Title:	Grid it, Map it
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Grade Level:	4-8
Time Allotment:	Introductory Activity: 40 minutes Activity: 40 minutes Culminating activity: 1 hour
Overview:	Once a Box City is built, groups of children use bodies and string to grid the city, then map sections of the city. The activity can be used with smaller city layouts as well, or following Boomtown projects. This activity invented itself over the course of several gym-sized Box Cities in New England towns. Whereas in some areas of the country towns and cities are based on straight lines and square corners, many New England town layouts are based on the area's varied topography. Given hills, and a river running next to the base of the hills, early settlers most often began their towns along the river; subsequent roads either skirted the edges of the hills or wound their way up and over those hills. The benefit of overlaying our New England topography with a regular mapping grid becomes clear in this hands-on mapping exercise.
Subject Matter:	Mathematics, Social Studies, Science & Technology - Mapping, Grids, Scale, Drawing Plan Views
Learning Objectives:	The children will: • physically experience and discover the utility of gridding an area for mapping purposes • engage in the design process to define and solve their design problem • draw features of their scale model in 1"=1' scale • draw features of the built environment in plan view • work cooperatively to construct grid lines over a Box City model • work cooperatively to assemble grid drawings into a whole map

Standards:	**Massachusetts Curriculum Frameworks**
	http://www.doe.mass.edu/frameworks
	History/Social Sciences:
	    • Physical Spaces of the Earth (Geography Standard 7)
	    • Places and Regions of the World (Geography Standard 8)
	
	Science and Technology:
	    • Lifelong learners are able to understand and apply the design process and the use of technology in society (Strand 3)
	
	Mathematics:
	    • Working together in teams and groups enhances mathematical learning, helps students communicate effectively and develops social and mathematical skills (Guiding Principle V)
	    • Students will use Problem-Solving, Communicating, Reasoning, and Connecting to explore, Develop, investigate and know: Number Sense (1.1); Computation and estimating (1.8); Geometry and Spatial Sense (3.3); Measurement (3.4) (Content in Mathematics)

CUBE components:	**Box City:** *Cognitive Mapping; Mapping the Special Places; Boomtown; Understanding the Plan*
Materials:	**48 children/participants** 1000' of visible string 22 small orange traffic/gym cones directional compass prepare two sets of each for coordinate signs: A,B,C,D,E,F; 1,2,3,4,5; (symbols large enough to be read from across the city) **per child**: pencil ruler drawing compass eraser clipboard crayons or markers 2 sheets graph paper handout (found in Handouts Link) scale ruler handout (found in Handouts Link)

	handouts:
	• 1/4" or 1" graph paper prepared as indicated below in Prep for Teachers (called Grid in Handouts Link)
	• Scale Rulers: 1" = 1' 1/4" = 1' 1/8" = 1' (called The Scale Ruler in Handouts Link)
	• Grid Example
Prep for Teachers:	Look ahead to the Box City activity: **Review handouts and use where needed.** Will you be building in 1/8" = 1' scale or 1/4" = 1' scale? How much total floor space will the City cover? If you grid the City as shown here (5 squares by 6 squares), what will be the dimensions of each square? This explanation uses grids of 8' x 8'. Prepare a graph paper master, then copy for student handouts. Use a thick black marker and a straightedge to draw an 8" x 8" square on 1" x 1" graph paper. Use a thinner black marker and a straightedge to draw the interior grid lines, 1" apart. Make a place on the sheet—just *inside* a corner of the 8" x 8" grid—for children to write their names, scale of the map, and arrow indicating North, and grid coordinates (e.g. C, 3). Also: read the Evaluation section of this lesson plan. Decide if you want your children to begin the set of activities by clearly, in a group, writing out the design problem that they need to solve. If they do so now you will all have a clear basis on which to evaluate your work during and after the activities are completed. Children often perform better at tasks they have defined for themselves, tasks that have an understood and agreed-upon purpose.
Introductory Activity:	**Mapping Practice–Drawing in Plan View / Drawing in Scale:** Prior to Box City, prep the children: Introduce concepts of mapping, the utility of gridding, and compass directions. Work with the children to lay out an 8'x8' square on a floor. Place construction-paper greenspace, roads and waterways on the 8'x8' space. Set several boxes, blocks or objects of different shapes on the space to represent features of the built environment. Label each building and feature.

Be sure that some roads, waterways, greenspaces and buildings extend *beyond* the edges of the 8'x8' space. Clearly mark each side of the space to represent N,S,E,W.

Discuss and demonstrate how to draw an accurate plan-view sketch of the space and all of its features, in scale, on the graph paper handout sheet. Drawing in PLAN means drawing a two-dimensional, top, or bird-eye view. Drawing in SCALE: 1" = 1' means that every 1" of the graph paper represents 1' of model space. (Model space, not real-life buildings' space. There is yet another scale relationship between the box models and the real-life buildings they represent. Do not confuse this issue.)

Demonstrate that you are building exactly *what* you see within the 8'x8' square, and exactly *where* it is in the square. Draw the land features first, then the buildings. The interior grid lines on the graph paper handout are there to help locate where buildings should be drawn.

Have the children help you measure a box building with the 1"=1' scale ruler and determine how large you should draw that building on your graph paper.

Demonstrate, too, that you are standing in one location to draw, e.g. on the South side of the square, looking North; and that you have oriented your graph paper to match.

If only part of a building or road is sited within the square, that is what you draw—part of the building. In the real Box City each child will be drawing one grid; other children will be drawing the adjoining grids.

Children tend to draw the buildings too small. To counteract that, you may want to demonstrate sketching very lightly at first, marking key building corners locations with x's or dots, until you see that the layout is somewhat of the proper size to fill the square. Then use a straightedge and draw over your sketch lines for a more permanent drawing.

Next, have each child take a pencil, eraser, ruler, clipboard and graph paper handout. (You may have to divide the class into groups; only about 8 children can comfortably practice drawing this space at the same time.) Have each child:
- Orient his paper to the direction in which he is drawing.

	• Sketch the locations of every land feature, then built feature. • Have her paper checked; make corrections as needed. • Draw over sketch lines, using a straightedge or compass when needed to make a more permanent drawing. • Color and label features and buildings.

Learning Activity:	**Gridding the City**
	[Note: This explanation uses a 40'x48' Box City layout set in a gym. Adapt as needed for layouts of other sizes.]
	
	Prep:
	Pre-determine and label "North, South, East, West" in Box City. Pre-set cones along the perimeter of the City:
	   1 cone at each corner
	   5 additional cones along north and south sides, 8' apart
	   4 additional cones along east and west sides, 8' apart
	Pre-cut string lengths long enough to span each opposing pair of cones to create a grid (add an additional 2' to each length to give each child something to hold onto.)
	Lay coordinate signs along the perimeter, in-between the cones.
	
	Activity:
	Bring 48 children into the gym. Have the first team of two children each pick up an end of the first string, walk that string across the city to its location (a pair of opposing cones), hold the string tight at top-of-the-cone height, and sit down. Cooperation is needed from all participants throughout this activity. Continue with second string, and so on, until the string grid is created. (This is more interesting when you do *not* prep the children. Somewhere in the stringing process you will see them realize what they are creating.)
	
	Assign the rest of the children to be "coordinate holders," i.e. have them sit at a sign along the perimeter and hold up their sign.
	
	Discuss why they think they have just done what they have done, why grids can be useful in a city layout, and why mapmakers use coordinates.
	
	Help the children to suggest and try out location games:

	- moving a student through the city with coordinate instructions - placing a student in a spot and asking the children to describe where he is - moving a student from one building to another using street names and cardinal directions [Note: keep the strings set up for the next activity.]
Culminating Activity:	**Mapping the City** **Prep:** have *one class of children* each bring pencil, crayons or markers, eraser, ruler (compass-optional), clipboard, 2 copies of the graph paper handouts to the gym. Review what was learned in the Mapping Practice activity. **Activity:** assign each child a City grid (e.g. A, 4). Orient the children all the same way (e.g. all facing North) and BE SURE their graph paper is oriented to match. Have them write their name, grid number, "North" arrow, and "Scale: 1"=1'" on their graph paper sheet. Each child will need to stand just outside of (i.e.to the South of) his grid to fully draw it. Tell the children that this may result in some children needing to stand in *someone else's grid* and that cooperation is required. As done in the practice activity, have each child sketch, then have their sketch checked, then draw the land features and built environment features within his/her grid. **Final piece:** Back in class, have each child neatly trim the excess edges from his graph paper sheet, keeping only the grid drawing (and the black edge line). Test fit all of the grid sections together. In a moment of self-assessment, have the children check and see how well their edges connect with those of their adjacent squares. Have the children work together to erase and redraw lines as needed. Then have them each take their individual grid drawings back and color, then label the features. Connect the individual grid-maps together into a large wonderful wall map, a permanent memory of Box City.

Evaluation/ Teacher Reflection:	This project can be defined and therefore evaluated as a Design project. 1.Define the design problem: *Whom* are we designing for? With *what* materials? *When* should we be done? *Where* will the final product end up? *Why* are we doing this? In this case, your children should help you write the answers to these questions, e.g.: "We are creating a two-dimensional representation of our Box City model…to end up on the school lobby wall…for ourselves and others to view… after Box City ends…. so we can remember what was in the city…and so on." At the end of the activity ask the children: • Did we solve our stated design problem? • How well did we solve it? • If we had the time, should it have been improved upon? How?
Cross Curricular Extensions:	Extension: take one or more Box City grid maps outside to a paved surface. Work with the students to—with measuring tools, string, and chalk—enlarge the features and buildings of that grid to full scale. Related reading: **Map Making With Children**, by David Sobel
Community Connections:	Acquire and study town planners' maps of your local neighborhood. Compare how the town maps communicate information about the natural and built environments with how your final Box City map communicates information about your Box City world.