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INNOVATIONS

Learning Lab #9

Agenda

- Obstacle Course
- Investigation: Coordinate Maps
- Geometric Thinking
- HIS-EM Framework for Math Teaching
- CCSS for Mathematical Practice
- Video Analysis
- Making & Using Tangrams

Greetings!

Obstacle Course

Rosie's Walk

by Pat Hutchins

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A Big Idea about Spatial Relationships

Relationships between
objects and places
can be described
with mathematical precision.

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A New Route for Rosie:
A Math Investigation for Adults

- On a coordinate grid, map out a new route for Rosie to walk. The route must include three places for Rosie to visit.
- Move to sit with a partner from another table.
- With a barrier to hide the maps from each other, one partner describes her/his map while the other tries to draw it. The drawer may only ask two clarifying questions.
  - Switch so each person gets a turn in each role.
- Did you learn anything from the 1st round of the game that changed how you played the 2nd?
- How far does Rosie have to travel to complete the route on your map?
  - Does the map you made tell you Rosie walked?
  - What do you need to know to figure it out?

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A Big Idea about Spatial Relationships

Our own experiences
of space and
two-dimensional representations of space
reflect a specific point of view.

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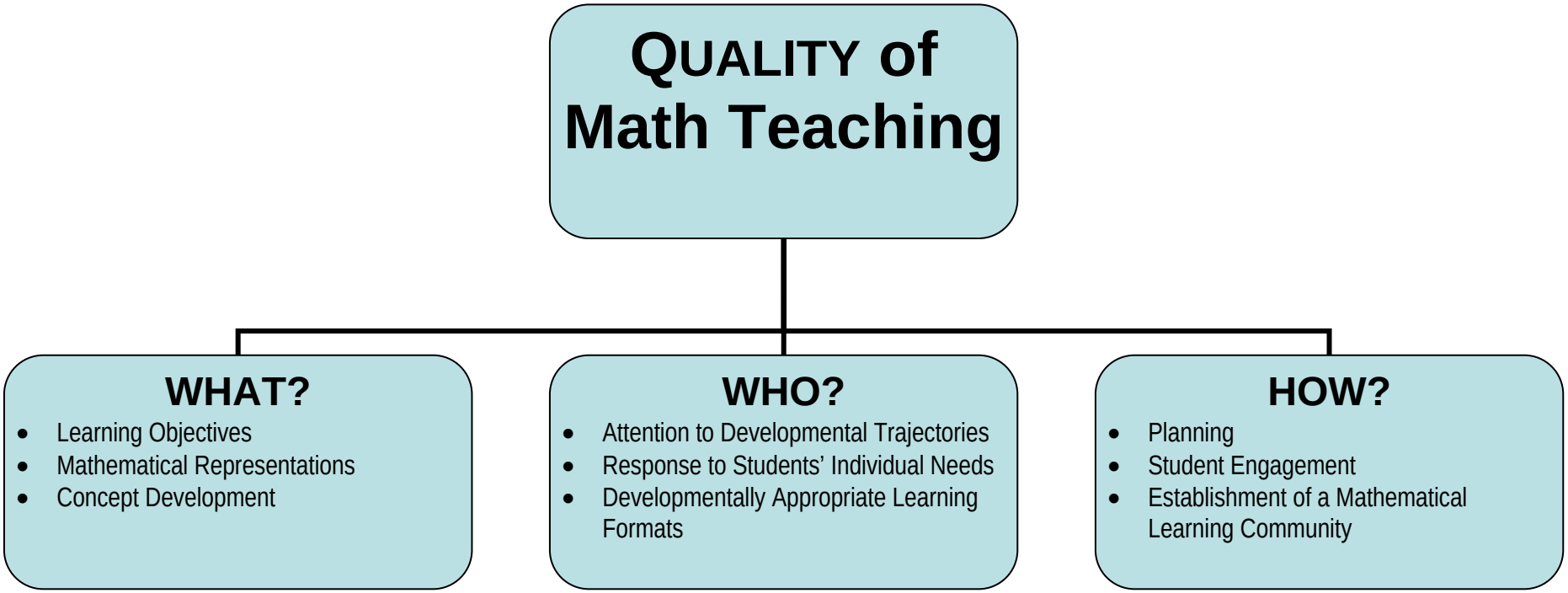
High-Impact Strategies for Early Mathematics (HIS-EM)



The HIS-EM framework considers three ***domains*** when examining the quality of math teaching:

WHAT? The degree to which teaching practice incorporates a deep knowledge of foundational mathematics concepts.

WHO? The degree to which teaching practice demonstrates an understanding of young children's typical developmental growth in mathematics and an understanding of particular, individual students' learning needs.

HOW? The degree to which teaching practice includes the effective use of mathematics teaching strategies**.**

Each of the three ***domains*** is further defined by three ***dimensions*** that make a significant impact of the quality of mathematics teaching and learning in the classroom. (See the chart on the next page for further explanation.)

HIS-EM Dimension Explanations

WHAT?		WHO?		HOW?
Learning Objectives Considers how well & clearly the teacher emphasizes the learning objectives, which reflect important learning & conceptual understanding, by connecting the lesson with students' prior knowledge & refocusing students on lesson objectives.		**Attention to Developmental Trajectories** Focuses on the teacher's awareness & knowledge of the developmental trajectory for different mathematical ideas & considers the degree to which the teacher provides feedback that promotes students' learning. Examines how the teacher makes use of student error to clarify & deepen all students' understanding.		**Planning** Considers how well the teacher selects & prepares a coherent & well-organized math lesson that helps students focus on math concepts.
Mathematical Representations Focuses on the ways in which the teacher promotes the use of multiple mathematical representations (e.g., mathematical language, tools & models) to illustrate & connect math ideas & concepts accurately & coherently. Mathematical representations should help students make sense of mathematical ideas.		**Response to Students' Individual Needs** Considers the teacher's awareness of & response to students' different academic needs & examines the degree to which the teacher facilitates students' ability to actively explore & learn at their own pace by monitoring their work & adjusting the lesson as needed.		**Student Engagement** Examines the degree to which the teacher facilitates opportunities for students to construct & make meaning of mathematical ideas & make use of variety of strategies to solve problems & justify their thinking.
Concept Development Considers the extent to which teacher's mathematical content knowledge is accurate & coherent. Examines whether a teacher anticipates common student misconceptions, draws out key math ideas for students & helps them generalize their understanding.		**Developmentally Appropriate Learning Formats** Focuses on the degree to which the instructional grouping & the pace of the lesson are appropriate & productive for the age of the students & whether the lesson is hands-on, meaningful & connected to students' lives.		**Establishment of a Mathematical Learning Community** Considers the degree to which the teacher's attitudes towards math & the teacher's interactions with students foster a sense of community in which all students feel welcomed to share their mathematical ideas & contribute to the lesson & classroom discourse.

High-Impact Strategies for Early Mathematics

ESSENTIAL QUESTIONS TO EXAMINE QUALITY IN 9 DIMENSIONS

WHAT	**Learning Objectives**	*Does the teacher make the learning objective, or purpose, of the lesson clear to students?* *Is the learning objective focused on procedures or concepts?*
	Mathematical Representations	*Are the mathematical representations accurate?* *Do they help students make sense of mathematical ideas?*
	Concept Development	*Does the lesson lead students to a deeper understanding of concepts?* *Does the teacher help students generalize what they've learned?*
WHO	**Attention to Developmental Trajectories**	*Is the lesson pitched to the right developmental level?* *Does the teacher scaffold to help build students' understanding?*
	Response to Students' Individual Needs	*Is the teacher aware of how individual students are learning the concepts?* *Does the teacher adjust the lesson when necessary?*
	Dev. Appropriate Learning Formats	*Is the format of the lesson developmentally-appropriate?*
HOW	**Planning**	*Has the teacher prepared for the lesson's activities?* *Is the teacher intentional in her plans or following a manual without making it her own?*
	Student Engagement	*Who is doing the bulk of the math work—the thinking, explaining, and justification?*
	Establishment of a Mathematical Learning Community	*Does the lesson promote a culture of learning where math is understood to be an important, sense-making activity?* *Are students welcomed to share their ideas?*

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Activity Plan

Date _____ **Completed by:**
Teacher _____ **Grade:** _____ **Teacher**
School _____ **Teacher & Coach**

Title of Activity (list lesson number, or related children's book)

CCSS for Mathematical Content (check one)	**CCSS for Mathematical Practice** (check one or two)
Number and Operations o Counting and Cardinality o Base Ten o Fractions Operations and Algebraic Thinking Geometry Measurement and Data	1 Make sense of problems and persevere in solving them 2 Reason abstractly and quantitatively 3 Construct viable arguments and critique the reasoning of others 4 Model with mathematics 5 Use appropriate tools strategically. 6 Attend to precision. 7 Look for and make use of structure 8 Look for and express regularity in repeated reasoning

What **Big Idea** or **Central Mathematical Concept** will children explore?

Format Used (if more than one, indicate %)
Whole group Small group Partners Centers Independent work

How do you plan to **engage** children at the start of the lesson? (e.g. Math-to-Math or Math-to-Self connection, problem to solve, children's book, etc.)

How do you plan to **make the mathematical concepts visible** to children?

What strategy do you plan to use to ensure **all students participate**? When?

Questions to **assess understanding**:

How do you plan to **summarize children's learning** at the end of the lesson?

As you plan for this activity, what **dimension of your teaching** are you thinking about the most? (check one)

Lesson Objectives	Attention to Learning Trajectories	Planning
Mathematical Representations	Response to Individual Students' Needs	Student Engagement
Concept Development	Developmentally-Appropriate Learning Formats	Mathematical Learning Community

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Activity Plan

Date 12/7/11
Teacher T
School XYZ School
Grade: Prek

~~Completed by:~~ ~~Teacher~~ **Teacher & Coach**

Title of Activity (list lesson number, or related children's book)
Walk with Rosie - obstacle course & mapping based on Rosie's Walk

CCSS for Mathematical Content (check one)

- Number and Operations
  - o Counting and Cardinality
  - o Base Ten
  - o Fractions
- Operations and Algebraic Thinking
- ✓ ~~G~~eometry
- Measurement and Data

CCSS for Mathematical Practice (check one or two)

1 Make sense of problems and persevere in solving them
2 Reason abstractly and quantitatively
3 Construct viable arguments and critique the reasoning of others
✓ ~~4~~ Model with mathematics
5 Use appropriate tools strategically.
✓ ~~6~~ Attend to precision.
7 Look for and make use of structure
8 Look for and express regularity in repeated reasoning

What **Big Idea** or **Central Mathematical Concept** will children explore?
We describe space, position, and location using language and models such as maps.

Format Used (if more than one, indicate %)
Whole group Small group 100% Partners Centers Independent work

How do you plan to **engage** children at the start of the lesson? (e.g. Math-to-Math or Math-to-Self connection, problem to solve, children's book, etc.)
Review how Rosie walked in the book (across, over, under) and invite children to make their own path through an obstacle course.

How do you plan to **make the mathematical concepts visible** to children?
I will demonstrate moving through the course, labeling the spatial relationships. Children will also move their bodies, use language and place landmarks on a simple map

What strategy do you plan to use to ensure **all students participate**? When?
We will chant the directions to practice the language. All children will have a turn to move through the course. We will make the map together, but I'll encourage them to make their own at center time.

Questions to **assess understanding**:

- How can we move through the obstacle course? Can you show me with your hands or your body?
- Where does the ____ go on the map? How do you know?
- Can you use your finger to show me the path?

How do you plan to **summarize children's learning** at the end of the lesson?
I want to ask children how the obstacle course and the map are the same and how they are different. Ask: why is a map useful?

As you plan for this activity, what **dimension of your teaching** are you thinking about the most? (check one)

Lesson Objectives	Attention to Learning Trajectories	Planning
✓ Mathematical Representations	Response to Individual Students' Needs	Student Engagement
Concept Development	Developmentally-Appropriate Learning Formats	Mathematical Learning Community

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COACHING INTERVIEW: *WALK WITH ROSIE*

F=Filmmaker C=Coach T=Teacher

F: Did today's lesson go as you expected?

C: Um, I think it did. You know, T and I spent so much time thinking about how she would set up the obstacle course and especially the mapping that things pretty much went as we anticipated.

F: You sound a little surprised?

C: Well, T was really unsure about this lesson at first, mostly about the mapping part. It was hard for her to consider mapping in Pre-K since she'd never done it before. She could only imagine it once we practiced making a map together.

F: Why was that a turning point for her?

C: I think sometimes when you have a seasoned teacher like T, it's easy to forget that she still needs support to try something new. Without spending time to walk through that map step by step, you know, I don't think she would have done that part of the lesson or it would not have been a success and she might think that she was right that Pre-K is too young for mapping. T was also skeptical that her students would be interested and able to recreate the map on their own but I convinced her to just try as a pilot saying that she would leave the obstacle course out during free play in case children wanted to go through it on their own or make their own map. T was amazed that kids actually did it! This was another 'aha' for her.

F: Do you think nudging T to try something new was the right choice as a coach?

C: For sure! Because getting the map right made all the difference in this lesson, and she saw that. T is more open to what her students are able to do with spatial thinking.

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What evidence of these TEACHER practices do you see in the video?
Are there missed opportunities for engaging in these practices?
What INSTRUCTIONAL DECISIONS has this teacher made?

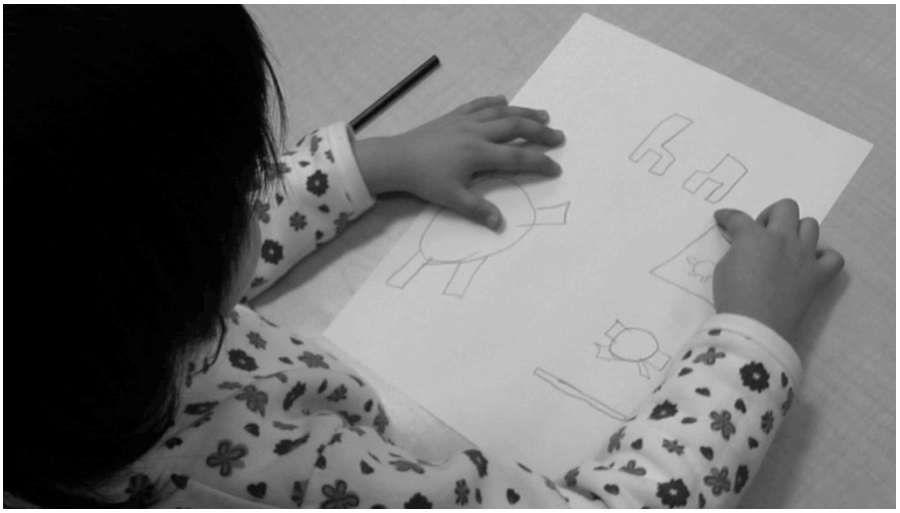
HIS-EM dimension: Mathematical Representation
High-Impact Strategies: Teachers make math concepts visible with language, gesture, drawings & other models. Teachers model students' thinking. Teachers scaffold as students explain or model their own thinking.
Are the mathematical representations accurate? *Do they help students make sense of mathematical ideas?*

What evidence of these STUDENT practices do you see in the video?
Are there missed opportunities for engaging in these practices?

CCSS for Math Practice #4: Model with mathematics.	CCSS for Math Practice #6: Attend to precision.

Are the mathematical representations accurate?
Do they help students make sense of mathematical ideas?

Video Analysis: Mathematical Representation



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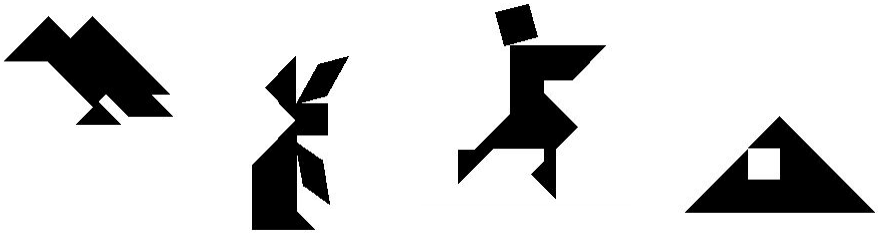
Tangram Time

- We start by making our own.
- Can you put it back into a square?
- Can you make your first initial?
- Can you complete one of these puzzles?



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A Big Idea about Spatial Relationships

Spatial relationships
can be visualized
& manipulated mentally.

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Have a restful winter break
& a happy start to the New Year!

We'll see you again
at Erikson
on Friday, February 1, 2013.

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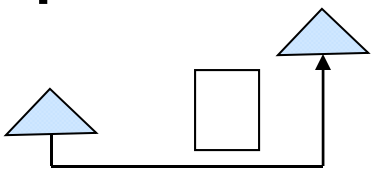
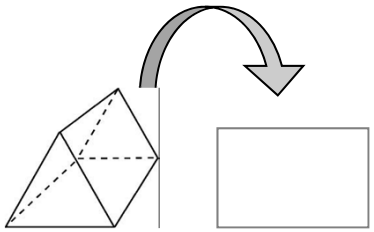
Big Ideas of Spatial Relationships

Topic	Big Ideas	Examples
Describing Space 	● Relationships between objects and places can be described with mathematical precision.	• Maps and models represent the 3-dimensional world. • *Joshua is in front of Ana, and he is behind Tameika.*
Visualizing Space 	● Our own experiences of space and two-dimensional representations of space reflect a specific point of view. ● Spatial relationships can be visualized and manipulated mentally.	• A party hat looks triangular from the side, but when you lay it down, it can look like a circle. • An expert jigsaw-puzzle solver can picture a missing piece and does not rely on trial and error.

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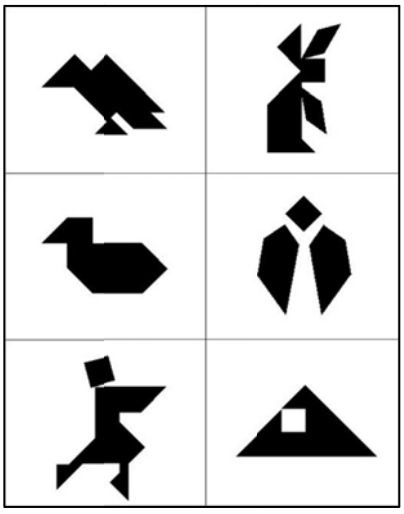
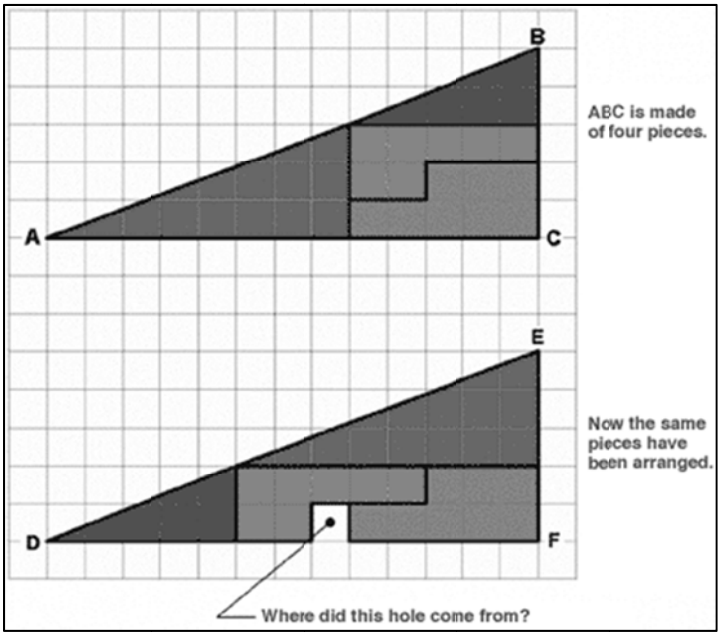
More Math to Ponder



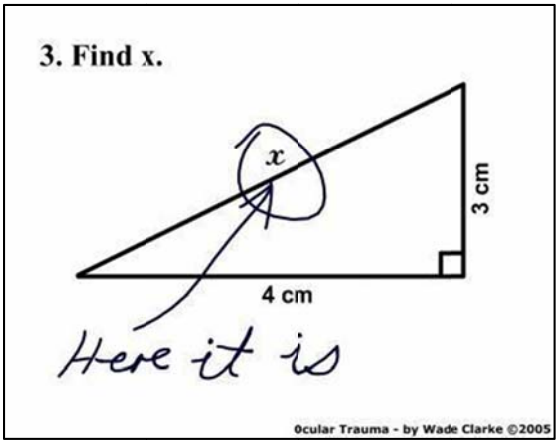
Tangram Puzzles!

Tangram fun on youtube

How to build a Tangram Puzzle	http://www.youtube.com/watch?v=bFcCfNIuQQ8
A Sage's Journey: The Story of Tangrams	http://www.youtube.com/watch?v=X5mc-dkYLfI
The Fox Fairy- A Tangram Tale	http://www.youtube.com/watch?v=3RwRAUAAld0



A PUZZLING Puzzle



A Literal Answer