Amazing Mazes

EXPANDED LEARNING BY CITIZEN SCHOOLS

Materials and Teaching Checklist – lesson 3

Lesson Name: How to Build a Maze
Date to be taught: 3/19/2013

"I Can" Skills:

Last Time	This Time	Next time
-Identify maze complexity characteristics **-Create lines in a 2D plane**	**Build mazes with different complexities**	**Create and control maze walkers**

Before the Lesson:

Copies to Make	Materials to Bring	Visuals to Make
	- Projector - Computers with Internet connectivity -	

During the Lesson:

Section	Time (min)	I Say / Do	They Say / Do
		Review	
	10	- Quick review and **teach-back** of last lesson ○ Drawing lines with (x,y) coordinates: "addresses": **x-going across, y-going up** ○ **Student participation**: draw a simple shape on the board – with grid ▪ Ask students to call out (x,y) coordinates ("addresses") ○ **Note**: this simple ("H") shape can be **replicated** to create a more complex maze	- **Students review key points of last lesson** ○ **"Addresses" ((x,y) coordinates)** ○ **x-going across, y-going up**
Hook			- **The simple shape ("H"):** ○ draw-path (1,5)(3,5) ○ draw-path (3,5)(3,1) ○ draw-path (3,3)(6,3) ○ draw-path (6,5)(6,1)
Activity 1		**Building mazes**	
	15	- **Hands-on activity**: Use the MazeBuilder **http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html** program to draw the simple maze we created on the board (above)	- **students use** the MazeBuilder **http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html** program to draw **the "H" shape above**

- Tie this back to their plans to build simple/complex mazes
    - Number of turns ("curviness")
    - Number of junctions/intersections
    - Number of possible solutions/entry/exit points

Maze building as a program (series of instructions)

Mini Lesson	15	- So far, students have built shapes/mazes using the User Interface (UI) to enter (x,y) coordinates ("addresses") for the points and lines
		- Draw students attention to the "history window" at the top right of the UI. Ask them to figure out what it means.
		- It records "instructions" for drawing maze lines, as we create the maze
		- **Emphasize:**
		    - **we can build mazes by using these <u>instructions</u> (or commands) and providing the right "parameters" (the x,y coordinates – as before)**
		    - **A collection of instructions/commands makes a <u>program</u>**
		- So there are two ways to build shapes/mazes:
		    - using the **User Interface** (UI) to enter (x,y) coordinates
		    - Using a **program** made of a series of instructions/commands
			- **Students try to figure out the meaning and purpose of the "history window" at the top right of the User Interface (UI)**

Activity 2	10	**How to build mazes with maze programs**
		- One the board:
		    - Show students how to replicate the simple shape we had create above by **adding 5 to each x coordinate**
		- Hands on:
		    - Students in pairs, using the MazeBuilder program
			- **Students build a more complex maze by replicating the simple shape above to create:**
			    - draw-path (**1**,5)(**3**,5)
			    - turns to draw-path (**6**,5)(**8**,5)
			    - draw-path (**3**,5)(**3**,1)

		▪ Replicate the shape	○ turns to draw-path (**8**,5)(**8**,1) ○ And so on
	15	**Building Mazes by writing a program** - Students in pairs, using **http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html** will build ○ A replication of the simple shape shifted in the x-direction	- **Students in pairs, use http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html to build the replicated simple shape/maze:** ○ draw-path (1,5)(3,5) ○ draw-path (3,5)(3,1) ○ draw-path (3,3)(6,3) ○ draw-path (6,5)(6,1) ○ ○ draw-path (6,5)(8,5) ○ draw-path (8,5)(8,1) ○ draw-path (8,3)(11,3) ○ draw-path (11,5)(11,1)
Activity 3			
Exit Tix	10	If we have time: - replicate the simple shape another time in the x-direction (**adding 5** to the x-coordinate of the second replica, or **adding 10** to the first – this is easier!) - replicate the simple shape another time in the y-direction (adding 4 to the y-coordinate of the first replica) -	**Students in pairs, use http://www.employees.org/~hmark/courses/amazingmazes/amazing-mazes-builder-2-students.html to build** - **3 replicas in the x-direction:** ○ draw-path (1,5)(3,5) ○ draw-path (3,5)(3,1) ○ draw-path (3,3)(6,3) ○ draw-path (6,5)(6,1) ○ draw-path (6,5)(8,5) ○ draw-path (8,5)(8,1) ○ draw-path (8,3)(11,3) ○ draw-path (11,5)(11,1)

- draw-path (11,5)(13,5)
- draw-path (13,5)(13,1)
- draw-path (13,3)(16,3)
- draw-path (16,5)(16,1)

- **1 replica in the y-direction (adding the following, to the end of the program above):**
  - draw-path (1,9)(3,9)
  - draw-path (3,9)(3,5)
  - draw-path (3,7)(6,7)
  - draw-path (6,9)(6,5)

Remind students of our goals:

Build mazes

Dismiss

Create maze walkers

Teach maze walkers to "solve" (walk) the mazes effectively

Thumbnails lesson outline:

- **Review and teach-back** of lesson 2 – points in the 2D plane have "addresses": (x,y) coordinates
  - Going x lines across, and y lines up

- **On the board simple "H" shape** – students call out:
  - (1,5)(3,5)
  - (3,5)(3,1)
  - (3,3)(6,3)
  - (6,5)(6,1)

- Students - **NetLogo** – MazeBuilder
  - **Students draw** the "H" shape

- Teacher - NetLogo – MazeBuilder – history window
  - **History window** – a collection of instructions/commands is a program

- Teacher – on the board – **replicate the "H"** shape in the x direction (add 5 to x coordinates)
  - Explain how to use the History window – to copy and paste for replication

- If we have time
  - Students - NetLogo – MazeBuilder
    - Students replicate the “H” shape **2 or 3 times** in the x direction
    - Students replicate the “H” shape in **the y direction**