EXPANDED LEARNING BY CITIZEN SCHOOLS

Amazing Mazes

Materials and Teaching Checklist – lesson 2

Lesson Name: Introduction to Maze Building
Date to be taught: 3/12/2013

"I Can" Skills:

Last Time	This Time	Next time
Describe main characteristics of mazes	**Identify maze complexity parameters** **Create lines in a 2D plane**	**Build mazes with different complexities**

Before the Lesson:

Copies to Make	Materials to Bring	Visuals to Make
	- Projector with speakers - Internet connectivity - Big sheets (Easel size) of quadrille paper to post/paste/use on whiteboard (for teaching 2D coordinates) - Quadrille/grid/graph notebook size paper for students	

During the Lesson:

Section	Time (min)	I Say / Do	They Say / Do

Hook	10	**Review**
		- Quick review of last lesson – for students who missed it
		  ○ Different mazes, shapes, difficulty
		  ○ Different views:
		  ▪ Bird's eye view, Inside view
		- Reminder: goals of the apprenticeship:
		  ○ Learn to build mazes
		  ○ Learn to program maze walkers
			- **Students review key points of last lesson**

Activity 1	15	**Complexity of mazes (parameters)**
		- Build motivation: Use **http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-maze-maker-3-students.html** to show student randomly changing mazes
		- Ask students to go to the webpage at TBD and determine the meaning/impact of
		  ○ Path-width
		  ○ Gap
		  ○ Curviness
		- Tie this back to their plans to build simple/complex mazes
		  ○ Number of turns ("curviness")
			- **students use http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-maze-maker-3-students.html to determine the meaning/purpose/impact of**
			  ○ **path width**
			  ○ **gap**
			  ○ **curviness**

		○ Number of junctions/intersections ○ Number of possible solutions/entry/exit points	
Mini Lesson	15	**Points in 2D** - Ask students for their ideas for how to teach "someone as dumb as a computer" to draw lines on the screen ○ establish the need for a starting point and an ending point for each line - Cartesian notation (x,y) for points in a 2D plane ○ Use the whiteboard and quadrille sheets - **Emphasize: each point has an "address" made of 2 numbers, the first tells how much we "go across", the second tells how much we "go up"**	- **Students describe their ideas** - **Students guide the instructor to draw on the board different points using (x,y) coordinates**
Activity 2	15	**Lines in 2D** - Students in pairs, using quadrille paper ○ Draw 4 points that make a square ○ Write down in (x,y) notation (x,y) each point ○ Teacher will ask each pair to call out the size of their square	- **Draw 4 points that make a square (any size they want) on quadrille paper** - **Write down the(x,y) coordinates of each point** - **Determine the size of their square** ○ **How did they do it?**
Activity 3	15	**Building Mazes** - Students in pairs, using **http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html** will build ○ The square they created on paper, using the 4 points that make the square ○ A shape/maze of their choice - Teacher will point out that if the students want to have a maze walker walk the maze in the future, the maze has to consist of right-angle lines (no diagonals)	- **Students in pairs, use http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html to build shapes and mazes**
Exit Tix	10	If we have time: - Draw a maze on the board and ask students to build it with as few lines as possible - Using copy & paste, can students create a maze made of 3 "shifted" squares by a certain offset (using an offset for the x and y coordinates)	**Students in pairs, use http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html to build shapes and mazes**

Dismiss		Remind students of our goals: Build mazes Create maze walkers Teach maze walkers to "solve" (walk) the mazes effectively	

Thumbnails lesson timeline:

- Review of lesson 1 – different mazes, complexity, bird's eye view, inside maze view
- NetLogo - MazeMaker (automatic) – explore function of: path-width, gap, curviness
- Building hard/complex mazes: size, density, turns, junctions
- Points in 2D – (x,y) coordinates
    - Kids instruct teacher to draw 4 points that make a square (without the lines)
    - We'll have to instruct the computer
- Lines in 2D – starting point, ending point
    - Kids draw on paper a square, and write the (x,y) coordinates
    - Kids call out the size of the square (length of a side)
- NetLogo – MazeBuilder
    - Kids draw their square in the program
    - Kids draw a simple maze/shape
    - Note: maze walker needs maze with right angles in order to walk
- If we have time
    - MazeBuilder – copy and paste and offset the x and/or y coordinates to duplicate shapes
        - Kids can shift their square 2 more times