

Numeracy for everyone?

Numeracy is a human activity Numeracy is functional and highly practical

International Mathematics Week

14 MARET

HARI MATEMATIKA

Universitas Sriwijaya, Palembang, Sumatera-Selatan, Indonesia



Co-funded by the Erasmus+ Programme of the European Union



Prof. Kees Hoogland 14th March 2023



Selamat pagi dari Belanda !





A decade of PMRI in Indonesia

Edited by

Robert Sembiring Kees Hoogland Maarten Dolk



Numeracy for everyone or Mathematics for everyone

HARI MARET INTERNASIONAL

INTERNATIONALE DAG VAN

14 MAART

Luis Miguel Paz Corrales, from Universidad Pedagógica Nacional Francisco Morazan, Langue, Valle, Honduras, adds:

"In my opinion, access to mathematics should be democratized for everyone. Because traditionally, it has been believed that it is only for those who possess certain types of problem-solving skills. And research, mainly in Mathematics Education, has shown that Mathematics is compulsory all over the world because it contributes to the formation of competent citizens."

That is called "numeracy".

Happy Pl-day

14 March in USA: 3 - 14

My proposal:

pi-day at: 22 July in Europe & Asia

Why? **22/7**

3.14159265......

Mathematics

Happy PIE-day

World's Most Accurate Pie Chart



It is numeracy, when ...

- ... it is closely connected with reality
- useful meaningful • ... it is meant to improve the self-efficacy of people inclusive
- not used to select •... large numbers of people can understand it

The Mathematisation of Society

Situations



	A1	*	fx .	Expense	
	A	В	C	D	E
1	Expense	Jan	Feb	Mar	
2	Phone	\$45.65	\$56.83	\$42.58	-
3	Insurance	\$75.80	\$75.80	\$75.80	
4	Rent	\$750.00	\$750.00	\$750.00	



	Renogy Wenderer 30A Li PWM Charge Controller	Renogy Rover 20A Li MPPT Charge Controller	Renogy Rover 40A Li MPPT Charge Controller
Battery Type	Sealed, gel, flooded, and lithrum	Sealed, gel, flonded, and othium	Sected, gel, flooded, and lithium
Charge Stage	4	4	4
LCD Display		×	1
Grounding Type	Negative	Nangati ter	Negative
Nominal system voltage	12 VDC	129/249 DC	12V/24V DC
System Capacity	400W	200W (12 Melt) / 400W (24 Melt)	000W (12 Volt) / 800W (24 Volt)
luctooth Medule Compatible	1	1	1
Dimensions	65x43x18m.	3.9×8.3×2.31n	5.8 x 9.4 x 2.8 in.

Wallpaper Calculator

Wall width (m)	Wall height (m)
Wallwidth	Wall height
Wallpaper width (cm)	Roll length (m)
Wallpaper width	Roll length
Pattern Repeat (cm)	
Pattern offset	Calculate







The Mathematisation of Society

Individuals acting in numeracy/mathematical situations











Mathematisation of Society - minidoc as part of Inaugural Lecture Kees Hoogland (2nd June, 2021) Producer: Marleen Stoker at Mokermedia marleenstoker.com

Besmettingen

Dutch COVID-19 Dashboard





Numeracy = how to deal with the "quantitative" or "mathematical" aspects of the world around us.

Q or M = numbers, graphs and diagrams, 2D/3D aspects, Q or M = not only calculations, but also interpreting and reasoning Q or M = mathematical cognitions



Jakarta (Indonesia) - Country Note - Skills Matter: Further Results from the Survey of Adult Skills

Figure 2. Numeracy proficiency among adults

Percentage of 16-65 year-olds scoring at each proficiency level in numeracy



PIAAC –scores age 16-65 yr (from 2012& 2015)



Figure 4. Synthesis of socio-demographic differences in literacy proficiency

Difference in literacy scores between contrast categories within various socio-demographic groups



Figure 5. Information-processing skills used at work

Average skills use, working population aged 16-65



Notes: For reading, writing, numeracy and ICT skills, skills use indicators are scales between 1 "Never" and 5 "Every day". Problem-solving skills use refers to respondents' answers to "How often are you usually confronted with more complex problems that take at least 30 minutes to find a good colution?". The set of persible answers also represented between 1 "Never" and 5 "Every day".

Basic skills

- Basic skills = what you need to cope inclusively, autonomously and adequately with the world you live in.
- Every period in history has its own needs of what is relevant and important in that particular period.



Reading, writing, arithmetic

19th century 3Rs: Reading, 'Riting 'Rithmetic



Language and Maths

20th century

Numeracy, Literacy, Digital skills



21st century

Three cornerstones of basic skills to participate in the 21st century



Numeracy conceptual development



The Numerate world 21st c.AD

Cognitive processes Interpretation

Understanding of hidden algorithms Valuating Measuring Estimating Critical thinking

Knowing reference numbers

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...

...

Manifestations Product labels, advertisements, brochures,

Apps, websites, ... Money, prices, ... Length, weight, ... Ubiquitous, Politics, intimidation with numbers Body, country, world

Szr jwfyj gjmf{ntzwfsi uwfhynhjx

OFCD Skills Studies

The Assessment Frameworks for Cycle 2 of the Programme for the International Assessment of Adult Competencies

OECD

Redefining basic skills



Numeracy as social practice (NSP)

"... aggregate of skills, knowledge, beliefs, dispositions, habits of mind, communication capabilities, and problem-solving skills that individuals need in order to autonomously engage and effectively manage numeracy situations that involve numbers, quantitative or quantifiable information, or visual or textual information that is based on mathematical ideas or has embedded mathematical elements". (See Gall, 2000, p.6)

The framework acknowledges the great efforts from the past: ALL, IALS, PIAAC, ACER, ..., ..., ... It will be developed further by many.



Co-funded by the Erasmus+ Programme of the European Union Conceptually inspired by:

- Situated cognition
- Cultural-historical activity theory (CHAT)
- Literacy as social practice (LSP)
- Ethnomathematics

"A social practice view of numeracy not only takes into account the different contexts in which numeracy is practised, such as school, college, work and home, but also how people's life and histories, goals, values and attitudes will influence the way they carry out numeracy".

(See Oughton, 2013)



EDITED BY KEIKO YASUKAWA, ALAN ROGERS, KARA JACKSON AND BRIAN V. STREET

NUMERACY AS SOCIAL PRACTICE Global and local perspectives

(See Yasukawa et al., 2018)

Common European Numeracy Framework

- Erasmus+ project 1: Common European Numeracy Framework
 - running from December 2018 November 2021
 - 4 countries + networks e.g., ALM and EBSN
 - Developing a framework and professional development modules (PDM)
- Erasmus+ project 2: Numeracy in Practice NiP
 - running from January 2022 December 2024
 - 11 countries (IR, NL, BE, FR, AU, SP, IT, SL, GR, TU, PO)
 - + networks e.g., ALM, EBSN, ...
 - Upscaling provisions and professional development
 - Working on awareness and critical mass
 - Attracting attention from Canada, South America, Africa, Asia, Australia, ..



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What matters to improve numerate behavior



cenf.eu

Implications for secondary education

- Less algebra, more statistics
- Less procedures, more interpretation of numbers, graphs, tables, infographics
- Less fractions, more electronic tools: calculator, software, apps,

Recommendation for educational policy

Think about two tracks:

A: numeracy for all

B: mathematics for technical studies and professions









Everybody needs a calculator. Because of this, there have been many calculators through the years, and hey're actually pretty easy to find. Most people use them to figure out stuff like how much to tip at estaurants, and students literally must have them for school. Believe it or not, Android can solve all of your needs in this instance. Here are the best calculator apps for Android.

The best calculator apps for Android

1. Calc	6. Financial Calculators
2. <u>Calcu</u>	7. HiEdu Scientific Calculator
3. ClevCalc	8. HiPER Scientific Calculator
4. Desmos Graphing Calculator	9. MyScript Calculator 2
5. Digitalchemy calculator apps	10. Your phone's stock calculator

Google	(a+b)^2 × 🤳				
	🔍 Alle 🗔 Afbeeldingen 🕞 Video's 🗉 Nieuws 📀 Maps 🗄 Meer	Tools			
Ongeveer 25.270.000.000 resultaten (0,32 seconden) Je probleem oplossen $(a + b)^2$		I			
	Vereenvoudig 1 Splits het kwadraat af $(a + b)^2$ (a + b)(a + b)	^			
	2 Pas distributie toe	~			
	3 Pas distributie toe	~			
	4 Pas distributie toe	~			
	5 Combineer gelijke termen	~			
	Oplossing				

 $a^2 + 2ab + b^2$

Catastrophic teaching of basic skills

1. Learn - practice - never use

Demotivation, alienation, loss of meaning.

This produces math anxiety! These skills disappear or become a superficial memory item ("They never taught me this." "I can't remember this, or maybe vaguely" (but it arouses anxiety nevertheless)

2. Learning – practicing – only use in test or exam

Teaching to the test, learning to the test, fixed mindsets, no ownership, no personal development. ("Tell me exactly what to do.").

These skills do not last or badly. After test or exam rapid decrease in skills. Math anxiety is increased.

Implications for primary education

Multiply 18 x 365 =

Challenge

Conduct research per age group: how often do you use pen-and-paper to find the answer to such a multiplication (outside an educational setting !!)

	> 1 per day	< 1 per day	< 1 per week	< 1 per month	< 1 per year	never
[12-18> yr						
[18-30> yr						
[30-50> yr						
[50-80> yr						

Teaching skills to use

Learning – practicing – using functionally

- In daily life: indoors and outdoors
- In vocational situations
 - General vocations: tables, dimensions, spreadsheets
 - Specific vocations: formulas, apps,
- In games and digital games
- In (social) media
- In concrete situations
- With concrete materials

Ultimately aiming at "unconscious/unnoticed" use.

Before 1975

- Focus on **basic facts** in **formal** notations
 - 7 x 9 =
 - 12 + 9 =
 - 34 18 =
 - 35 : 7 =

Basic calculation facts are executed

by heart/instantaneously only when they are

automated.

Automated = learned->practiced->used (a lot)

This is not the same as Memorizing

$1 \times 2 =$ $2 \times 2 = 4$ $3 \times 2 = 6$	1 x 3 2 x 3 3 x 3		
$4 \ge 2 = 8$	4 x 3		
$5 \times 2 = 10$ $6 \times 2 = 12$	6 x 3		- And M. K.
$7 \ge 2 = 14$	7 x 3	Bendleter Land	
8 x 2 = 16	8 x 3		- TEL OR
$9 \ge 2 = 18$	9 x 3		
10x 2 = 20	10x 3		
1 x 6 =	1 x 7 =	1 x 8 =	1 x 9 =
$2 \times 6 =$	$2 \times 7 =$	2 x 8 =	2 x 9 =
$5 \times 6 =$	$3 \times 7 = 4 \times 7 = 100$	$3 \times 8 =$	3 x 9 =
5 x 6 =	$5 \times 7 =$	$4 \times 8 =$ 5 x 8 =	$4 \times 9 =$
$6 \ge 6 = 36$	6 x 7 =	6 x 8 =	$6 \times 9 =$
$7 \ge 6 = 42$	$7 \ge 7 = 49$	7 x 8 =	$7 \times 9 =$
$8 \ge 6 = 48$	8 x 7 = 56	8 x 8 = 64	8 x 9 =
$9 \ge 6 = 54$	$9 \ge 7 = 63$	9 x 8 = 72	9 x 9 = 81
10x 6 = 60	10x 7 = 70	10x 8 = 80	10x 9 = 90



1900-1975

 Were these (formal) basic facts like 6 x 8 and 13 - 9 widely used?





Especially in all those pen-and-paper calculations that were needed to perform larger calculations with pen-and-paper.

789	512,693	123	35.750 : 12 =
, 0J	15 678	56	of
סכ	43.078	50	12 / 35.750 \
X	+		

That was at that time a very functional use in study, profession and daily life

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After 1975 (1985, 1995)

- Calculators
- Computers
- Models (AEX, weather, ...)
- Digitization of services
- There's an App for that....





Basic skills in 2050



8

1975 – 2050 Basic facts

Unnoticed: Auditory: く» く» **<**> Games en digital games <mark><</mark>)» **८**% Visual: Estimate ≈ 7 x 11,9 ≈ 12 x 500.000 ≈ 6 x 125 ≈ 1000 : 71 ≈ 500 x 7 MB ≈



Are the basic facts like 6 x 8 and 13 - 9 still widely used?



After 1975

•Use of tools is permitted !!

- Dealing well and wisely and critically with a calculator / calculation app is a skill.
 So, you have to practice it a lot and consciously!!
- And then use it a lot and use it critically.
- Where are the learning materials who support the learning of how to use a calculator.
- Use calculator properly (PC, phone, web-based)?

Q 16 x 234

16 x 234

Use of Google etc. in a proper and sensible way?

Summary redefining basic skills

- Learning and practicing math facts, preferably informal, in (digital) games, visual, auditory, ...
- Using calculation facts for estimates, ratio tables, conversion, ...
- Learn to master tools for calculations and use them critically (and that does not happen automatically).

Key message of this presentation



- Numeracy, Literacy and Digital Competences are crucial and connected basic skills for individuals coping with the digitalised and technologised 21st-century society.
- This will work out if and only if Numeracy, Literacy, and Digital Competences are defined and implemented as multifaceted, social and 'holistic' concepts which are intertwined, and integrated in human behaviour.
- This means that numeracy in the major policies of almost all countries needs a serious upgrade regarding awareness, content, professional development, and provisions.
 A Common European Numeracy Framework can be instrumental to this.
- Systematically acknowledge multidimensionality when dealing with numeracy (research, teaching, professional development,)
- Redefine basic skills in (more) relevant cognitive processes and their manifestations.



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- Programme manager of Erasmus+ project: Common European Numeracy Framework
- Member of the OECD Numeracy Expert Group PIAAC 2nd cyle
- Trustee of Adults Learning Mathematics A research Forum
- Fellow of the International Society for Design and Development in Education
- Chair of the Thematic Working Group Adult Mathematics Education at CERME 12 (Bolzano, Italy, 2-6 February 2022) Just published:
- ALM: key-note https://www.gecijferdheid.nl/adult-numeracy-practices-imperative-implications-for-education/
- Springer: National Reflections on the Netherlands Didactics of Mathematics: https://link.springer.com/book/10.1007/978-3-030-33824-4
- ZDM: "Computer-based assessment of mathematics into the twenty-first century: pressures and tensions" <u>https://rdcu.be/Oz4e</u>



Mathematisation of Society - minidoc as part of Inaugural Lecture Kees Hoogland (2nd June 2021)

Numeracy + 10 weergaven + 1 week geleden

Mathematisation of Society - minidoc as part of Inaugural Lecture Kees Hoogland (2nd June, 2021) Producer: Marleen Stoker at Mokermedia marleenstoker.com