated Instruction/Modifications/Accommodations: This lesson incorporates the six out of the seven types of intelligences.

· Parallel lines · straight line · Line segments · Intersecting line · Quadrilaterals · Ray ·Polygons · Heptagons · Hexagons · Octagons · Angle	This lesson provides linguistic learners with the ability to verbalize their thinking and learning to their group members. It provides logical learners with a word problem that is solved through using logic and previous knowledge. Logic is called on again when students are asked to translate their geometric shape to the ozobot. This lesson is kinaesthetic because students are able to physically create geometric shapes, physically program their robot to react a certain way, and visually see the robot physically represent their shape through movement. Students are given opportunities to work in whole group independently and in small groups with their peers which fosters both interpersonal and intrapersonal learning styles. Students are able to use math tools to physically create geometric shapes which acts as a manipulative to assist the students in solving the problem. By integrating technology into this lesson, students are able to make connections between geometric shapes and their impact on the real world. The shape worksheet provide the same big idea. Therefore, students at different mathematical levels of thinking can all participate.
Minds-On Goal: o Identifying and exploring shapes in the polygon family o Changing attributes changes a shape o Sharing student thinking	**Part 1: <u>Minds-On Activity: (10 min)</u>** o Ask students: what do you remember about the ozobot challenges we did yesterday? o Explain that today students will have a chance to solve some of the other problems that were available. o Provide students for time.

Part 2: <u>Working On It</u>

<u>Open Task:</u>

Divide students into their math working groups and provide each with pencils, protractor, compass, ruler, white paper, an ozobot, Ipad and markers for coding.
Review the co-constructed math learning group contract with students which includes: mutual respect, attentive listening, and participation.
Review rules of using ozobot, coding and technology in the classroom emphasizing digital citizenship- students' responsibilities to themselves and each other.
Students will be asked to work in their groups to draw a shape with the specified number of sides, and then must name the shape and include the specified code used to create each shape.
Each group will be presented with a task sheet to work on.
Students will write down or communicate their answers.
The task sheet will act as a reference moving onto day 3's lesson.

<u>Groupings:</u>

Whole Group
Levelled Small Groups

<u>Scaffolding Questions:</u> ○ What strategies do you already know that can help you solve this problem? ○ What could happen when the sides of the polygon increase? ○ Is there another way to solve this problem? ○ How does your understanding of geometric shapes help you when coding ozobot? ○ Did you achieve the learning goal for this lesson?	**Problem Solving Strategies:** ○ Students will be provided with math tools to help them in solving the math problem they are presented. Through trial and error (guess and check) students will discover what happens if they do not use a tool properly and will have the opportunity to

- How well did your group do collaborating? Discuss with your group and determine a number for today's collaboration out of 5. (Self-assessment)

Probing Questions:

- What strategy did you use to solve the problem?
- Did you use a model?
- How did you use the math tools to help you solve the problem?
- Can you explain your thinking?
- Does your group agree with your thinking? Why? Why Not?
- How many types of shapes can we make with ozobot?
- Are there boundaries for ozobot to follow?
- Do you notice anything interesting?
- Do you see any patterns?

try solving the problem in a new way/with a new strategy.
- Students may have assumptions about the answer to their problem without using steps to solve it. Students need to be open to many different possibilities and answers.
- Students are asked to use logical reasoning to explain their thinking throughout all areas of the lesson.
- Students are provided with time to ask questions, experiment and make mistakes.
- Students are provided with manipulatives to create tracks for their robots to follow
- Engage students in 21st century thinking by asking how understanding of geometric shapes helps when coding ozobot? Why? Why not? Students are given opportunities to look for patterns when translating their shape to the ozobot.
- Students will record their thinking using chart paper- symbols, pictures, words, diagrams, etc.
- Students will reflect on their learning individually and their collaboration as a group.
- Students will communicate their learning and justify their choices.

(Marian Small, Chapter 5, "Making Math Meaningful to Canadian Students")

Part 3: Consolidation

Key Concepts:

- Identifying and exploring shapes
- Changing attributes changes a shape
- Sharing thinking.

To consolidate student knowledge math groups with gather together and participate in a community circle. Each group will have the opportunity to present one shape they created to the classroom so each group is able to present one of their findings to the community.
"Revoice" student ideas.
Ask if students have anything to add onto a groups work or any questions.
Ask consolidating questions.
Collect Ipads/ozobots/materials
Have students reflect as a group on their collaboration and rate their work out of 5 (this is done consistently to help students evaluate their work).

Consolidation Questions:

- How does your understanding of geometric shapes help you when coding ozobot?
- What are the boundaries of ozobot when it comes to line and shapes?
- How could you use the math tools to help you solve the problem?
- Did you think you achieved the learning goal for this lesson? (Self-assessment)

Productive Talk Moves:

- Revoicing
- Asking students to apply their own reasoning to someone else's
- Prompting students for further participation
- Opportunity to ask questions

Further Extensions:

Students can explore other shapes that they can make with ozobot and record their findings. Is there any shapes ozobot can't make?

Assessment:

Assessment will take place through observations, discussions, hands on experience, scrap work and problem solving strategies used, demonstration of learning, participation, collaboration, explaining thinking, peer/self-evaluation and providing a justification for specific thinking and reasoning.

Ozobot Geometry Maps
Grade: 5

Strand:
Geometry and Spatial Sense

Curriculum Expectations:

Overall:

- identify and classify two-dimensional shapes by side and angle properties, and compare and sort three-dimensional figures;

Specific:

- distinguish among polygons, regular polygons, and other two-dimensional shapes;

Learning Goal:

- We are learning to use sides and angles to construct, represent and classify polygons.

Underlying Math Big Idea:

- Different attributes of shapes and figures can be used to sort and classify these shapes and figures in different ways.
- Any shape or figure can be represented in many ways. Each way highlights something different about the shape or figure
- Composing and decomposing a shape or figure can provide information about the shape or figure.
- Marian Smalls

Connections:
By taking on a kinesthetic approach to mathematics in this lesson, students are able to deepen their understanding of geometric relationships and their relationship to location and movement by translating their knowledge of shapes into coding a map that can be understood by a robot. This lesson promotes 21st century thinkers.

Materials:
An ozobot for each group of students
An Ipad for each group of students
White paper
Pencils
Ozobot markers
Rulers
Compass'
Protractors
Chart Paper
Coding Reference Sheet

Prior Knowledge:

- Students already have knowledge on how to use the ozobot robot within the classroom and are familiar with coding the robot to achieve different results.
- Students have experience with identifying, describing, drawing and creating 2d and 3d shapes.
- Students have been using math tools such as compass, protractor and rulers to create shapes for several weeks.
- Students follow a Tribes approach to collaborative learning which is centred on 4 principles: mutual respect, attentive listening, the right to pass, and appreciations/no put downs. https://tribes.com/
- Students have been working in collaborative levelled math groups all year and are familiar with working as a team to solve problems
- Students are familiar with their role and responsibility when engaging in technology and with community members.

Vocabulary:

· Ruler
· Protractor
·Compass
· Geometric shapes
· Parallel lines
· straight line
· Line segments
· Intersecting line
· Quadrilaterals
· Square
· Rectangle
· Rhombus
· Trapezoid
·Polygons
· Heptagons
· Hexagons
· Octagons
· Angle

Differentiated Instruction/Modifications/Accommodations:

This lesson incorporates the six out of the seven types of intelligences.

This lesson provides linguistic learners with the ability to verbalize their thinking and learning to their group members. It provides logical learners with a word problem that is solved through using logic and previous knowledge. Logic is called on again when students are asked to translate their geometric shape to the ozobot.

This lesson is kinaesthetic because students are able to physically create geometric shapes, physically program their robot to react a certain way, and visually see the robot physically represent their shape through movement.

Students are given opportunities to work in whole group independently and in small groups with their peers which

	fosters both interpersonal and intrapersonal learning styles. Students are able to use math tools to physically create geometric shapes which acts as a manipulative to assist the students in solving the problem. By integrating technology into this lesson, students are able to make connections between geometric shapes and their impact on the real world. The shape worksheet provide the same big idea. Therefore, students at different mathematical levels of thinking can all participate.
Minds-On Goal: o Identifying and exploring shapes in the polygon family o Changing attributes changes a shape o Sharing student thinking	**Part 1: <u>Minds-On Activity: (10 min)</u>** o We often work with maps in our history and geography work but maps are also very much related to mathematics. o What do you know about maps? o How might your knowledge of maps be important when creating a map using an ozobot?

Part 2: <u>Working On It</u>

<u>Open Task:</u>

Divide students into their math working groups and provide each with pencils, protractor, compass, ruler, white paper, an ozobot, Ipad and markers for coding.
Review the co-constructed math learning group contract with students which includes: mutual respect, attentive listening, and participation.
Review rules of using ozobot, coding and technology in the classroom emphasizing digital citizenship- students' responsibilities to themselves and each other.
Students will be asked to work in their groups to use their knowledge from previous lessons to draw a variety of geometric shapes that are readable by ozobot and then connect those shapes to a track to make a working map.

<u>Groupings:</u>

Whole Group
Levelled Small Groups

<u>Scaffolding Questions:</u> o What strategies do you already know that can help you solve this problem? o What could happen when the sides of the polygon increase? o Is there another way to solve this problem? o How does your understanding of geometric shapes help you when coding ozobot? o Did you achieve the learning goal for this lesson? o How well did your group do collaborating? Discuss with your group and determine a number for today's collaboration out of 5. (Self-assessment) **<u>Probing Questions:</u>** o What strategy did you use to solve the problem? o Did you use a model? o How did you use the math tools to help you solve the problem? o Can you explain your thinking? o Does your group agree with your thinking? Why? Why Not? o How many types of shapes can we make with ozobot? o Are there boundaries for ozobot to follow? o Do you notice anything interesting? o Do you see any patterns?	**Problem Solving Strategies:** o Students will be asked to use predictive strategies to make guesses about their shape might be o Students will be provided with math tools to help them in solving the math problem they are presented. Through trial and error (guess and check) students will discover what happens if they do not use a tool properly and will have the opportunity to try solving the problem in a new way/with a new strategy. o Students may have assumptions about the answer to their problem without using steps to solve it. Students need to be open to many different possibilities and answers. o Students are asked to use logical reasoning to explain their thinking throughout all areas of the lesson. o Students are provided with time to ask questions, experiment and make mistakes. o Students are provided with manipulatives to create tracks for their robots to follow

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Engage students in 21st century thinking by asking how understanding of geometric shapes helps when coding ozobot? Why? Why not? Students are given opportunities to look for patterns when translating their shape to the ozobot.
Students will record their thinking using chart paper- symbols, pictures, words, diagrams, etc.
Students will reflect on their learning individually and their collaboration as a group.
Students will communicate their learning and justify their choices.

(Marian Small, Chapter 5, "Making Math Meaningful to Canadian Students")
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<tr><td colspan="2">Part 3: <u>Consolidation</u></td></tr>
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Key Concepts:

Identifying and exploring shapes
Changing attributes changes a shape
Sharing thinking.

Groups of students will use a second Ipad to record their ozobot navigating on their geometric shaped map and post the video to the classes google page.
Students will gather to watch each group's map and ozobot exploration.
Ask consolidating questions.
Collect Ipads/ozobots/materials
Have students reflect as a group on their collaboration and rate their work out of 5 (this is done consistently to help students evaluate their work).

Consolidation Questions:

How does your understanding of geometric shapes help you when coding ozobot?
What are the boundaries of ozobot when it comes to line and shapes?
How could you use the math tools to help you solve the problem?
Did you think you achieved the learning goal for this lesson? (Self-assessment)

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Productive Talk Moves:

"Revoicing"
Asking students to apply their own reasoning to someone else's
Prompting students for further participation
Opportunity to ask questions

<u>Further Extensions:</u>

Students can start to make maps using math tools to calculate distance and area.

Assessment:

Assessment will take place through observations, discussions, hands on experience, scrap work and problem solving strategies used, demonstration of learning, participation, collaboration, explaining thinking, peer/self-evaluation and providing a justification for specific thinking and reasoning.
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