VISUAL / SPATIAL LEARNERS

Visual - Spatial Learners

- About 65% of all students are visual – spatial learners (of various degree).
- Over 80% of Indigenous Learners are visual – spatial learners.
- Until recently almost all of our schools have used an auditory- linear approach to learning.

www.visualspatial.org

Dr. Linda Kreger Silverman

Ontario First Nations Urban Aboriginal Task Force Final Report (Barrie Midland), Sept 2007

Key Findings: “Learning style(s) was mentioned as an important issue affecting Aboriginal education. Aboriginal children tend to have a visual-spatial learning style which is different than non-Aboriginal children and are often alienated by the prevailing teaching styles.”

AUDITORY-LINEAR LEARNERS	VISUAL-SPATIAL LEARNERS
Thinks primarily in words	Thinks primarily in pictures
Has auditory strengths	Has visual strengths
Relates well to time	Relates well to space
Is a step-by-step learner	Is a whole-part learner
Does well at arithmetic	Is better at math reasoning than computation
Is well-organized	Creates unique methods of organization
Can show steps of work easily	Arrives at correct solutions intuitively

AUDITORY-LINEAR LEARNERS	VISUAL-SPATIAL LEARNERS
Excels at rote memorization	Learns best by seeing relationships
May need some repetition to reinforce learning	Learns concepts permanently; is turned off by drill and repetition
Learns well from instruction	Develops own methods of problem solving
Is comfortable with one right answer	Generates unusual solutions to problems

“ … in the linear, mathematical way of the Eurocentric society… one is expected to *know* things to *believe* things….”

The American Indian Mind in a Linear World

Donald Fixico 2003

“If mathematics education is about helping people to relate better to their environment, then it is clearly failing at that task”

Mathematical Enculturation

Alan J. Bishop 1997

Lisa Lunney Borden

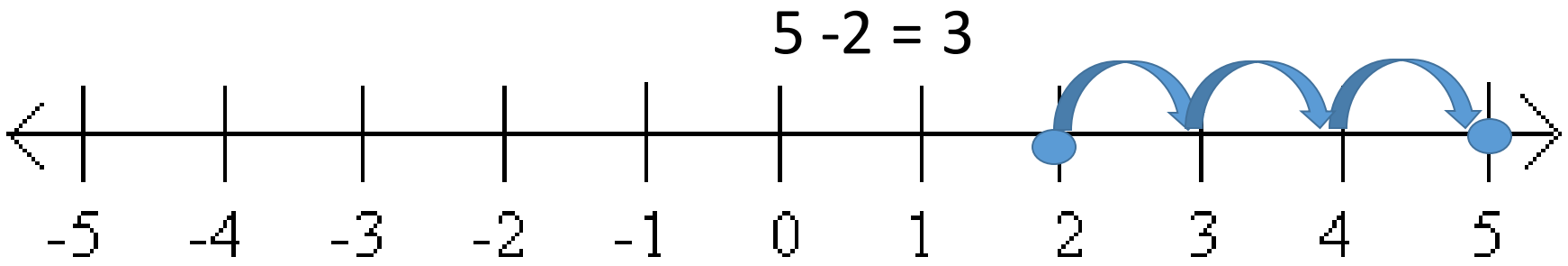
- Ten Frames
- Spatial Reasoning

Learn Teach Lead – Student Achievement Division

Subtracting Integers

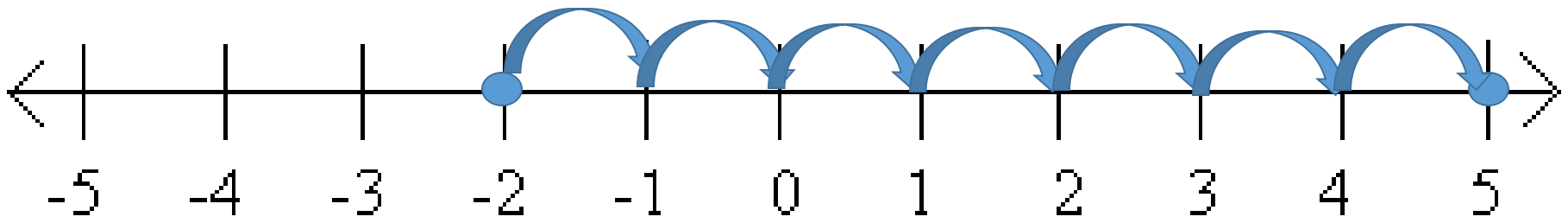
When subtracting integers add the opposite.

5 – (-2) = + 7



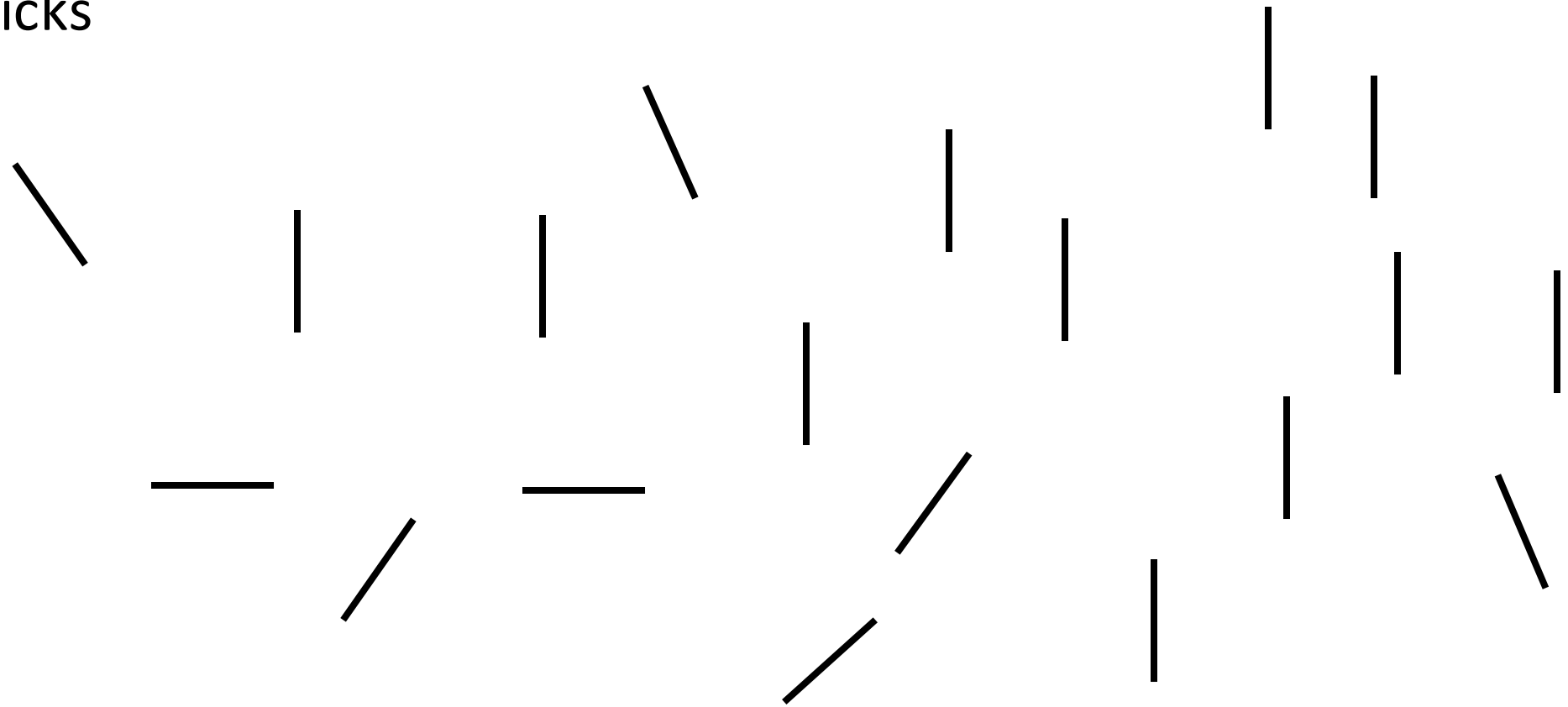
$5 - (-2)$

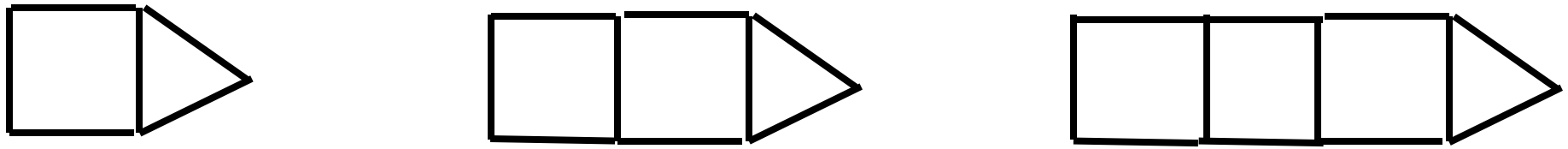
+7



Representations of a Story

Toothpicks



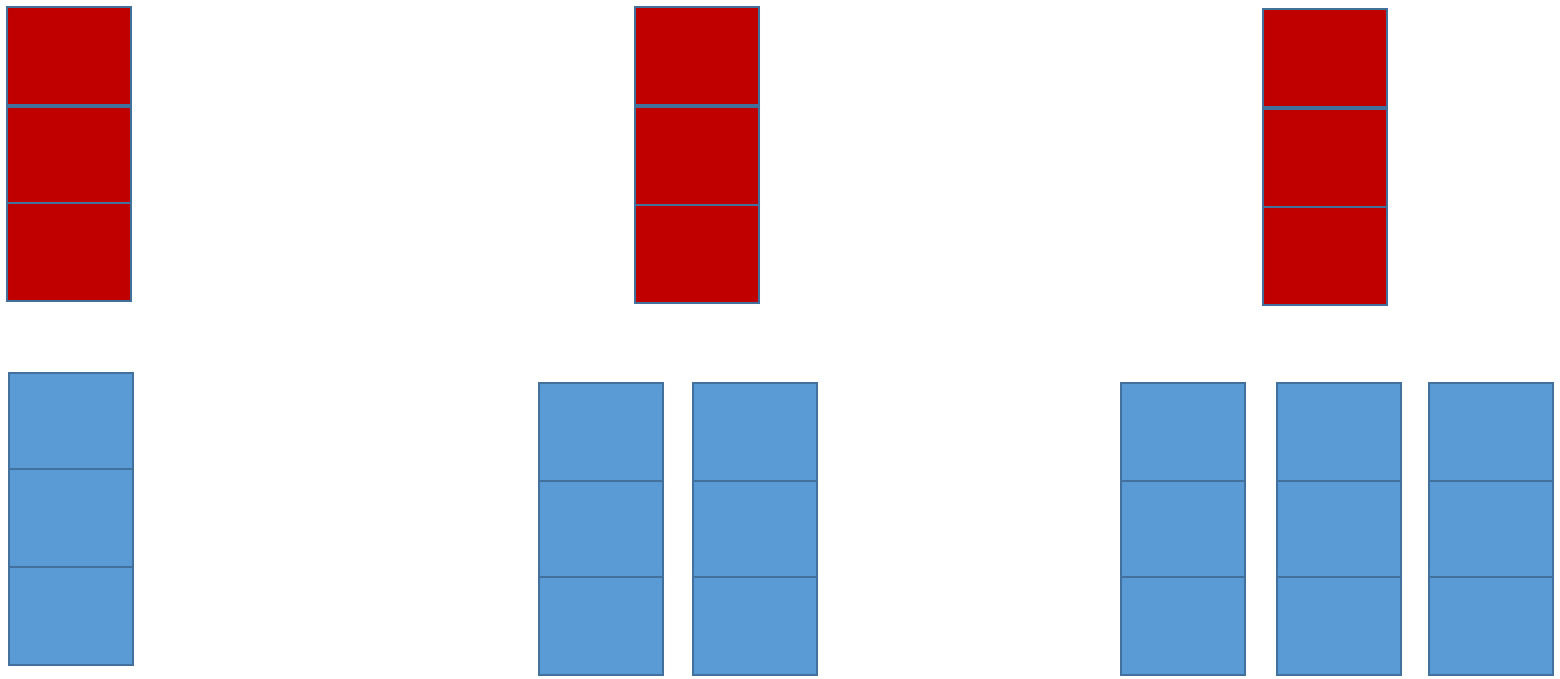


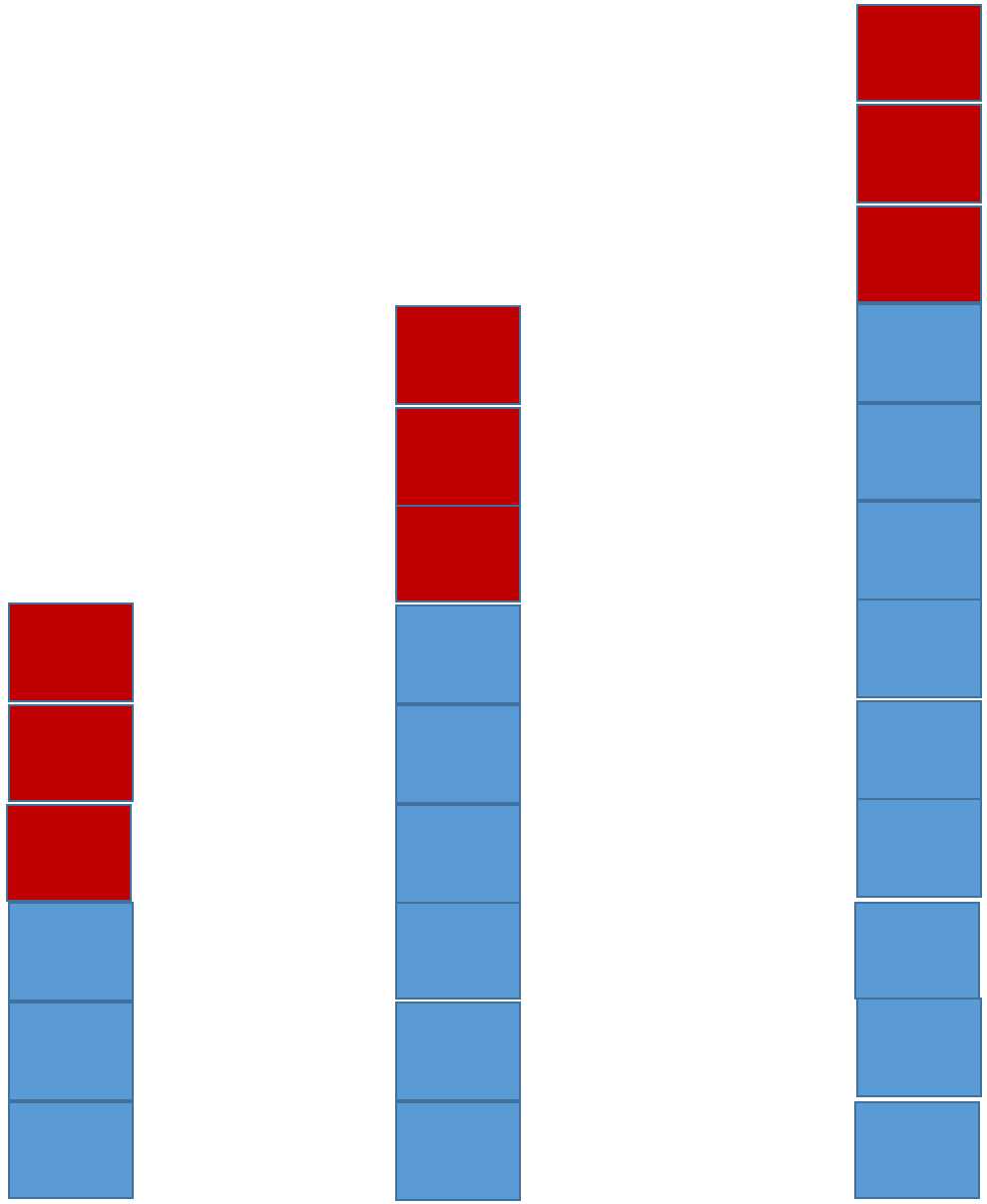
1 2 3

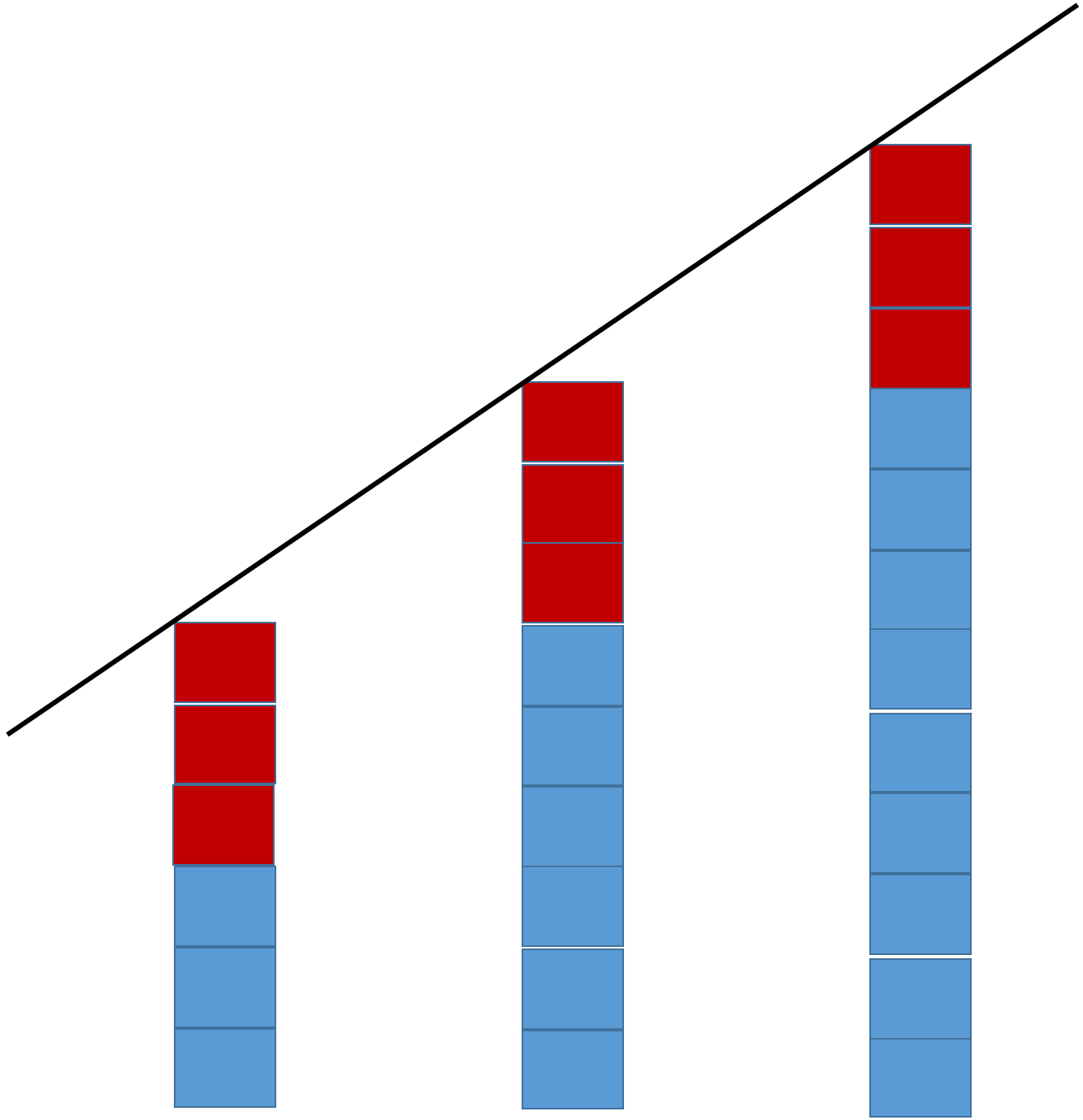
- Figure 1 has one of each.
- Figure 2 has 2 squarish shapes and 1 triangle
- Figure 3 has 3 squarish shapes and 1 triangle
- Each shape has 3 toothpicks so we can multiply by three for each of the shapes in the diagram.

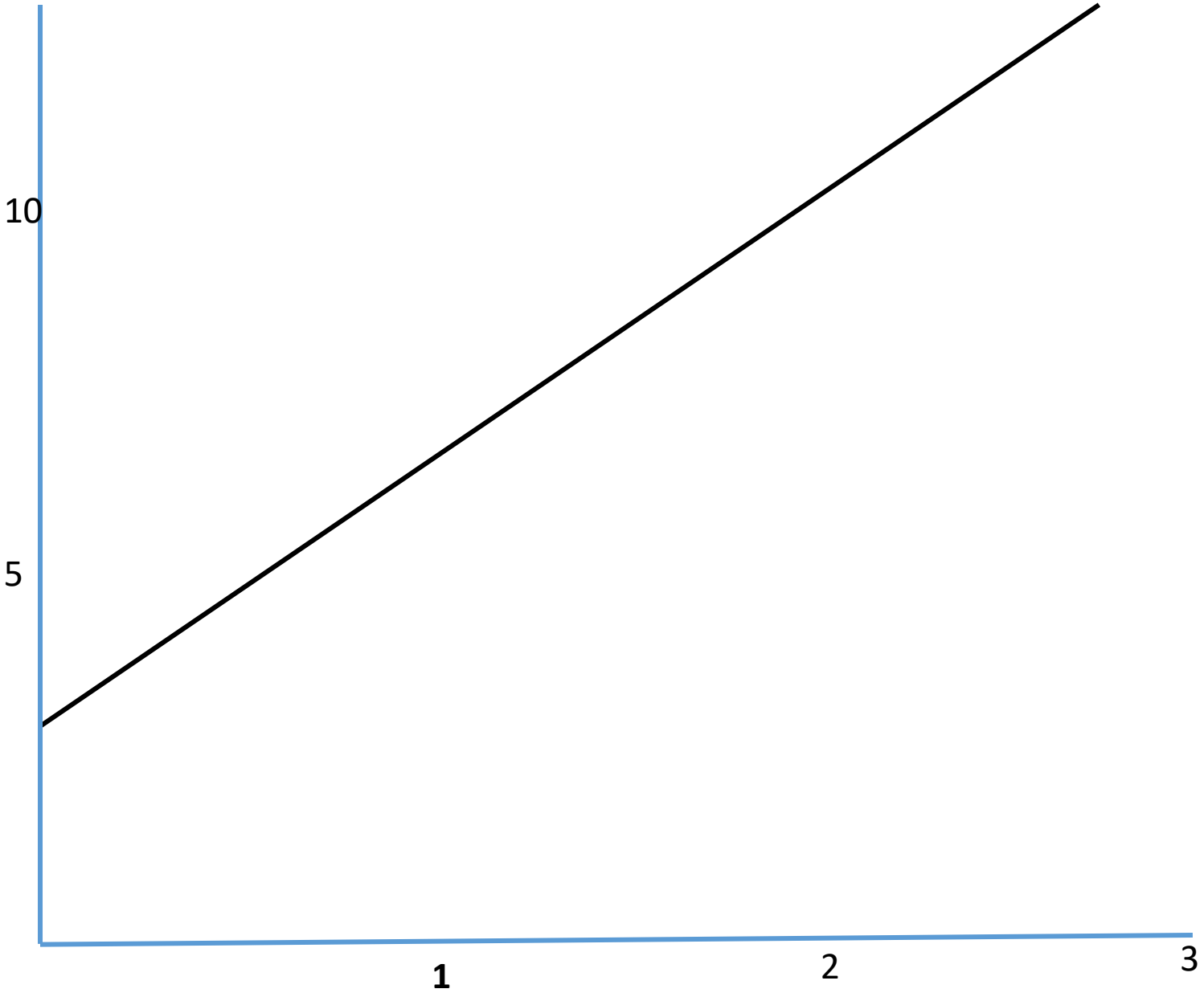
Different Representations

Position	Number or Toothpicks
1	6
2	9
3	12
10	?
100	?


1
2
3


1
2
3




10
5
1
2
3

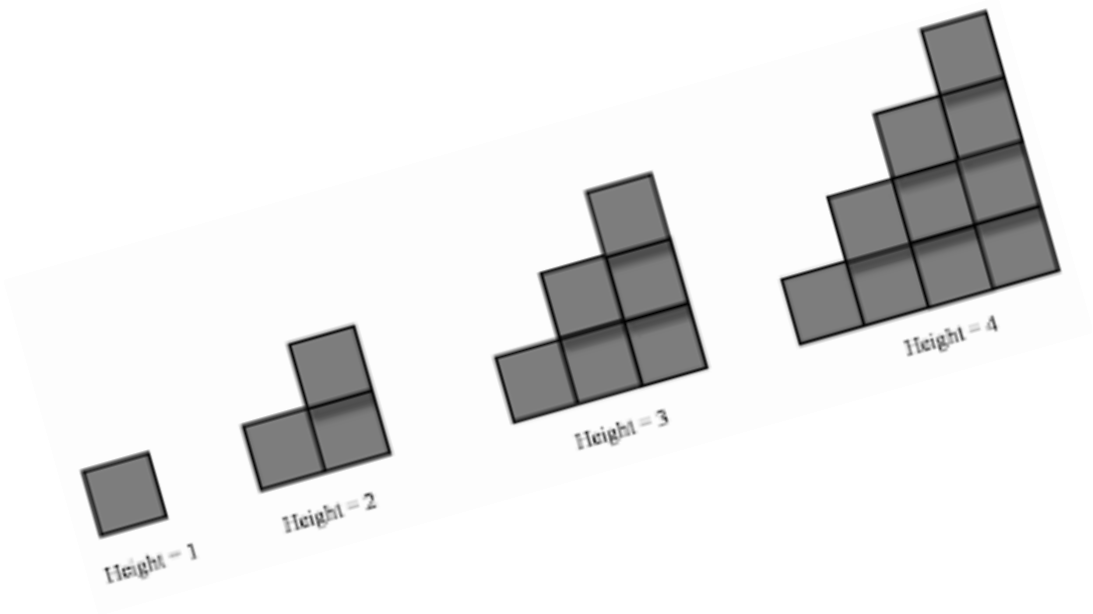
3 times the position number + 3

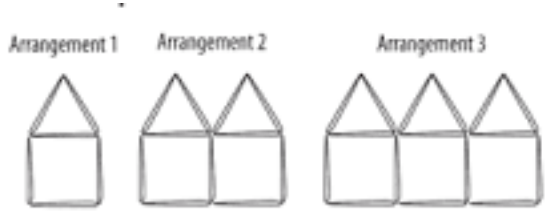
Or

$3x + 3$

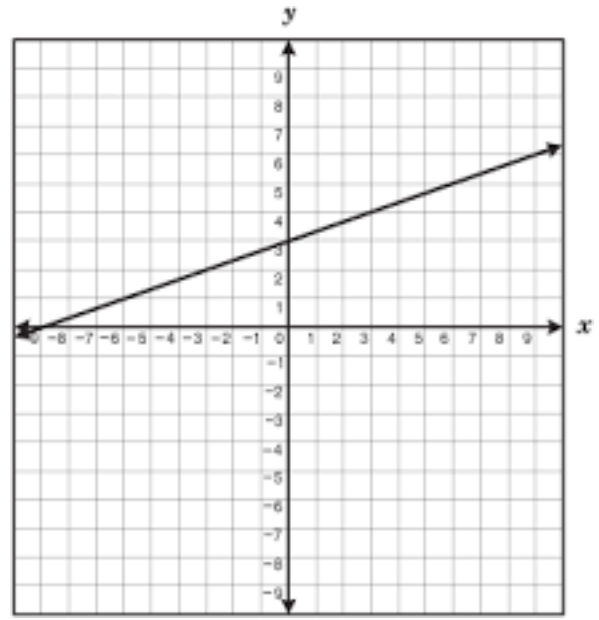
Or

$y = 3x + 3$


Height = 1
Height = 2
Height = 3
Height = 4


Arrangement 1
Arrangement 2
Arrangement 3

$y=3x+3$


y
x

“Yours is not to reason why, just invert and multiply”

“A negative times a negative equals a positive”

Task Analysis Guide

Lower Level Demands	Higher Level Demands
Memorization - Involve either reproducing learned fact, rules, formulas, or definitions or committing facts, rules, formulas, or definitions to memory - Cannot be solved using procedures because a procedure does not exist or because the time frame in which the task is being completed is too short to use a procedure - Are not ambiguous. Such tasks involve exact reproduction of previously seen material, and what is to be reproduced is clearly and directly stated. - Have no connections to the concepts or meaning that underlies the facts. Formulas, or definitions being learned or reproduced	**Procedures with connections** - Focus students' attention on the use of procedures for the purpose of developing deeper levels of understanding of math concepts and ideas - Suggest, explicitly or implicitly, pathways to follow that are broad general procedures that have close connections to underlying conceptual ideas as opposed to narrow algorithms that are opaque with respect to underlying concepts - Usually are represented in multiple ways, such as visual diagrams, manipulatives, symbols, and problem situations. Making connections among multiple representations helps develop meaning. - Require some degree of cognitive effort. Although general procedures may be followed, they cannot be followed mindlessly. Students need to engage with conceptual ideas that underlie the procedures.

The Task Analysis Guide (Smith and Stein [1998])

Task Analysis Guide

Lower-level demands	Higher-level demands
Procedures without connections - Are algorithmic. Use of the procedure is either specifically called for or is evident from prior instruction, experience, or placement of the task. - Require limited cognitive demand for successful completion. Little ambiguity exists about what needs to be done or how to do it. - Have no connection to the concepts or meaning that underlies the procedure being used - Are focused on producing correct answers instead of developing on mathematical understanding - Require no explanations or explanations that focus solely on describing the procedure that was used	**Doing Mathematics** - Require complex and non-algorithmic thinking – a predictable, well rehearsed approach or pathway is not explicitly suggested by the task, task instruction, or a worked-out example - Require students to explore and understand the nature of mathematical concepts, processes or relationships - Demand self-monitoring or self regulation of one's own cognitive process - Require students to access relevant knowledge and experiences and make appropriate use of them in working through the task - Require students to analyze the task and actively examine task constraints that may limit possible solution strategies - Require considerable cognitive effort

The Task Analysis Guide (Smith and Stein [1998])

Division

- “Division is usually quite difficult for these children, since it is usually in a step-by-step fashion, and these students are lost after the second step. They are not step-by-step learners. They would learn much more rapidly if they were simply given a divisor, a dividend and a quotient, and asked to figure out their own method of arriving at the quotient. *Don’t ask them to show their steps*. Just give them another problem with the solution already worked out and see if their system works. Gradually increase the difficulty of the problems to test their system. This way of teaching is a lot like the methods used in video games.” Teaching Mathematics to Non-sequential Learners Linda Kreger Silverman 1983

Showing Your Work When it Feels Like There is Nothing to Show

Alexandra Shires Golon

Dr. Cynthia Wesley- Esquimaux

- Professor at Lakehead University
- Honourary Witness Truth and Reconciliation Commission

Resources

- Urban Aboriginal Task Force Final Report, June 2007, and Sept 2007 (Barrie Midland)

www.visualspatial.org

Dr. Linda Kreger Silverman

Jerry Lassos

Steven C Haas – Native American Student Advocacy Institute

The American Indian Mind in a Linear World – Donald L. Fixico

Teaching Mathematics to Non-sequential Learners – Linda Kreger Silverman

Algebra For Gifted Visual Spatial Learners - Steven C. Hass

Showing Your Work When There's Nothing to Show - Alexandra Golon

The Visual Spatial Classroom: Differentiation Strategies That Engage Every Learner - Alexandra Golon

Nora Newcombe Spatial Language - Learn Teach Lead – Thoughts on Teaching and Learning Mathematics video

Mathematical Enculturation - Alan J. Bishop

Patterning to Algebra - Beatty and Bruce

Learn Teach Lead – Ministry of Education