What are relevant basic numeracy skills in 2030?
And how can we teach them?

EBSN annual conference 2022
VHS, Vienna, Austria

Numeracy is a human activity
Numeracy is functional and highly practical

Kees Hoogland (HU); 9th June, 2021

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

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Biodermal
Hot Sun Cream
Beschermt uw huid tegen de felle zon
SPF 10
Biodermal
Hot Sun Cream
Beschermt uw gezicht tegen de felle zon
SPF 12
Biodermal
Hot Sun Milk
Beschermt uw lichaam tegen de felle zon
SPF 10
Biodermal
Sun Cream
Beschermt en verzorgt uw gezicht
SPF 8
Biodermal
Sun Milk
Beschermt en verzorgt uw huid
SPF 6

Besmettingen

Positieve testen

Aantal positief geteste mensen

6.575 Waarde van 14 januari 2021

Besmettelijke mensen

Aantal besmettelijke mensen

140.833 Waarde van 31 december 2020

Reproductiegetal

Meest recente reproductiegetal

0,95 Waarde van 25 december 2020

Sterfte

Gemeld aantal personen overleden aan COVID-19 per dag

89 Waarde van 14 januari 2021

Verdeling positief geteste mensen in Nederland

Deze kaarten laten zien van hoeveel mensen gisteren is gemeld dat ze positief getest zijn op COVID-19, per 100.000 inwoners.

Per gemeente | Per veiligheidsregio

Aantal per 100.000 inwoners

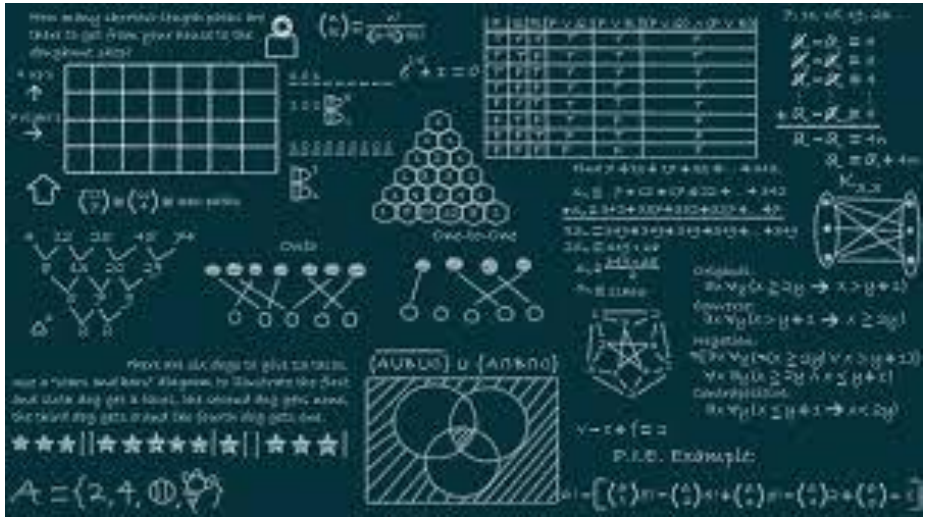
0 4 7 10 20 30

Waarde van donderdag 14 januari · Bron: RIVM

The Mathematisation of Society

Situations

	Renogy Wanderer 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 lithium	Sealed, gel, flooded, and lithium	Sealed, gel, flooded, and lithium
Charge Stage	4	4	4
LCD Display	-	✓	✓
Grounding Type	Negative	Negative	Negative
Nominal system voltage	12 VDC	12V/24V DC	12V/24V DC
System Capacity	400W	200W (12 Volt) / 400W (24 Volt)	400W (12 Volt) / 800W (24 Volt)
Bluetooth Module Compatible	✓	✓	✓
Dimensions	6.5 x 4.3 x 1.8 In.	5.9 x 8.3 x 2.3 In.	6.8 x 9.4 x 2.8 In.



Microsoft Excel - Book1

File Edit View Insert Format Tools Data Window
Help Adobe PDF

A1 | Expense

	A	B	C	D
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
5	**Totals**	$871.45	$882.63	$868.38
6				

Sheet1 Sheet2 Sheet3

Wallpaper Calculator

Wall width (m)

Wall width

Wall height (m)

Wall height

Wallpaper width (cm)

Wallpaper width

Roll length (m)

Roll length

Pattern Repeat (cm)

Pattern offset

Calculate

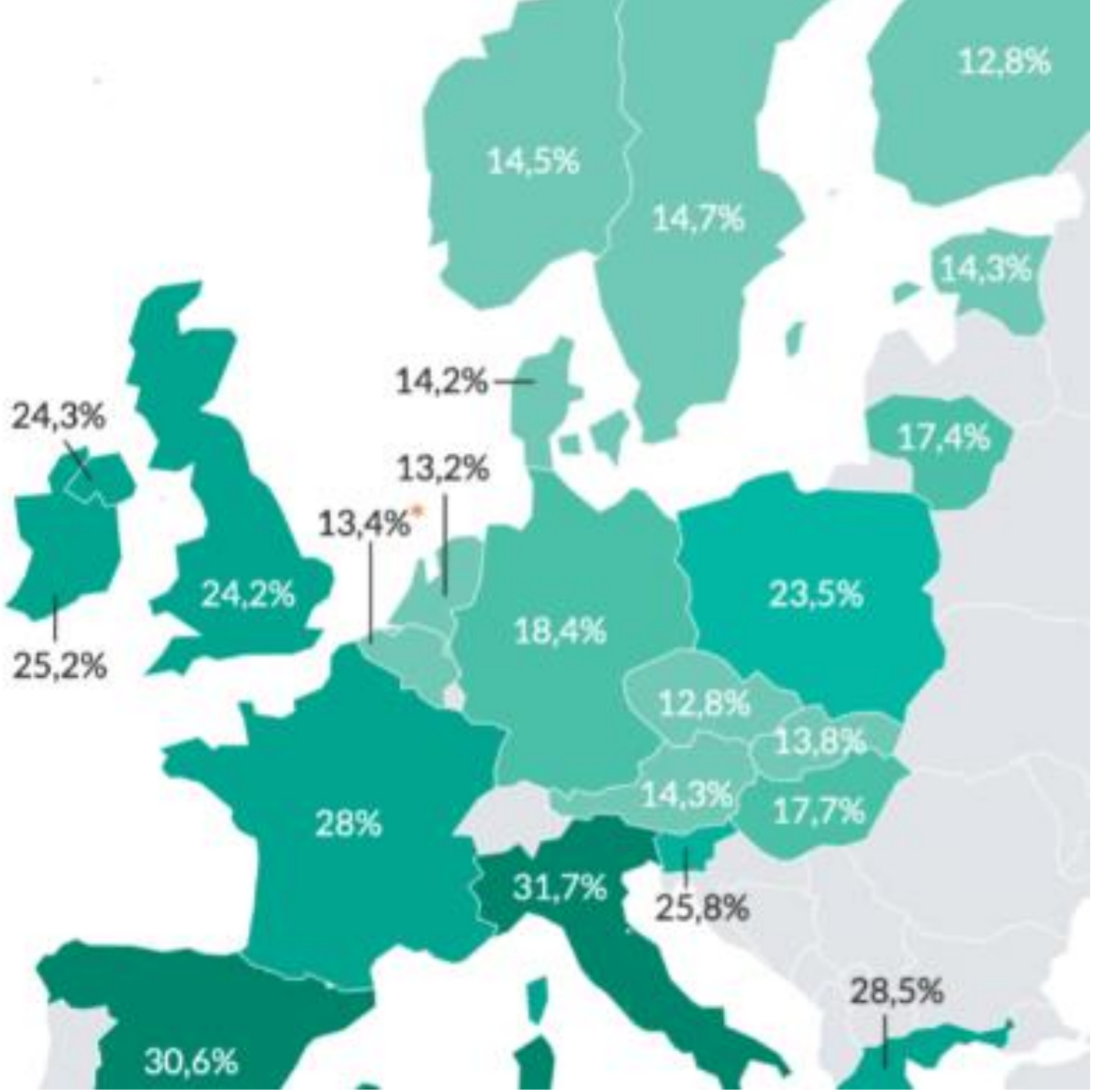
The Mathematisation of Society

Individuals acting in numeracy/mathematical situations

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

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



Source: Survey of Adult Skills (PIAAC) (2012, 2015, 2018) as indicated in Table A2.3 in Skills Matter Additional results from the survey of Adult skills (Annex A) – OECD 2019.

Percentage of adults scoring at proficiency level 1 and below in numeracy

10-15	15-20	20-25	25-30	30-

OECD average 23,5%

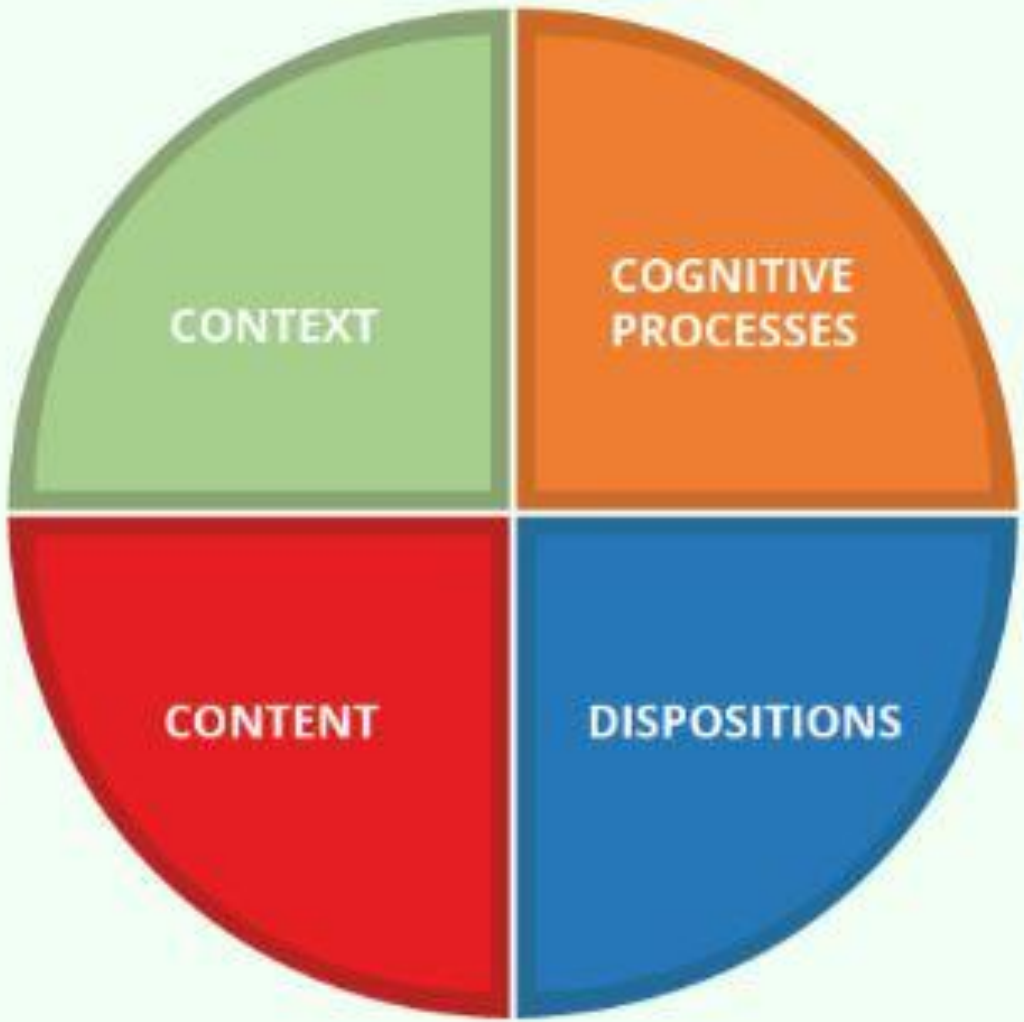
What matters to improve numerate behavior

Context

Everyday life
Work-related
Citizenship
Further learning
Finances
Health and care
Recreation

Knowledge and skills

Quantity and number
Dimension and shape
Pattern, relationships and change
Data and chance
Using a calculator
Using spreadsheets
Using digital skills



Higher order skills

Managing situations
Analysing situations
Processing information
Reasoning
Mathematising
Problem solving
Critical thinking

Dispositions

Self-confidence
Affection
Beliefs
Collaborations
Flexibility
Math anxiety
Math difficulties

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)

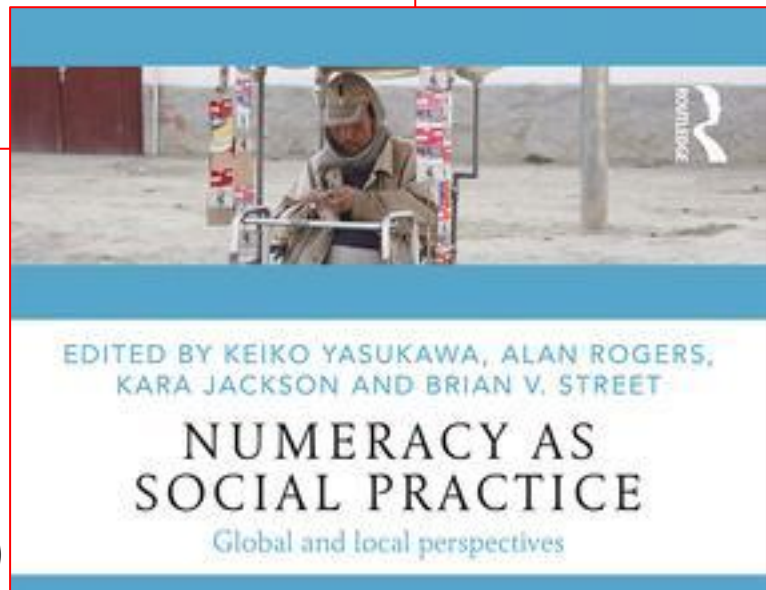
Conceptually inspired by:

- 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)

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



(See Yasukawa et al., 2018)

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

Educational activities

- Numeracy conversation
- Counteract math anxiety (Talk about it!)
- Exploring the quantitative worldarfound you
- e.g., Using pictures of real life situations
- Working on awareness of personal successful numerical behaviour (What are people able of?)
- Discuss themes (finance, health, climate, ….)
- Discuss numbers in media, news, advertisements

X1 / X2

Y1 / Y2

Placemat-voorkant

Gecijferdheid telt mee

	Open:	Sluit:
Din	9:00	18:00
Woe	9:00	18:00
Don	9:00	18:00
Vrij	9:00	18:00
Zat	9:00	18:00
Zon	9:00	18:00

2 voor de prijs van 1

gecijferdheidteltmee.nl

HOGESCHOOL UTRECHT

Pro biblio

Gecijferdheid telt mee

gecijferdheidteltmee.nl

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Pro biblio

Educational activities

- Thematic courses/meetings
  - Better trading on E-Bay
  - Educational games
  - Budgeting, planning, saving
  - Cooking
  - Et cetera
- Discussing weekly experiences: critical dialogue
- Integrate into language lessons and into language support...
- Integrate into digital skills courses

Absolutely fine those broad holistic ideas and connecting with reality, this is very appropriate for our learners who will use it in a functional and practical way but first, of course, we need to

"explain"
“re-teach"
"repair"
"practice“
“remedy”

these basic calculational skills

"which they don't have"
"which they have not learned"
"which they didn’t maintain enouigh"
"which they don't learn/teach anymore in primary school"

Persistent “calculational” paradigm

Catastrophic teaching of basic skills

1. **Learn - practice - never use**

Demotivation, alienation, loss of meaning.

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.

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.

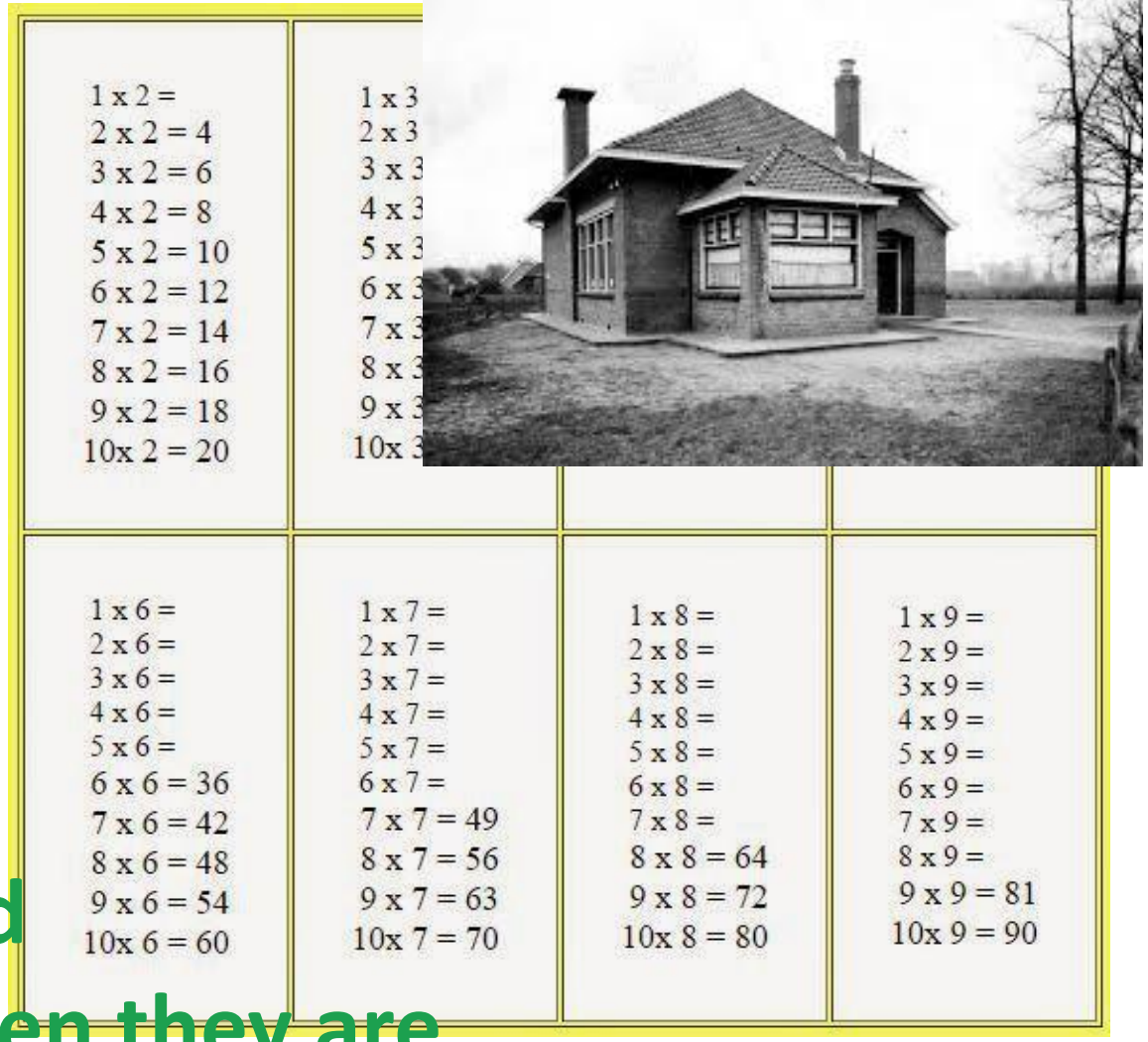
1900 - 1975

- Rise of mass education
- Industrialisation
- Capitalism: economic transactions
- Standardized procedures to calculate
- Calculations with pen-and-paper
- Decimal metric system

At school: teaching of fixed procedures - focused on mathematical structure and not on functional use

1900-1975

- 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

1900- 1975

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

YES

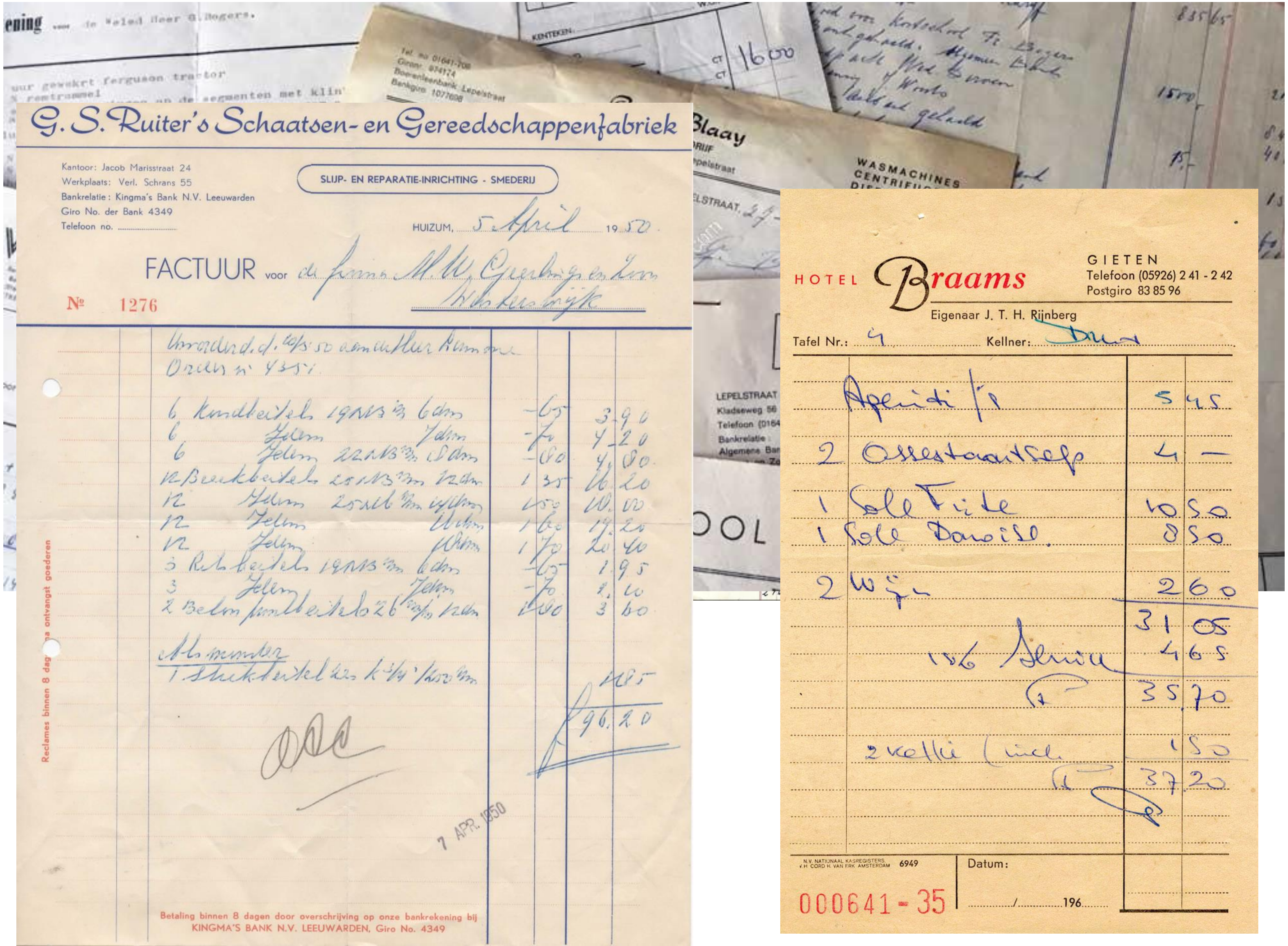
Board Games

Estimations

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 =
56	45.678	56	of
----- x	--------- +	----- -	12 / 35.750 \

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


G. S. Ruiter's Schaatsen- en Gereedschappenfabriek

Kantoor: Jacob Marisstraat 24
Werkplaats: Verl. Schrans 55
Bankrelatie: Kingma's Bank N.V. Leeuwarden
Giro No. der Bank 4349
Telefoon no.

SLIJP- EN REPARATIE-INRICHTING - SMEDERIJ

HUIZUM, 5 April 1950

FACTUUR voor

№ 1276

Reclames binnen 8 dagen na ontvangst goederen

7 APR. 1950

Betaling binnen 8 dagen door overschrijving op onze bankrekening bij
KINGMA'S BANK N.V. LEEUWARDEN, Giro No. 4349

HOTEL Braams

GIETEN
Telefoon (05926) 2 41 - 2 42
Postgiro 83 85 96

Eigenaar J. T. H. Rijnberg

Tafel Nr.: 4
Kellner:

Aperitif	5 45
2 Ossestaartsoep	4 —
1 Sole Frite	10 50
1 Sole Dansie	8 50
2 Wijn	2 60
	31 05
15% Service	4 65
	35 70
2 koffie	1 50
	37 20

N.V. NATIONAAL KASREGISTERS v.h. CORD H. VAN ERK AMSTERDAM 6949

Datum: ..../..........196....

000641 - 35

1975 - 2050

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

Besmettingen

Positieve testen
Aantal positief g

6.575 ↑ Waa

Besmettelijke mensen
Aantal besmettelijke mensen

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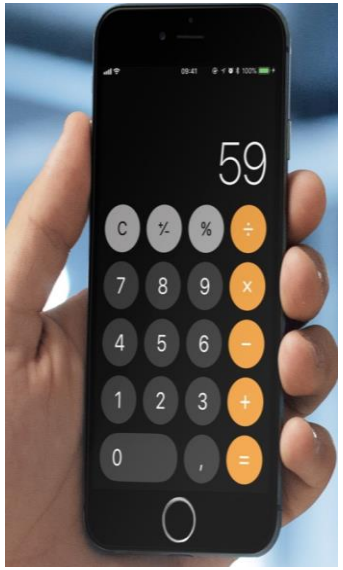
Sterfte
Gemeld aantal personen overleden aan COVID-19 per dag

89 Waarde van 14 januari 2021

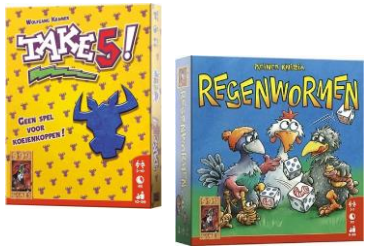
Basic skills in 2050



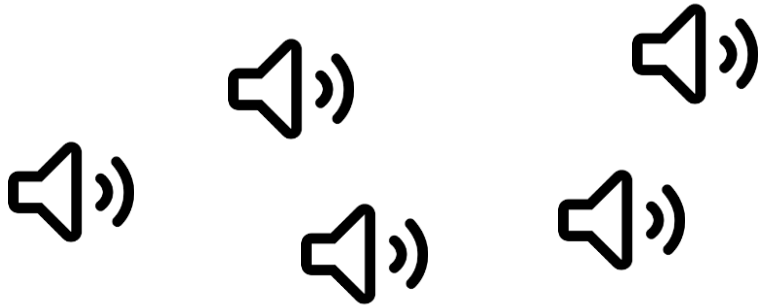
1975 – 2050 Basic facts

Unnoticed:

Games en digital games



Auditory:



Visual:

Estimate ≈

7 x 11,9 ≈

12 x 500.000 ≈

6 x 125 ≈

1000 : 71 ≈

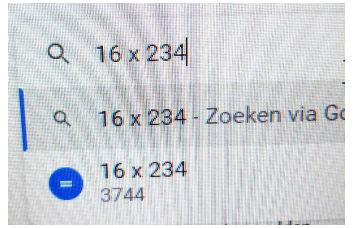
500 x 7 MB ≈

1975 - 2050

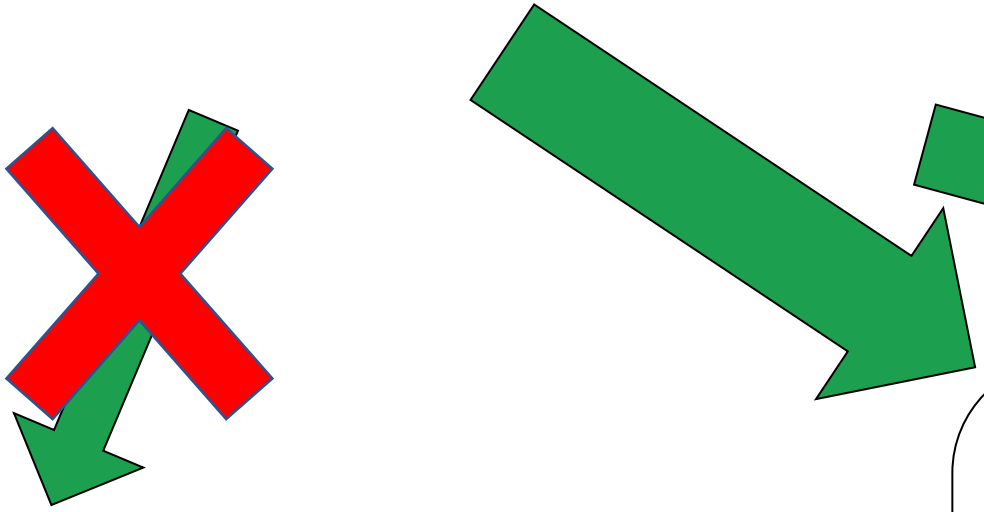
Are the basic facts like

6 x 8 and 13 - 9 still widely used?

1975 - 2050



Are these basic facts (6 x 8 and 13 -9) widely used?



(digital) games

Proportional reasoning

Large calculations are done with "tools"

```
234          512.693      123
 16           45.678       56
----- x     ---------- +  ----- -
```

35.750 : 12 =
of
12 / 35.750 \

Estimating, global arithmetic, order of magnitude, ...

≈

6 boxes of € 11,95 ≈
room of 6.3 by 4.8 ≈
1.200 x 50.000 ≈

Extra basic facts

7 x 50

6 x 25

200 : 5

1000 x 1000

Functional use

Use in recognizing and using proportions, and in calculations with percentages

persons	1		4	…	120
quantity in grams	..		600	1000	…

If you know a set of two, then you know the all!

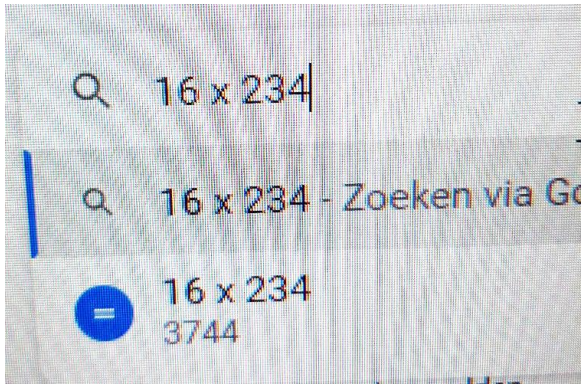
Number…	…	75	…	250	…
%	1	…	50	100	121

Number…	…	…	79,95	…	129,95
%	1	21		100	121

1975 – 2050 Tools

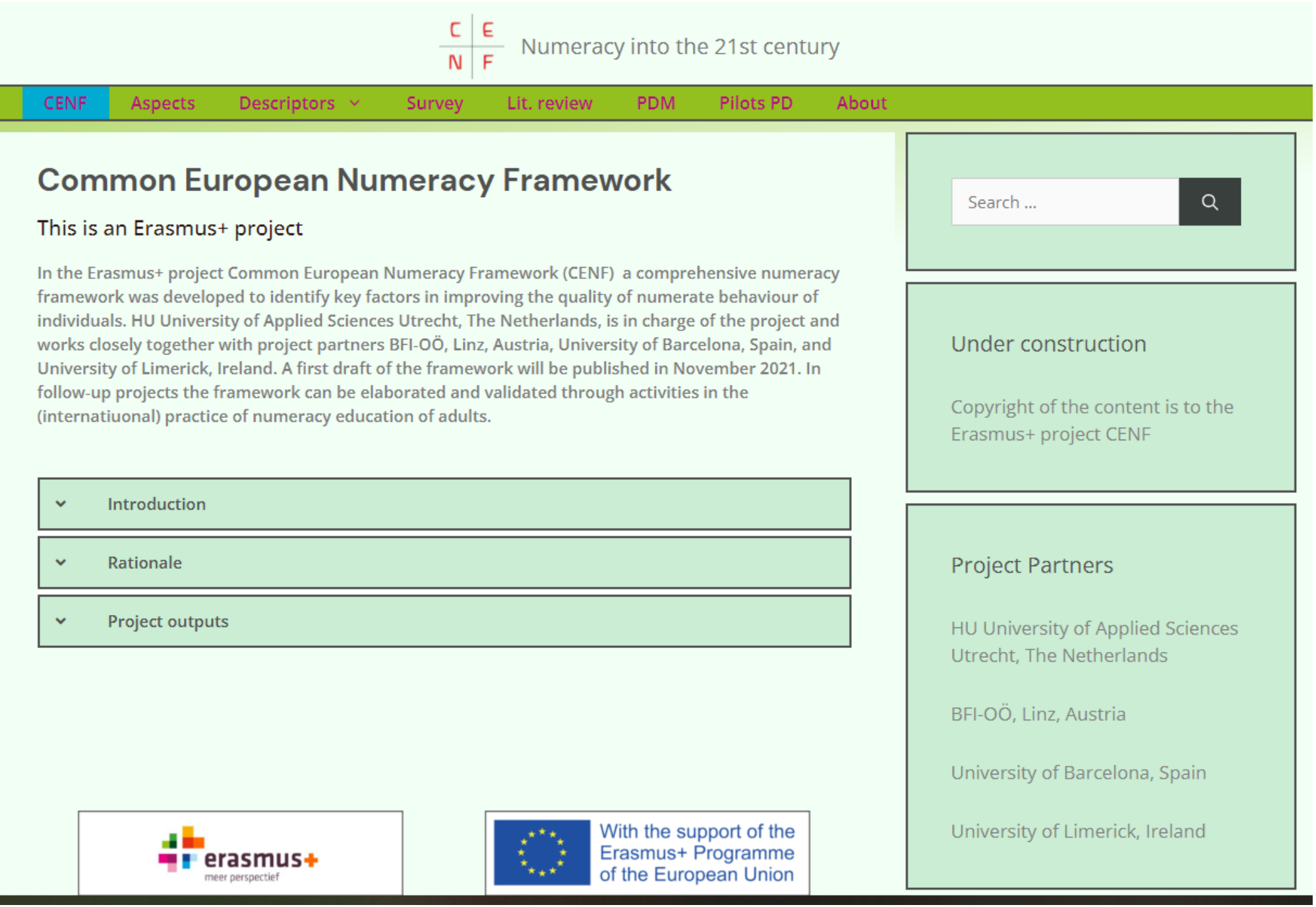
- Use of tools is permitted !!
  - Dealing well and wisely and critically with a calculator / calculation app is a skill.
    So, you have to practice it a lot and consciously!!
  - And then use it a lot and use it critically.
  - Where are the learning materials who support the learning of how to use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

.



Summary

- 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).



Under construction

Delivery date:
Summer 2022

- Link to the website

Common European Numeracy Framework

C E
N F

- Erasmus+ project 1 CENF
  - 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 (**granted!**)
  - 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

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For information, collaboration, and comments, please contact Kees Hoogland

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UNIVERSITY OF APPLIED SCIENCES UTRECHT

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https://www.gecijferdheid.nl/kees-hoogland-appointed-professor-of-mathematical-and-analytical-competences-of-professionals/?lang=en

- 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" https://rdcu.be/Oz4e

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

Numeracy • 10 weergaven • 1 week geleden

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Producer: Marleen Stoker at Mokermedia marleenstoker.com