



Coding the Way

Strands:	Suggested time
Algebra Spatial Sense Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes	60
Topic:	Grade:
Coding directions Geometric translations	4
Overall and Specific Expectations:	
Algebra • C3. Solve problems and create computational representations of mathematical situations using coding concepts and skills. ◦ C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves sequential, concurrent, repeating, and nested events Spatial Sense • E1. Describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them. ◦ E1.3 describe and perform translations and reflections on a grid, and predict the results of these transformations Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes • A1. Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to	

learn, build resilience, and thrive, students will apply, to the best of their ability, a variety of social-emotional learning skills to support their use of the mathematical processes and their learning in connection with the expectations in the other five strands of the mathematics curriculum.

In these lessons, to the best of their ability, students will learn to **think critically and creatively** as they apply the mathematical processes of **connecting** (make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports),) and of **communicating** (express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions), so they can make connections between math and everyday contexts to help them make informed judgements and decisions.

Learning Goals:	Success Criteria:
We are learning to : • describe translations on a grid. • record translations on a grid by writing sequential code. • record a simple set of coded directions using annotations.	I can : • identify and describe the translations needed to travel between two objects on a grid. • write the steps of a code in the correct sequence to travel from one spot to another on a grid. • use numbers and letters to represent the coded steps to perform a translation.
Prior Learning:	Resources and Materials:
Knowledge of cardinal (e.g., north, south) or relational directions (e.g., left, down) that can be used to describe movement on a grid.	• Go For a Hike game board (PDF) • Pencil/paper (independent task) or projector (whiteboard group task) Go for a Hike virtual option

Learning and Teaching Activities:

Starting Learning	
1. Ask students, “What types of maps have you used or seen used before?” (e.g., street maps, theme park maps, shopping mall maps, etc.) 2. Distribute or project Go For a Hike (PDF). Ask students, “Why might someone be using this map?” (e.g., to go hiking, to find their way to their campsite, to visit different spots in a forest) 3. Explain to students that this map uses a grid system, and draw their attention to the individual squares on the grid. 4. Introduce or review the math concept of a translation as a motion from one location on a grid to another. 5. Provide a directional system for students to use to move through the grid. You may decide to use cardinal directions (e.g., north, south) or relative directions (e.g., left, right) for students to use as they describe their translations.	
Active Learning	
1. Draw students attention to the backpack in the upper left section of the grid.	Teacher moves You may wish to clarify whether diagonal movements/translations will be allowed or whether students should travel only horizontally and vertically.

Opportunities for Differentiation
Share or display several examples of maps as visual prompts to support students as they activate prior knowledge.

Simplify or increase the difficulty of the grid by adding/decreasing the barriers on the grid (i.e., rows of trees) that students must navigate around.

2. Ask students what movements would need to occur to travel across the grid from the backpack to the boat. 3. Invite students to brainstorm and share some of the movement sequences. 4. Highlight the use of numbers to provide greater precision (e.g., Move forward 5 squares, turn right a quarter turn and forward 2 more squares). Explain that when we provide both a distance and a direction this is called a translation. 5. Direct students to finish the set of translations needed to arrive at the boat. Invite a student to share the completed directions. Ask students to test the set of translations by following along on their grids or model as a whole group on a projected version of the grid. 6. Reveal to students that the work they are doing is very similar to what a computer programmer or coder would do! Explain that when we code we must be careful to provide an accurate set of commands to complete a task. When we	Pose the question: “When might it be useful to travel diagonally on a hike?” It is likely that student descriptions will not be precise at this point. Example, students may say things like “Go to the right” or “Go over and down”. Eventually, you will want the students to say “move forward two squares, turn right a quarter turn then move forward three more squares. The student is actually going “down” towards the backpack instead of going backwards. This is going “down” but without making you walk “backwards” Ensure students understand the need to include both distance and direction when providing descriptions of their translations.	Opportunities for Assessment Assessment FOR Learning Observe and review with students to ensure it is understood that translations must include both distance and direction.
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record the steps to perform a task we are coding!	You may consider scaffolding this task by requiring students to code an accurate set of translations between 2 set items (i.e., backpack to fishing rod) before attempting to code more lengthy translations (i.e., backpack to waterfall).	Opportunities for Differentiation Provide a list of predetermined pairings of landmarks/items to choose from. Invite students to record the translations needed to cross the grid and visit 3 or more landmarks/items (i.e., backpack, boat, fishing rod). Opportunities for Assessment Assessment FOR Learning Provide opportunities for students to share and test out other coded translations on the grid for accuracy. Assessment AS Learning Ask students to reflect on both types of coded translation steps (e.g., “left, left, down” and “L2 D1”). Pose the following reflection questions: Which set of directions do you think people might find easier to follow? Why?
7. Invite students to record a new set of translations to describe the movement between two other landmarks/items on the grid.		
Consolidation of Learning		
1. Invite students to share some of the coded translations they were able to complete. 2. Ask students if they found it tiring to continue repeating the writing of the directional words. 3. Explain that coding is meant to increase the speed in which a task is able to be performed. Model how to record the translations they completed in the practice portion of the lesson by annotating using letters, numbers and arrows. For example, a coding sequence of “forward 3 blocks, turn right a quarter turn, forward 5 blocks and backwards 2 blocks” could be coded as : “Frw 3, ↗, Frw 5, Bkw 2” Note: It is possible that students may naturally begin using a form of annotation during the previous portion of the lesson. You may wish to stop the class at this point and allow students to share with each other this simplified version of recording the code. 4. Provide an opportunity for students to revise an original set of coded translation steps using the modelled format of letters, arrows and numbers.		

5. Allow time for students to test out each other's newly coded steps to ensure accuracy.	Which set of directions do you think are easier to write as the programmer? Why? What are some of the potential errors that could happen with each specific style of directions?
Further Consolidation/Next Steps for students and teachers:	
1. Students may wish to construct their own map on a blank grid and code the translations found within.  Blank grid virtual 2. Students may be challenged to work backwards from a set of coded translations in order to place landmarks/items on a grid. 3. Students may wish to guide a partner through a grid using a set of oral coded translations.	