Understanding Geometry by Utilizing Shapes

GRADE LEVEL
4 - 6

SUBJECTS
Using Prepositions

ESTIMATED TIME
(2) 50-minute sessions

> I think the universe is pure geometry - basically, a beautiful shape twisting around and dancing over space-time. Antony G. Lisi

OVERVIEW

The purpose of the exercise is to enhance student understanding of geometric shapes by duplicating and tracing a geometric shape already drawn on the floor using an educational robot with an attached magic marker. The student and their mentor will engage in a series of trials by reprogramming their robot to converge on tracing the same geometric pattern that has been drawn on the sheet of paper until it progressively duplicates the shape.

NATIONAL/STATE MATH STANDARDS

A number of the state standards for many states are met by the use of these exercises for grades 3-6.

OBJECTIVES

In this series of lessons, students will

- Become familiarized with the various geometric shapes such as: circle, triangle, square, rectangle, etc.….
- Develop a sense of line segment length and angles.
- Become familiar with the concept of acute, right and obtuse angles and what they mean in geometry.

MATERIALS

- Educational Robot which can be programmed
- A laptop computer with the graphical programming interface installed

- Markers of various colors
- Masking tape (or equivalent)

SETUP

1. Find a piece of paper approximately 3 to 4 feet on a side and draw a triangle or square or other geometric shape that is being studied.
2. Place the drawn figure on the floor (and tape it if needed)
3. Write a program using the programming language that accompanies your educational robot. For the STEMBoT educational robot the program is known as STEMBoT Commander. View the tutorial if needed which will include an example of the two foot square program.
4. In writing your program you may want to introduce a specific error, such as one side being incorrectly sized or an angle is slightly off.
5. Connect a fully charged robot to the laptop and attach it to the laptop via the programmer cable to build and upload the program.
6. Be sure to upload the program to the robot. Prior to class, perform a dry run with the robot (without marker) to confirm the program is installed on the robot and the geometric shape fits on your paper
7. Once confirmed, attach a marker to the robot.
8. Place the robot on the floor and hit the run button to see that it is working properly.
9. Prior to the session, the teacher can present geometric shapes to the students and have them draw the shape on paper to familiarize them with what they mean.
10. RECOMMENDED: to use time efficiently one student per robot should be assigned a mentor to assist and guide the student

LESSON

1. Have the mentor check to see the magic marker is securely attached at the front of the robot with tape. The mentor will have the student place their robot at the starting position and press the start button.
2. The mentor and student will observe the robot's path that is being traced on the paper. The marker may need to be readjusted to make certain that it is actually tracing on the paper. Upon initial completion of the pattern the pupil will mark it as run #1.
3. The mentor and student will discuss why the traced pattern did not match the original geometric shape. For beginning students the mentor can do the reprogramming. For experienced students who are familiar with the programming and the procedures for downloading into the robot they can be observed by the mentor as they make changes to the program.
4. The color of the marker can be exchanged for a different color before the next run is executed to show subsequent trials getting progressively better.
5. Robot is placed at the starting point and the run button is pressed once again.

6. The previous steps can be repeated until the pattern duplicates the original geometric pattern.
7. For non-native speakers, the student can be asked to explain in English to the mentor why the pattern is in error and how to improve it after each trial is completed.

Depending on time, resources available and number of mentors present the exercise can be repeated for other shapes. Experienced or students making good progress can proceed to the "Spirograph" lesson.

ASSESSMENT / EVALUATION

1. Does the pupil comprehend what the intention of each preposition is?

2. Does the pupil have hand-eye coordination ability?

3. For non-English speaking pupils, are their language skills enhanced after the exercise?

4. For students in higher grades or advanced students, programming is a tangible goal. Students who complete the exercises early can themselves serve as mentors to their classmates.

5. The teacher may wish to engage the class in a follow up discussion of key lessons learned by students that day. Students who show commitment and interest may be asked to share with their classmates what they learned about geometry and/or programming.

ENRICHMENT

1. Knowledge of the various geometric shapes and polygons is reinforced by this sequence of exercises by employing a robot to engage interest and participation in the exercise. If a square is the example, the next shape could be a rectangle. Students can learn that a square is a special case of a rectangle.

2. Depending on time, a review of each polygon can be displayed and traced (e.g. square becomes a rectangle) .

3. Questions on "angles" and their attributes or lengths of the side of the polygon can be asked. A pupil will see the progression of improvement being traced out on paper for each new programming change.

4. A sense of ownership and accomplishment which is evidenced by the duplication of the shape will be seen by the pupil. They may wish to sign their names to their work to have hung in the classroom or taken home to show parents.

5. For non-English speaking students, new words will have been added to their vocabulary.