# Difference-Research Powering PISA Performance: Count and Multiply before you Add

**5** -Luther- Tarp Theses II II = -4 = 2 2s 3\*5 = 15 = 3 5s 8/4 = 2 each = 2 4s 2w+3d = 5 = 17d1/2+2/3 = 7/6 = 3/5 Curriculum Architect, Allan.Tarp@MATHeCADEMY.net Teaches Teachers to Teach MatheMatics as ManyMatics, Tales of Many a Heidegger-inspired VIRUS-Academy: To learn, ask the subject, not the instructor *Full 31 page article: http://mathecademy.net/difference-research/* 

## Poor Pisa Performance in Scandinavia

www.uvm.dk/~/media/UVM/Filer/Udd/Folke/PDF13/Dec/131203%20PISA%20Resultatnotat.pdf



Ser man bort fra Finland (519 point), er Danmark det eneste af de nordiske lande, som er placeret i gruppen, der ligger signifikant over det internationale gennemsnit. Eleverne i Island (493 point) og i Norge (489 point) præsterer omkring gennemsnittet, mens den svenske score (478 point) er signifikant lavere end gennemsnittet. I tabel 1 nedenfor vises tallene bag figur 2.

#### Tabel 1. Gennemsnit for nordiske lande 2003-2012

-	2003	2006	2009	2012	2012-2009	2012-2003
Finland	544	548	541	519	-22	-25
Danmark	514	513	503	500	-3	-14
Island	515	506	507	493	-14	-22
Norge	495	490	498	489	-9	-6
Sverige	509	502	494	478	-16	-31
OECD	500	498	499	494	-5	-6

All go down, Sweden especially - despite increased research funding Can Difference-Research make a Difference by finding a Difference?





- Januariproblemen »»» Novemberlösningarna »»»
- "Bättre kunskaper med externa
- Tänka,

- hjärnrörelse sprids i skolor (12/1)

Improving Schools in

An OECD Perspective

10Th

OECD

förskoleklass men ä också relevant för

lärare i grundskolan

Sweden:

# **Different Differences**

#### Background

• Poor PISA Performance, witnessing 50 years of low-performing Math Education Research

#### **10. Different Education**

• Classroom: Half-Year Self-Chosen Blocks versus Multi-Year Forced Lines

#### 20. Different Mathematics

• BottomUp Many-based Math from Below, versus TopDown Set-based Math from Above

#### 30. Different Research

- Ancient Sophism, Renaissance Natural Science, (Post)Modern Existentialism
- 40. Different Math Education, showing the Beauty of the Simplicity of Math
- To master Many, Count & Multiply before you Add, Add next-to & on-top, and forwards & backwards

# Powering PISA Performance - in a Nutshell

The Greek Sophists: Beware of choice masked as nature.



One Goal - many Means; Goal Displacement: When <u>a</u> Means becomes <u>the</u> Goal Difference-Research unmasks Means masked as Goals, and says: <u>Use Full Sentences</u>, if not, predicates becomes subjects and a means the goal

# Difference-Research, Main Finding: The Simplicity of Math – Math as Tales of Many

#### Meeting Many we ask: 'How Many in Total'

• To answer, we math. *Oops, sorry, math is not an action word but a predicate.* 



• Take II. To answer, we **Count & Add**. And report with Tales of Many (Number-Language sentences): T = 2 **3s** = 2\*3

#### Three ways to Count: CupCount & ReCount & DoubleCount

- CupCount gives units. ReCount changes units. Double-count bridges units by per-numbers as 2\$/3kg
   Recount to & from tens gives Multiplication & Equations, coming before Addition
- To tens: T = 5 7s = ? tens = 5\*7 = 35 = 3.5 tens. From tens: T = ? 7s = u\*7 = 42 = (42/7)\*7 = 6 7s (ReCount-Formula)
- Counting gives variable or constant unit- or per-numbers, to be Added in 4 ways
- Addition & multiplication unites variable & constant unit-numbers.
- Integration & power unites variable & constant per-numbers.

#### Adding NextTo & OnTop roots Early Childhood Calculus & Proportionality

• EarlyChildhood-Calculus: T = 2 3s + 4 5s = ? 8s. EarlyChildhood-Proportionality: T = 2 3s + 4 5s = ? 5s







# Education & Mathematics & Research

#### Education: a Social Institution

 In sociology, Bauman warns against 'the danger of so-called *goal displacement*. The survival of the organization, however useless it may have become in the light of its original end, becomes the purpose in its own right.'

#### Mathematics & Research: Truth claims

- In philosophy, Sartre says: 'In existentialism, existence precedes essence.'
- In philosophy, Heidegger warns against true sentences with a subject & verb & predicate: 'Trust the subject; but doubt the predicate, it could be different.'
- In counter-philosophy, the Greek sophists said: 'Beware of choice masked as nature.'

Difference-Research asks 1 Question only: find a Difference that makes a Difference - to **unmask** claimed goals, existence, subjects, nature as masked means, essence, predicates, choice.

# Difference-Research, Main Recommendation: Visible and Tangible BUNDLES in Tales of Many

China: Educate Wans of DifferenceResearch Professors for the New SilkRoad & Africa

To improve PISA Performance, the Outsider (Child, Migrant) must touch & see & write the BUNDLE and use full number-language sentences in Tales of Many. (Bundles = units)

And must Count & Multiply before Adding.

• Several counting sequences:

T = IIIIIII = 7 = B-3 (BUNDLE less 3) = ½B&2 (The Total is the goal, the subject)

• Recount in the same unit, **3s**, to create/remove over- or underload

Seeing T = 47 = 4B7 = 3B17 = 5B-3 makes a difference in multiplication tables:

 $T = 2*7 = 2*(\frac{1}{2}B\&2) = B\&4 = 14$ , or T = 2\*7 = 2\*(B-3) = 20-6 = 14

 A calculator predicts by the <u>RecountFormula</u>, where the operations (/, \*, –) are icons for bundling & stacking & removing stacks to find unbundled: <u>T = 7 = (7/3)\*3</u> = 2B1 **3s**

7/3	2.some
7 – 2*3	1

# Difference-Research, Main Warning: The 3x3 Goal Displacements in Math Education

	Numbers	Could: be icons & predicates in Tales of Many, T = 2 3s = 2*3; show Bundles, T = 47 = 4B7 = 3B17 = 5B-3; T = 456 = 4*BB + 5*B + 6*1 Instead: are changed from predicates to subjects by silencing the real subject, the total. Place-values hide the bundle structure
rimar	Operations	Could: be icons for the counting process as predicted by the RecountFormula T = (T/B)*B, from T pushing Bs away T/B times Instead: hide their icon-nature and their role in counting; are presented in the opposite order (+ - * /) of the natural order (/, *, -, +).
Р	Addition	Could: wait to after counting & recounting & double-counting have produced unit- and per-numbers; wait to after multiplication Instead: silences counting and next-to addition; silences bundling & uses carry instead of overloads; assumes numbers as ten-based
e	Fractions Could: be per-numbers coming from double-counting in the same unit; be added by areas (integration) Instead: are defined as rational numbers that can be added without units (mathe-matism, true inside, seldom outside	
Viddl	Equations	Could: be introduced in primary as recounting from ten-bundles to icon-bundles; and as reversed on-top and next-to addition Instead: Defined as equivalence relations in a set of number-names to be neutralized by inverse elements using abstract algebra
2	Proportionality	Could: be introduced in primary as recounting in another unit when adding on-top; be double-counting producing per-numbers Instead: defined as linear functions, or as multiplicative thinking supporting the claim that fractions and ratios are rational numbers
	Trigonometry	Could: be introduced in primary as mutual recounting of the sides in a right-angled triangle, seen as a block halved by a diagonal Instead: is postponed till after geometry and coordinate geometry, thus splitting up geometry and algebra.
High	Functions	Could: be introduced in primary as formulas, i.e. as the number-language's sentences, T = 2*3, with subject & verb & predicate Instead: are introduced as set-relations where first-component identity implies second-component identity
	Calculus	Could: be introduced in primary as next-to addition; and in middle & high as adding piecewise & locally-constant per-numbers Instead: differential calculus precedes integral calculus, presented as anti-differentiation

## 11. Different Education EU: Line-organized & Office-directed Schools

From secondary school, continental Europe uses **line-organized** education with forced classes and forced schedules making teenagers stay together in age groups even if girls are two years ahead in mental development.

The classroom belongs to the class. This forces teachers to change room and (in lower secondary school) to teach several subjects outside their training.

Tertiary education is also **line-organized** preparing for offices in the public or private sector. This makes it difficult to change line in the case of unemployment, and it forces the youth to stay in education until close to 30 making reproduction fall to 1.5 child/family, causing the European population to die out very quickly by decreasing it to 25% in 100 years.

# 12. Different Education US: Block-organized & talent-directed

Alternatively, North America uses **block-organized** education saying to teenagers:

"Welcome, inside you carry a **talent**! Together we will uncover and develop your personal talent through <u>daily lessons in self-chosen half-year blocks</u>, academical or practical, together with 1subject teachers. If successful the school will say 'good job, you have a **talent**, you need some more'. If not, the school will say 'good try, you have **courage** to try out the unknown, now try something new'".

The classroom belongs to the teacher teaching one subject only.

Likewise, college is **block-organized** easy to supplement with additional blocks in the case of unemployment.

At the age of 25, most students have an education, a job and a family with three children, 1 for mother, 1 for father, and 1 for the state to secure reproduction.

## 20. Different Mathematics The Beauty of the Simplicity of Mathematics

- 21. The Goal & Means of Mathematics Education
- 22. Totals as Blocks. Digits as Icons. Operations as CupCounting Icons
- 23. ReCounting gives Proportionality & Multiplication & Equations
- 24. Multiplication tables simplified by ReCounting
- 25. DoubleCounting in different & same units creates PerNumbers & Fractions
- 26. Geometry: Counting Earth in HalfBlocks
- 27. Once Counted, Totals can be Added. But counting and double-counting gives 4 number-types (constant & variable unit-numbers & per-numbers) to add in 4 ways
- 28. How Different is the Difference? Set-based versus Many-based Mathematics

# The Goal and Means of Mathematics Education

#### The Set-based Top-Down Tradition:

- Mathematics exists as a collection of well-proven statements about well-defined concepts, all derived from the mother concept SET
- Mathematics is surprisingly useful to modern society
- Consequently, mathematics must be taught and learned

#### The Many-based Bottom-Up Difference:

- Many exists; to master Many we develop a number-language with Tales of Many, a 'ManyMatics'.
- Many-matics, defining concepts from below as abstractions from examples, is a more successful means to the goal of mastering Many than
- 'Meta-matics' defining concepts from above as examples from abstractions

22a. Different Mathematics Digits as Icons. Totals as Blocks to be Cup-Counted



**Icon-numbers.** A folding ruler shows: digits are, not symbols as the alphabet, but sloppy writings of icons having in them as many sticks as they represent. Thus, there are four sticks in the 4-icon, etc.

**Counting-sequences**. A total of a dozen sticks counted in **5s** gives different counting sequences:

'1, 2, 3, 4, Bundle, 1B1, ..., 2 Bundles, 2B1, 2B2', or

'01, 02, 03, 04, 10, 11, ..., 22', or (.1, .2, .3, .4, 1., 1.1, ..., 2.2', or

'1, 2, Bundle less 2, B-1, Bundle, B&1, B&2, 2B-2, 2B-1, 2Bundles, 2B&1, 2B&2.'

**Cup-Counting**. With a cup for the bundles, a total can be 'cup-counted' with inside bundles & outside singles in 3 ways: normal, with Overload or with Underload: T = 7 = 2]1 **3s** = 1]4 **3s** = 3]-2 **3s** Or, when counting in tens :

T = 37 = 3]7 tens = 2]17 tens = 4]-3 tens



# 22b. Different Mathematics Operations as CupCounting Icons

We count by bundling and stacking: T = |I| |I| = |II| |I| = |II| |I| = |II| |I| = |II| |I| = 2B1 3s = 2]1 3s = 2.1 3s

Thus, to count 7 in **3s** we take away 3 many times, iconized by an uphill stroke showing the broom wiping away the 3s. With 7/3 = 2.some, the calculator predicts that 3 can be taken away 2 times.

To stack the 2 **3s** we use multiplication, iconizing a lift, 2x3 or 2\*3, transforming the bundles into a stack.

###

7/3

2.some

To look for unbundled singles, we drag away the stack of 2 **3s** iconized by a horizontal trace: 7 - 2\*3 = 1.

The prediction 'T = 7 = 2 3s & 1 = 2B1 3s = 2]1 3s' provides the

ReCount-formula:  $T = (T/B)^*B$  | saying 'from T, T/B times, B can be taken away'. 7 – 2\*3

To also bundle bundles, power is iconized as a cap, e.g. 5<sup>2</sup>, indicating the number of times bundles themselves have been bundled.

Finally, addition is a cross showing that blocks can be juxtaposed next-to or on-top of each other.

Counting thus provides the number-formula called a polynomial, where all numbers have units:

T = 456 = 4\*BundleBundle + 5\*Bundle + 6\*1 = 4\*B^2 + 5\*B + 6\*1

So counting creates 3 operations: to divide & to multiply & to subtract.

MATHeCADEMY.net : Math as MANYmath - a Natural Science about MANY

## <sup>22c. Different Mathematics</sup> The ReCount Formula is all over Mathematics

ReCount-formula:  $T = (T/B)^*B$  saying 'from T, T/B times, B can be taken away'

ReCounting	T = (T/B)*B	8 = (8/2)*2 = 4*2 = 4 <b>2s</b>	
Proportionality	\$ = (\$/kg)*kg	\$ = p*kg	= price*kg, Economy
Coordinate Geometry	$\Delta y = (\Delta y / \Delta x)^* \Delta x$	$\Delta y = m^* \Delta x$	= slope*∆x
Differential Calculus	$dy = (dy/dx)^*dx$	$dy = y'^* dx$	= gradient*dx
Trigonometry	a = (a/c)*c; a = (a/b)*b	a = sinA*c; a = tanA*b	
Linearity	$y = k^*x$	F = m*a, dist = vel*time,	Physics
Eigenvalues	Ηψ = Ε*ψ	Schroedinger Equation in	Quantum mechanics



## 23. Different Mathematics ReCounting gives Proportionality & Multiplication & Equations

ReCounting in the same unit creates overloads & underloads

• T = IIIIIII = III III I = 2]1 **3s** = 1]4 **3s** (Overload III I I I I) = 3]-2 **3s** (Underload III III III II)

ReCounting in different units means changing units (Proportionality)

- T = 4 5s = ? 6s. Calculator predicts with ReCount-formula T = (T/B)\*B, T = 3]2 6s
  ReCounting from icons to tens gives Multiplication :
- T = 5 **7s** = ? **tens** = 5\*7 = 35 = 3.5 **tens**, predicted by multiplication 4\*5 3\*6

ReCounting from tens to icons gives **Equations** :  $u^*7 = 42 = (42/7)^*7$ 

• T = ?  $7s = u^*7 = 42 = (42/7)^*7 = 6 7s$  with solution u = 42/7 = 6

An equation is solved by moving to opposite side with opposite sign

2

## Multiplication Tables Simplified by ReCounting

<u>Geometry</u>: Multiplication means that, recounted in tens, a block increases its width and therefore decreases its height to keep the total unchanged.

Thus T = 3\*7 means 3 7s that may be recounted in tens as T = 2.1 tens = 21.

<u>Algebra</u>: The full ten-by-ten table can be reduced to a small 2-by-2 table containing doubling and tripling, using that 4 is doubling twice, 5 is ½Bundle, 6 is 5&1 or Bundle less 4, 7 is 5&2 or Bundle less 3, etc.

Beginning with doubling and halving visualized by CentiCubes

- T = 2 6s = 2\*6 = 2\*(½B&1) = B&2 = 12, or
- T = 2 6s = 2\*6 = 2\*(B-4) = 20-8 = 12.
  - T = 5 7s = 5\*7 = 5\*(B-3) = 5B 15 = 50 15 = 35
  - T = 87s = 8\*7 = (B-2)\*(B-3) = BB 2B 3B + 6 = 100 20 30 + 6 = 56

DoubleCounting in 2 units creates PerNumbers (Proportionality) DoubleCounting in the same unit creates Fractions

Apples are double-counted in kg and in \$.

With 4kg = 5\$ we have 4kg/5\$ = 4/5 kg/\$ = a per-number

**Questions**: 4kg/100kg = 4/100 = 4%

7kg = ?\$	8\$ = ?kg
$7 \text{kg} = (7/4)^* 4 \text{kg}$	8\$ = (8/5)*5\$
= (7/4)*5\$	= (8/5)*4kg
= 8.75\$	= 6.4kg

Answer: Recount in the per-number



## Geometry: Counting Earth in HalfBlocks

Geometry means to count earth in Greek. The earth can be divided in triangles; that can be divided in right triangles; that can be seen as a block halved by its diagonal thus having three sides: the base b, the height a and the diagonal c connected by the Pythagoras theorem. And connected with the angles by formulas recounting the sides in sides or in the diagonal:



## Once Counted & ReCounted, Totals can be Added

ОпТор	NextTo
2 <b>3s</b> + <b>4 5s</b> = 1]1 <b>5s</b> + 4 <b>5s</b> = 5]1 <b>5s</b>	2 <b>3s</b> + 4 <b>5s</b> = 3]2 <b>8s</b>
The units are changed to be the same.	The areas are added.
Change unit = Proportionality	Adding areas = Integration





MATHeCADEMY.net : Math as MANYmath - a Natural Science about MANY

## 27b. Different Mathematics Adding PerNumbers as Areas (Integration)



### <sup>27c. Different Mathematics</sup> With 2x2 different number-types we Add in 4 ways

Counting produces variable or constant unit-numbers or per-numbers

- Addition & Multiplication unites variable & constant unit-numbers
  - Subtraction & division splits into variable & constant unit-numbers
- Integration & Power unites variable & constant per-numbers
  - Differentiation & root/logarithm splits into variable & constant unit-numbers

Operations <b>unite</b> / <i>split into</i>	Variable	Constant
Unit-numbers	T = a + n	T = a*n
m, s, \$, kg	T-a=n	T/n = a
Per-numbers	T =∫a dn	T = a^n
m/s, \$/kg, m/(100m) = %	dT/dn = a	$log_a T = n, n \sqrt{T} = a$

### 28a. Different Mathematics How Different is the Difference? Set-based Math versus Many-based Math

	SET-based Tradition	Many-based Difference
Goal/Means	Learn Mathematics / Teach Mathematics	Learn to master Many / Math as Tales of Many
Digits	Symbols as letters	Icons with as many sticks as they represent
Numbers	Place-value number line names. Never with units	A union of blocks of stacked singles, bundles, bundle- bundles etc. Always with units
Number-types	Four types: Natural, Integers, Rational, Real	Positive and negative decimal numbers with units
Operations	Mapping from a set-product to the set	Counting-icons: /,*,-,+ (bundle, stack, remove, unite)
Order	Addition, subtraction, multiplication, division	The opposite
Fractions	Rational numbers, add without units	Per-numbers, not numbers but operators needing a number to become a number, so added by integration
Equations	Statement about equvalent number-names	Recounting from tens to icons, reversing operations
Functions	Mappings between sets	Number-language sentences with a subject, a verb and a predicate
Proportionality	A linear function	A name for double-counting to different units
Calculus	Differential before integral (anti-differentiation)	Integration adds locally constant per-numbers.

## 28b. Different Mathematics Main Parts of a ManyMath Curriculum

#### Primary School – respecting and developing the Child's own 2D NumberLanguage

- Digits are Icons and Natural numbers are 2dimensional block-numbers with units
- CupCounting & ReCounting before Adding
- NextTo Addition (PreSchool Calculus) before OnTop Addition
- Natural order of operations: / x +

#### Middle school – integrating algebra and geometry, the content of the label math

- DoubleCounting produces PerNumbers as operators needing numbers to become numbers, thus being added as areas (MiddleSchool Calculus)
- Geometry and Algebra go hand in hand always so length becomes change and vv.
   High School integrating algebra and geometry to master CHANGE
- Change as the core concept: constant, predictable and unpredictable change
- Integral Calculus before Differential Calculus

## 31. Different Research Ancient Greece: Sophist vs. Philo-Sophists

Difference research began with the Greek controversy between two attitudes towards knowledge, called 'sophy' in Greek. To avoid hidden patronization, the sophists warned: 'Know the difference between nature and choice to uncover choice presented as nature.'

To their counterpart, the philosophers, choice was an illusion since the physical was but examples of metaphysical forms only visible to them, educated at the Plato academy.

The Christian church transformed the academies into monasteries but kept the idea of a metaphysical patronization by replacing the forms with a Lord using an unpredictable will to choose world behavior.

## 32. Different Research Renaissance Natural Science

Background: Viking descendants in UK know how to sail, how to steal Spanish silver, how to follow the moon to go to India on open sea to buy silk and pepper:

How does the moon move?

Tradition: Between the stars. Newton: No, falling

Why does moons and apples fall?

Tradition : Following an metaphysical unpredictable will. Newton: No, a physical will predictable, following formulas.

What is the effect of a will or force

Tradition : Aristotle: a force maintains order . Newton: No, a force changes order.

*How to use formulas?* 

Tradition : Arabic algebra. Newton: No, different algebra about change, Calculus

# 33. Different Research Enlightenment Century 1700-1800

Newton's physical will inspired the Enlightenment century (Locke) with its two republics

The US: Skepticism towards philosophy, US pragmatism, Symbolic Interactionism, Grounded Theory, Action Learning & Research

The French 5<sup>th</sup> : post-structuralism inspired by German thinking:

- Counter-enlightenment: Hegel's metaphysical Spirit, the basis for Marxism and EU line-organized office-directed Bildung-education
- Existentialism: (Kierkegaard), Nietzsche, Heidegger, (Sartre: In Existentialism, existence precedes essence)

## 34. Different Research French Post-Structuralism

Inspired by Heidegger's: 'In sentences, trust the subject & doubt the predicate'

- Derrida: Words can be different (DeConstruction)
- Lyotard: Truth can be different (PostModern skepticism towards meta-narratives)
- Foucault: Diagnoses can be different, Curing institutions also (a school is really a 'pris-pital' mixing power techniques from a prison and a hospital by fixing and diagnosing students at the same time)
- Bourdieu: Education can be different, and stop using symbolic violence and mathematics especially to create outsiders accepting power be given to a new knowledge-nobility

### 35. Different Research Difference-Research finds Differences making a Difference

Difference-Research, inspired by its historical roots,

- Questions traditional words & truths & institutions
- Designs different micro-curricula & macro-curricula
- Reports if a difference makes a difference

### **Examples**

Micro-curricula: MATHeCADEMY.net with YouTube/YouKu videos (MrAlTarp/DrAlTarp)

Macro-curriculum: 'The Simplicity of Mathematics Designing a STEM-based Core Math Curriculum for Outsiders and Migrants', http://mathecademy.net/stem-based-core-math-for-migrants/

# 36. Different Research Difference-Research: For whom?

- For teachers observing problems in the classroom
- For teacher-researchers splitting their time between academic work at a university and intervention research in a classroom.
- For full-time researchers cooperating with teachers both using differenceresearch, the teacher to observe problems, the researcher to identify differences, together working out a different micro-curriculum, to be tested by the teacher, and reported by the researcher conducting a pretestposttest study.
- Difference-research begins by observing learning problems and wondering if we could teach differently, e.g. a child saying 'II II, that is not 4, but 2 **2s**', showing that children bring 2dimensional block-numbers to school where 1dimensional cardinal line-numbers then are forced upon them.

### Conclusion The 3x3 Goal Displacements in Math Education

	Numbers	Could: be icons & predicates in Tales of Many, T = 2 3s = 2*3; show Bundles, T = 47 = 4B7 = 3B17 = 5B-3; T = 456 = 4*BB + 5*B + 6*1 Instead: are changed from predicates to subjects by silencing the real subject, the total. Place-values hide the bundle structure
rimar	Operations	Could: be icons for the counting process as predicted by the RecountFormula T = (T/B)*B, from T pushing Bs away T/B times Instead: hide their icon-nature and their role in counting; are presented in the opposite order (+ - * /) of the natural order (/, *, -, +).
4	Addition	Could: wait to after counting & recounting & double-counting have produced unit- and per-numbers; wait to after multiplication Instead: silences counting and next-to addition; silences bundling & uses carry instead of overloads; assumes numbers as ten-based
e	Fractions Could: be per-numbers coming from double-counting in the same unit; be added by areas (integration) Instead: are defined as rational numbers that can be added without units (mathe-matism, true inside, seldom outside	
liddl	Equations	Could: be introduced in primary as recounting from ten-bundles to icon-bundles; and as reversed on-top and next-to addition Instead: Defined as equivalence relations in a set of number-names to be neutralized by inverse elements using abstract algebra
2	Proportionality	Could: be introduced in primary as recounting in another unit when adding on-top; be double-counting producing per-numbers Instead: defined as linear functions, or as multiplicative thinking supporting the claim that fractions and ratios are rational numbers
	Trigonometry	Could: be introduced in primary as mutual recounting of the sides in a right-angled triangle, seen as a block halved by a diagonal Instead: is postponed till after geometry and coordinate geometry, thus splitting up geometry and algebra.
High	Functions	Could: be introduced in primary as formulas, i.e. as the number-language's sentences, T = 2*3, with subject & verb & predicate Instead: are introduced as set-relations where first-component identity implies second-component identity
	Calculus	Could: be introduced in primary as next-to addition; and in middle & high as adding piecewise & locally-constant per-numbers Instead: differential calculus precedes integral calculus, presented as anti-differentiation

# ManyMath is Different But does it make a Difference? Try it out.

- Watch some YouTube or YouKu videos (MrAlTarp/DrAlTarp)
- Try the CupCount before you Add Booklet
- Try a 1day free Skype seminar How to Cure Math Dislike
- Try Action Learning and Action Research, e.g. 1Cup, 5Sticks
- Collect data and Report on its 8 MicroCurricula, M1-M8
- Try a 1year online <u>InService TeacherTraining</u> at the MATHeCADEMY.net using PYRAMIDeDUCATION to teach teachers to teach MatheMatics as **ManyMatics**, a Natural Science about the root of mathematics, **Many**

Some MrAlTarp YouTube Videos Screens & Scripts on MATHeCADEMY.net

- Postmodern Mathematics Debate
- CupCounting removes Math Dislike

MATHeCADE

- IconCounting & NextTo-Addition
- PreSchool Mathematics
- Fractions
- PreCalculus
- Calculus
- Mandarin Mathematics
- World History



## CupCount 'fore you Add Booklet, free to Download

My many Math Tears will not Stay – if I Cup the Stray Away

#### CupCount 'fore you Add

MathDislike Cured by 1 Cup & 5 Sticks

5 =	=	= 1)3	2s
5 =	= 🔟 I	= 2)1	2s
5 =	= 🔟 I	= 3)-1	2s

CupCount 7 in 3s: 7 = 2)1 3s = 1)4 3s = 3)-2 3s

NO, 4x7 is not 28, it is 4 7s = 2)8 = 1)18 = 3)-2 tens NO, 30/6 is not 30 divided by 6, it is 30 counted in 6s

CupWrite to tell InSide Bundles from OutSide 1s:



MATHeCADEMY.net

#### Contents

#### Preface

ntroduction to the Chapters	
01. From Sticks to Icons1	
02. Counting in Icons	
03. CupCounting in Icons5	
04. CupCounting with Dices7	
9. ReCounting in the Same Unit	
06. ReCounting in a New Unit11	
07. ReCounting in BundleBundles13	
08. ReCounting in Tens on Squared Paper or an Abacus15	
9. ReCounting from Tens	
19. ReCounting Large Numbers in Tens	
1. DoubleCounting with PerNumbers21	
2. DoubleCounting with Fractions and Percentages	
13. ReCounting PerNumbers, Fractions	
14. Adding OnTop24	
15. Reversed Adding OnTop25	
16. Adding NextTo26	
17. Reversed Adding NextTo27	
18. Adding Tens	
19. Reversed Adding Tens29	
20. Recounting Solves Equations	

#### 03. CupCounting in Icons

Job		Do	Calculator	
	Line	T=	9/5	1.some
	Count	1, 2, 3, 4, B, 1B1, 1B2, 1B3, <u>1B4</u>	9-1*5	4
9	Bundle	T = +++++1		
in 5s	Stack		9-0+5	٩
	Cup	T = 1)4 5s = 0)9 5s = 2)-1 5s	9-2+5	-1
	Answer	T = 9 = 1.4 5  s		_
	Line	T=1111111	9/4	2 some
	Count	1, 2, 3, B, 1B1, 1B2, 1B3, 2B, <u>2B1</u>	9-2*4	1
9	Bundle	T=+++++++++		-
in 4s	Cup	T = 2)1 4s = 1)5 4s = 3)-3 4s	9-1+4	5
	Stack		9-3+4	-3
	Answer	<u>T = 9 = 2.1 4s</u>		
	Line			
	Count			
9	Bundle		9/	
in 3s	Cup		9-	
	Stack			
	Answer			
	Line			
	Count			
8	Bundle		8	
in 4s	Cup		8	
	Stack			
	Answer			
	Line			
	Count			
8	Bundle		8	
in 3s	Cup		8	
	Stack			
	Answer			

MATHeCADEMY.net

CADEMY.net : Math as MANYMath - a Natural Science about MANY

# 1day free Skype Seminar:

# To Cure Math Dislike, CupCount before you Add

### Action Learning based on the Child's own 2D NumberLanguage

#### 09-11. Listen and Discuss the PowerPointPresentation

To Cure MathDislike, replace MetaMatism with ManyMath

- MetaMatism = MetaMatics + MatheMatism
- MetaMatics presents a concept TopDown as an example instead of BottomUp as an abstraction
- MatheMatism is true inside but rarely outside classrooms
- ManyMath, a natural science about Many mastering Many by CupCounting & Adding NextTo and OnTop.

#### 11-13. Skype Conference. Lunch.

**13-15. Do: Try out the <u>CupCount before you Add</u>** booklet to experience proportionality & calculus & solving equations as golden LearningOpportunities in CupCounting & NextTo Addition.

#### 15-16. Coffee. Skype Conference.

# A Primary School Test Curriculum, <u>before</u> Math Dislike CURED by 1 Cup & 5 Sticks

Having problems in a division class, the teacher says: "Timeout, class. Next week no division, instead we take a field trip back to day 1 to learn CupCounting"

Let's recount 5 in 2s by bundling, using a cup for the bundles:

**5** = || || || = 1)3 **2s** = 1 Bundle & 3 **2s** overload **5** = || || || = 1)3 **2s** = 2 Bundles & 1 **2s** normal **5** = || || || = 1)3 **2s** = 3 Bundles less 1 **2s** underload

Now we know that numbers can be ReCounted in 3 ways: Normal, overload or underload if we move a stick OUTSIDE or INSIDE. Now CupCount 7 in **3s**:

7 = |||||||| = 2)1 3s = 1)4 3s = 3)-2 3s

336

#### A Primary School Test Curriculum, after *Math Dislike CURED by 1 Cup & 5 Sticks* 336/7 = 33)6 /7 = 28)56 /7 = 4)8

When counting in TENS, before calculating, we cup-write the number to separate the **INSIDE** bundles from the **OUTSIDE** singles. Later we recount.

- 65 + 27 = 6(5 + 2)(7) = 8(12)(2) = 9(2) = 9(2)
- 65-27 = 6(5-2)7 = 4(-2) = 3(-2)8 = 38
- 7x 48 = 7x 48 = 2856 = 336 = **336**
- **336 /7** = 33)6 /7 = 28)56 /7 = 4)8 = **48**

With 336 we have 33 **INSIDE**, so to get 28, so we move 5 **OUTSIDE** as 50. Now try 456 / 7.

# • **456**/7 = 45)6/7 = 42)36/7 = 6)5 + 1 = **65** 1/7

# 8 MicroCurricula for Action Learning & Research

- C1. Create Icons
- C2. Count in Icons (Rational Numbers)
- C3. Recount in the Same Icon (Negative Numbers)
- C4. ReCount in a Different Icon (Proportionality)
- A1. Add OnTop (Proportionality)
- A2. Add NextTo (Integrate)
- A3. Reverse Adding OnTop (Solve Equations)
- A4. Reverse Adding NextTo (Differentiate)





#### MATHeCADEMY.net

a VIRUSeCADEMY Teaching Teachers to Teach MatheMatics as ManyMath, a Natural Science about MANY - the CATS approach: Count & Add in Time & Space

HOME	INTRO	COUNT	ADD	TIME	CRACE	DIC	VIDEOE	DAREPS	DECCUOOL	VABIOUS	DICLIVE
PLANE	INTINO	COUNT	AUU	TIME	SPACE	Dis	TIDEOD	PAPENS	PRESCHOOL	WARIO 03	DISCINE

#### ManyMath: CupCount before you Add

Teach Multiplication before Addition & Add NextTo before OnTop FREE 1day SKYPE Cure Math Dislike Teacher Seminar CupCount & ReCount \* KopTæl & OmTæl \* ICME13 Papers PPP: Existentialism in Math Ed \* From MetaMatism to ManyMath Hire MrAITarp: 2 weeks (Free), or 2 months

We ACT to deal with the outside world. We MATH to deal with the natural fact MANY ??? Oops, sorry, math is not an action word! We COUNT & ADD to deal with MANY.

CupCount & ReCount:

T = 111111 = 111 111 = 11) = 2)1 = 2.1 3s T = 2)1 3s = 1)4 3s = 3)-2 3s (Overload or Deficit) T = 2)1 3s = 1)2 5s = 3)1 2s = 11)1 2s T = 3×8 = 3 8s = 2.6 9s = 2.4 tens, or the sloppy version 24

Counting gives a decimal number with a unit (a natural number). Adding **OnTop**, a Total may be **ReC**ounted to shift the unit. Adding **NextTo**, means **Integration** of areas.

Add OnTop & Add NextTo:

Î.	Ш	III		11111				
Į.		Ц	Ч	5	6	9	Ξ	E
1	2	3	4	5	6	7	8	9

Teaches Teachers to Teach Teaches Teachers to Teach Nathe Matics as **Manya** Nathe Matics as **Manya** Natural Science about Math Natural Science about Math Natural Science about Math The **CATS** method: To lear & Space The **CATS** method: Time & Space



# Teacher Training in CATS ManyMath Count & Add in Time & Space

COUNT1.pdf - Adobe Reader	odf - Adobe Reader	ME1.pdf - Adobe Reader
e Edit View Window Help 🗶 🗙	View Window Help	<ul> <li>Edit View Window Help</li> </ul>
l / 4 50% ▼ Fill & Sign Comment	50% 🔻 🛃 🔻 Fill & Sign Comment	▶ 1 / 5 50% ▼ 📝 ₹ Fill & Sign Comment
<text></text>	$ \begin{array}{c} \textbf{b} \textbf{b} \textbf{b} \textbf{c} \textbf{c} \textbf{c} \textbf{c} \textbf{c} \textbf{c} \textbf{c} c$	

40

# **PYRAMIDeDUCATION**

To learn MATH: Count&Add MANY Always ask Many, not the Instructor MATHeCADEMY.net - a VIRUSeCADEMY

In PYRAMIDeDUCATION a group of 8 teachers are organized in

- 2 teams of 4 choosing 2 instructors and 3 pairs by turn.
- Each pair works together to solve Count&Add problems.
- The coach assists the instructors when instructing their team and when correcting the Count&Add assignments.
- Each teacher pays by coaching a new group of 8 teachers.



# Main Main Point: Respect the Child's own 2D BlockNumbers allowing ReCounting & Multiplying before Adding



Difference-Research Powering PISA Performance: Count and Multiply before you Add Think Things

III III III = T = 4 **3s** = 1 **dozen** = 1.2 **tens** = 12 = twelve = 'two left' in Wiking Danish

This talk has been in Anglish, a dialect from the Wiking area on the Danish WestCost

*Full 31 page article: http://mathecademy.net/difference-research/* 

Thank you for listening (Tak do for lytningen)

Allan.Tarp@MATHeCADEMY.net, Denmark