HOGESCHOOL UTRECHT

Big Ideas:

Visualize

Play

Investigate

Een beetje verder kijken

Embodiment

van “leren rekenen”
naar “gecijferde burgertjes”

Kees Hoogland (keeshoogland@nvorwo.nl)

NVORWO Studiedag, vrijdag 6 april 2018

Visiedocument NVORWO

Wat bedoelen we eigenlijk?

- Rekenen en wiskunde

Wat weten we er zoal van?

- Leren van rekenen en wiskunde

Wat doe je in de klas?

- Reken- en wiskundeonderwijs

Wat is daar voor nodig?

- Ontwikkeling van reken- en wiskundeonderwijs

http://www.nvorwo.nl/definitief-visie-document-curriculum-nu/

Blijf getallen steeds koppelen aan hoeveelheden

Dat kinderen leren rekenen met behulp van realistische én mechanische rekenmethoden is voor Harold Bekkering evident. Ook hersentechnisch is dit de beste oplossing, aldus de hoogleraar.

Onderwijsblad, 2 april 2018

Context

- Onderwijsblad 2 april 2018:

  “Stop de loopgravenoorlog”
- Constructief werken aan inspirerend rekenwiskundeonderwijs
- Leren van anderen in binnen- en buitenland

Internationale tendensen en voorbeelden

- Motivatie / dispositie
- Transfer / lagere- en hogere orde (denk)vaardigheden
- Representatie van de werkelijkheid
- Het jonge kind
- Embodiment

Starter Puzzles Measuring Puzzles Shape Puzzles Logic Puzzles Puzzle Games
Jigsaw Puzzles Number Puzzles Card Puzzles Einstein Puzzles Sam Loyd Puzzles
Algebra Puzzles

K-8 Curriculum

Big Ideas:

Visualize

Play

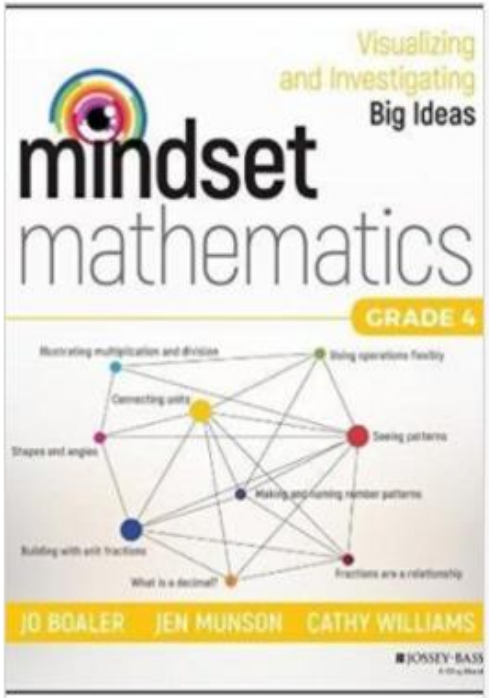
Investigate

Book Series Overview

A visual guide to the timeline of our K-8 curriculum book series

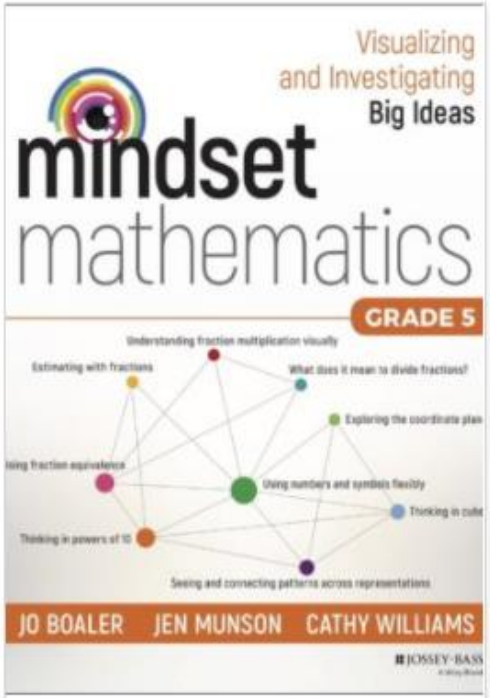
What Is Mathematical Beauty?

Teaching Through Big Ideas and Connections



Mindset Mathematics, Grade 4

Engage students in mathematics using growth mindset techniques, as we describe in this first book of our curriculum series!

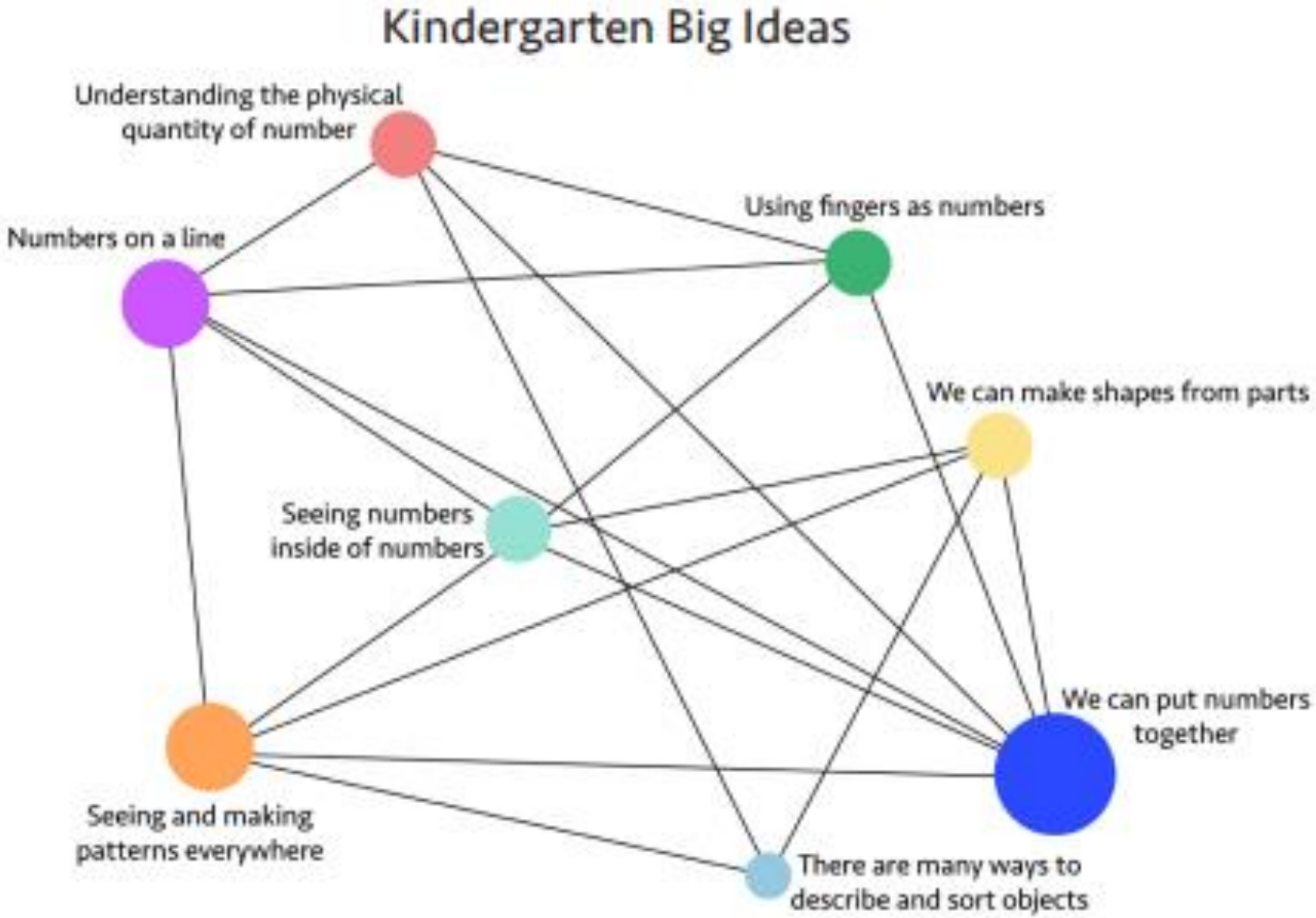


Mindset Mathematics, Grade 5

The second book in our curriculum series on visualizing and investigating big ideas, now available on Amazon.

youcubed

Big Ideas from Mindset Mathematics K-8 books



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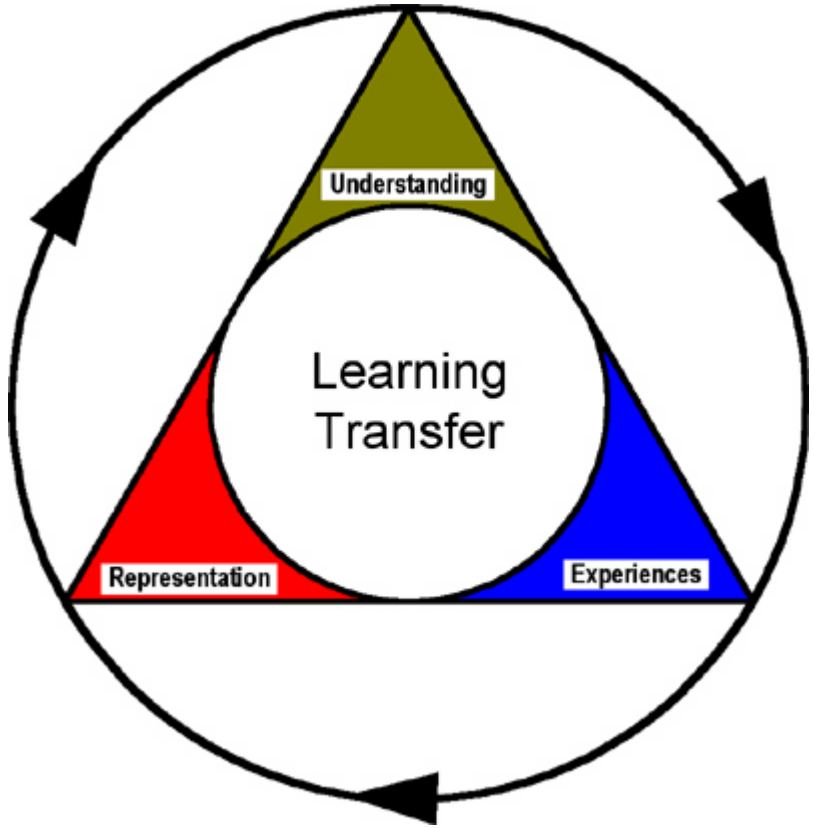
Transfer en ordes van vaardigheden

- Near and far transfer
  - Near = Naar vergelijkbare taken
  - Far = Naar “verderaf” gelegen taken
  - Far = Naar praktische zaken in het dagelijkse leven of beroep



Yackel, E. B. (1984). *Characteristics of problem representation indicative of understanding in mathematics problem solving*

Bransford e.a. (2000) : How People Learn

1. The necessity of initial learning;
2. The importance of abstract and contextual knowledge;
3. The conception of learning as an active and dynamic process;
4. The notion that all learning is transfer.

First, the necessity of initial learning for transfer specifies that mere exposure or memorization is not learning; there must be understanding. Learning as understanding takes time, such that expertise with deep, organized knowledge improves transfer. Teaching that emphasizes how to use knowledge or that improves motivation should enhance transfer.

Second, while knowledge anchored in context is important for initial learning, it is also inflexible without some level of abstraction that goes beyond the context. Practices to improve transfer include having students specify connections across multiple contexts or having them develop general solutions and strategies that would apply beyond a single-context case.

Third, learning should be considered an active and dynamic process, not a static product. Instead of one-shot tests that follow learning tasks, students can improve transfer by engaging in assessments that extend beyond current abilities. Improving transfer in this way requires instructor prompts to assist students – such as dynamic assessments – or student development of metacognitive skills without prompting.

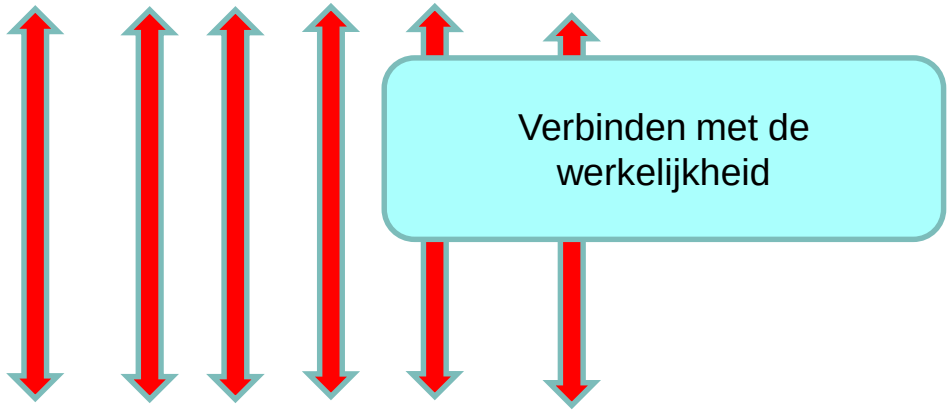
Finally, the fourth characteristic defines all learning as transfer. New learning builds on previous learning, which implies that teachers can facilitate transfer by activating what students know and by making their thinking visible. This includes addressing student misconceptions and recognizing cultural behaviors that students bring to learning situations.

A student-learning centered view of transfer embodies these four characteristics. With this conception, teachers can help students transfer learning not just between contexts in academics, but also to common home, work, or community environments.

Lagere-orde en hogere-orde

Hogere-orde = meta

Probleemoplossen, modelleren, redeneren, kritisch kijken



Verbinden met de werkelijkheid

Lagere-orde = feitelijk

Procedures, feiten, operaties

Elke leerling en op elk niveau

Representatie van de werkelijkheid

Addition Word Problems

1) There are thirty-six dogwood trees and thirty maple trees currently in the park. Park workers will plant fourteen more dogwood trees today. How many dogwood treeswill the park have when the workers are finished ?

2) Joan has thirty-five books and she has read eight of them. Sally has forty-eight books. How many books do they have together ?

3) Sara found forty-three seashells and Nancy found thirty-one seashells on the beach. When they cleaned them, they discovered that forty were cracked. How many seashells did they find together ?

Image-rich

Double glazing
€ 148.-
per m²

What is the cost of double glazing these windows?

€ ☐

Bron: ffLerenRekenen

Original Articles

Using Virtual Reality with and without Gaming Attributes for Academic Achievement

Jennifer J. Vogel, Adams Greenwood-Ericksen, Jan Cannon-Bowers & Clint A. Bowers

Pages 105-118 | Published online: 24 Feb 2014

Download citation https://doi.org/10.1080/15391523.2006.10782475

References Citations Metrics Reprints & Permissions Get access

Abstract

A subcategory of computer-assisted instruction (CAI), games have additional attributes such as motivation, reward, interactivity, score, and challenge. This study used a quasi-experimental design to determine if previous findings generalize to non simulation-based game designs. Researchers observed significant improvement in the overall population for math skills in the non-game CAI control condition, but not in the game-based experimental condition. The study found no meaningful, significant differences in language arts skills in any of the conditions. This finding has implications for the design of future learning games, suggesting that a simulation-based approach should be integrated into the gaming technology.

Keywords: games, education, simulation, CAI, motivation

People also read

Article

Designing a Virtual-Reality-Based, Gamelike Math Learning Environment ›

Original Articles

Using Virtual Reality with and without Gaming Attributes for Academic Achievement

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Keywords: games, education, simulation, CAI, motivation

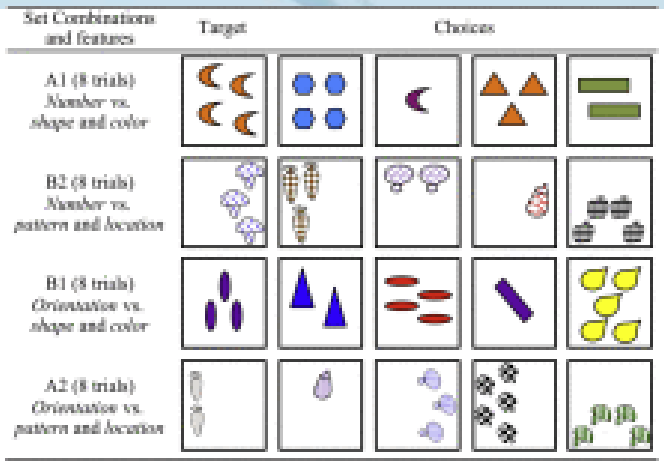
Het jonge kind

Young children's early mathematical competencies: analysis and stimulation

Lieven Verschaffel, Joke Torbeyns, and Bert De Smedt
University of Leuven, Belgium

CERME 2017, Dublin, February 1-5, 2017

- Approximate number system (ANS)
  - for the internal representation of numerical magnitudes
  - as Gaussian distributions of activation on a “mental number line” with increasingly imprecise representations for increasing magnitudes,
  - allowing to compare larger non-symbolic quantities or to perform some very basic approximate arithmetic on these quantities



ELSEVIER

Journal of Experimental Child Psychology

Volume 107, Issue 4, December 2010, Pages 394-406

Spontaneous focusing on numerosity as a domain-specific predictor of arithmetical skills

Minna M. Hannula [a, b], Janne Lepola [a, b], Erno Lehtinen [b, c]

- Mainstream research: early mathematical competence = ability; little or no attention to the “dispositional” side
- Disposition: the attention to, or feeling for, numerical magnitudes and mathematical relations, patterns and structures, and the spontaneous inclination to use one’s abilities when appropriate
- Spontaneous focusing on…
  - Numbers (SFON)
  - Relations (SFOR)
  - Patterns and structures (SFOPS)

- Increasing evidence for the importance of
  - ordinal and measurement aspects of number
  - understanding of mathematical relations
  - ability with mathematical patterns and structures (P&S)
  - spontaneous attention to numbers, relations, P&S
  - domain-general cognitive functions.
  - the quality of early mathematical learning environments at home and in other pre-school settings
  - the coherence between preschool and elementary school mathematics
  - the professionalism of the workers in these settings

Embodiment / Gestures

Review Process: Over 500 papers on gesture and maths and science education

Roth, W. (2001). Gestures: Their role in teaching and learning. Review of Educational Research, 71(3), 365-392.

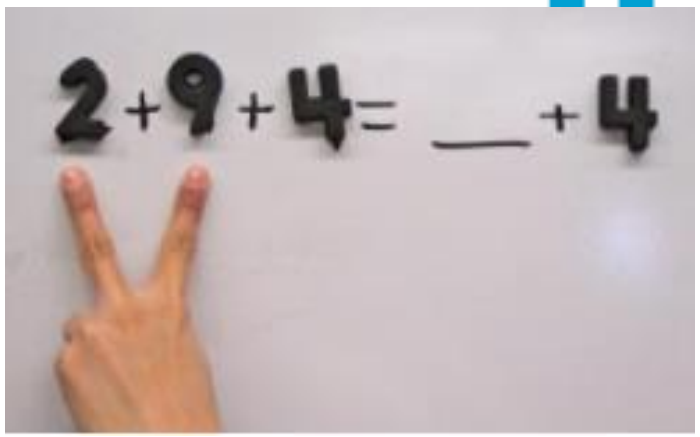


Fig. 7. Example of an emphatic right-hand gesture coproduced with the phrase *el tiempo antes*. The stroke is cotimed with the accentuated first syllable of *antes* ("before").

Psychological Science

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From Action to Abstraction

Using the Hands to Learn Math

Miriam A. Novack , Eliza L. Congdon , Naureen Hemani-Lopez , more...

First Published February 6, 2014 | Research Article | Check for updates

children benefit from gesturing during
er gesturing promotes learning because
use it uses physical action to represent abstract ideas. To address this question, we taught third-grade children a strategy for solving mathematical-equivalence problems that was instantiated in one of three ways: (a) in a physical action children performed on objects, (b) in a concrete gesture miming that action, or (c) in an abstract gesture. All three types of hand movements helped children learn how to solve the problems on which they were trained. However, only gesture led to success on problems that required generalizing the knowledge gained. **The results provide the first evidence that gesture promotes transfer of knowledge better than direct action on object**s and suggest that the beneficial effects gesture has on learning may reside in the features that differentiate it from action.

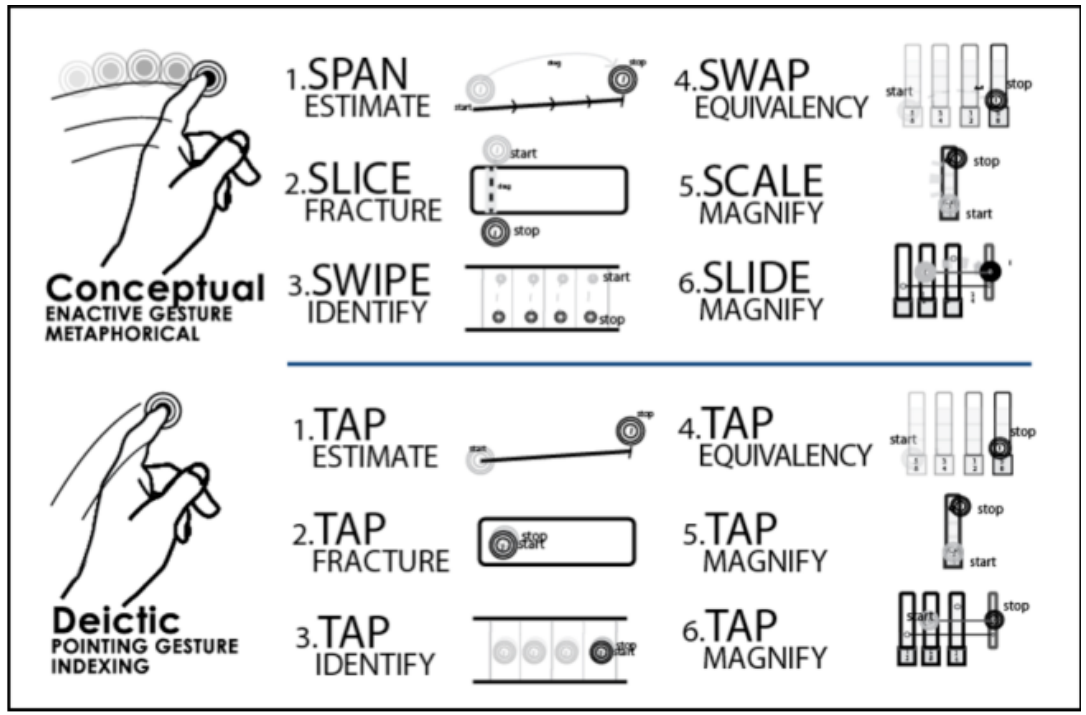


Figure 3. Conceptual Gestures and Deictic Gestures.

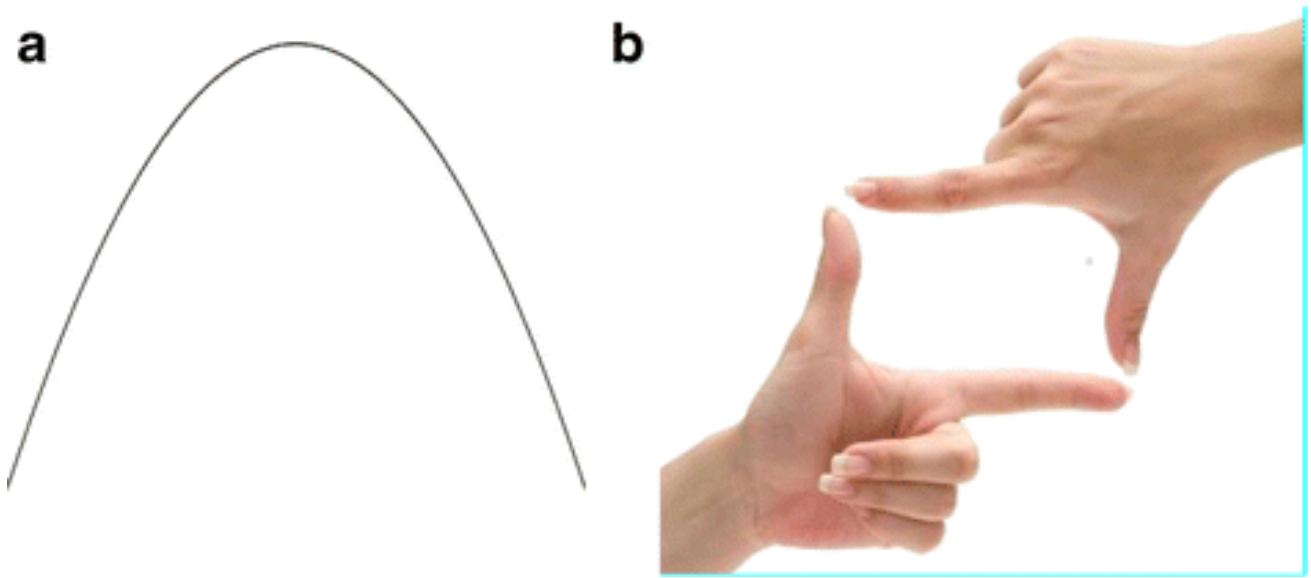
Educational Studies in Mathematics

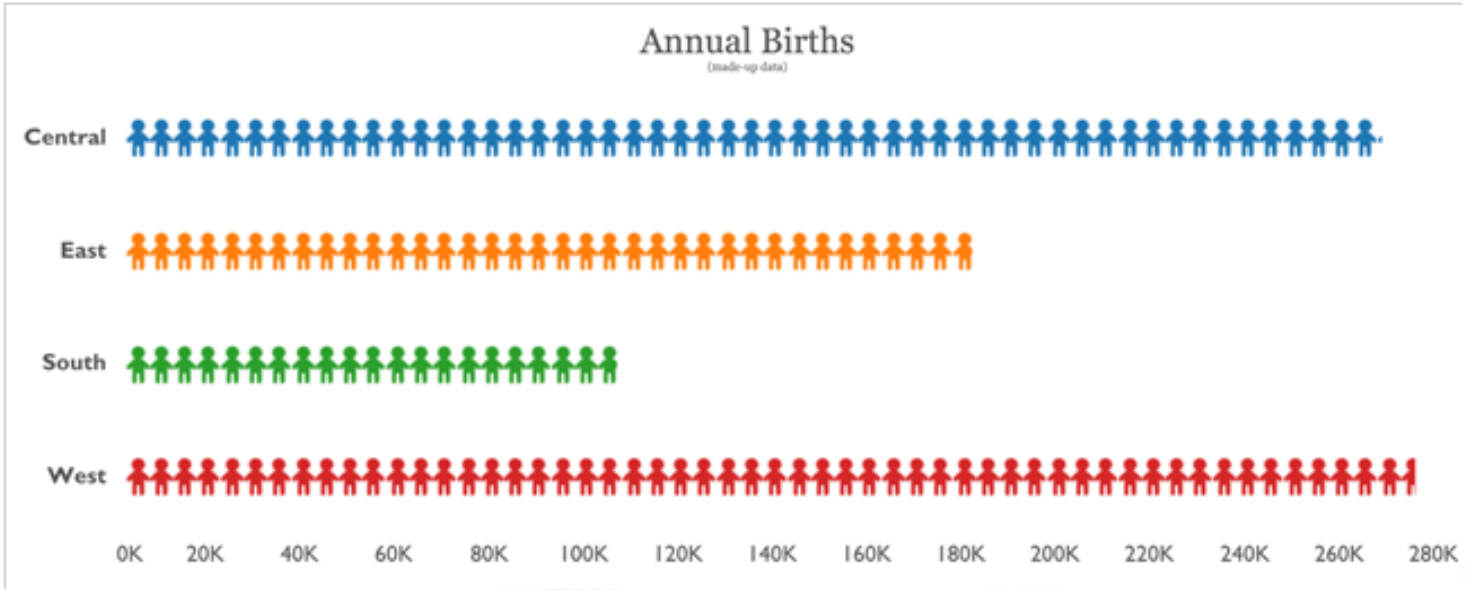
September 2015, Volume 90, Issue 1, pp 19–37 | Cite as

Growth point and gestures: looking inside mathematical meanings

Authors | Authors and affiliations

Ferdinando Arzarello, Ornella Robutti, Mike Thomas




Annual Births
(made-up data)
Central
East
South
West
0K
20K
40K
60K
80K
100K
120K
140K
160K
180K
200K
220K
240K
260K
280K

Ontwikkelingen

- *Curriculum.nu*
  - *Kansen voor nieuwe inspirerende ideeën en mogelijkheden vanaf 2024*

- *Politiek*
  - *Zorgelijk wegens zeer oppervlakkige beelden*
  - *Populisme legt nadruk op lagere-orde vaardigheden als simpele oplossing voor complex probleem*

Acties/ Vervolg

Steun voor streefdoel NVORWO

Website met visie-document met doorklikmogelijkheden naar

- Achtergrondinformatie
- Inspirerende voorbeelden
- ….

Start op deze jaarvergadering / studiedag!

Vragen / opmerkingen

Dank u voor uw aandacht !

Vragen en opmerkingen graag naar:

keeshoogland@nvorwo.nl

Dr. Kees Hoogland | Hogeschoolhoofddocent Didactiek van Rekenen en Wiskunde in het Beroepsonderwijs | Lectoraat Didactiek van Wiskunde en Rekenen | Kenniscentrum Leren en Innoveren | Hogeschool Utrecht | Padualaan 97 | 3584 CH Utrecht | tel. 06 3410 1701 | Skype: KeesHoogland |

Chair of the programme committee of ALM24 (Rotterdam, 2-5 July 2017)
Trustee of Adults Learning Mathematics – A Research Forum
Fellow of the International Society for Design and Devolopment in Education
Chair of the Thematic Working Group Adult Mathematics Education at CERME 11 (Utrecht, 6-10 February 2019)
Member of the Second Cycle PIAAC Numeracy Expert Group