Reflecting on an numeracy framework under construction

C E
N F

Numeracy is a human activity
Numeracy is functional and highly practical

ALM28 conference - workshop
Erasmus+ International Multiplier Event

Kees Hoogland (HU)

6th July, 2021

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Reflecting on an numeracy framework under construction

- 20 minutes: background info
- 10 minutes: Q&A
- 5 x 10 minutes: “cracking some nuts”
- 10 minutes: wrap up and call for action

And as everyone knows: 20 + 10 + 5 x 10 + 10 = 1:30

Partners

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Common European Numeracy Framework

- 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 (if granted!)
  - running from January 2022 – December 2024
  - 11 countries + networks e.g., ALM, EBSN, …
  - Upscaling provisions and professional development
  - Working on awareness and critical mass

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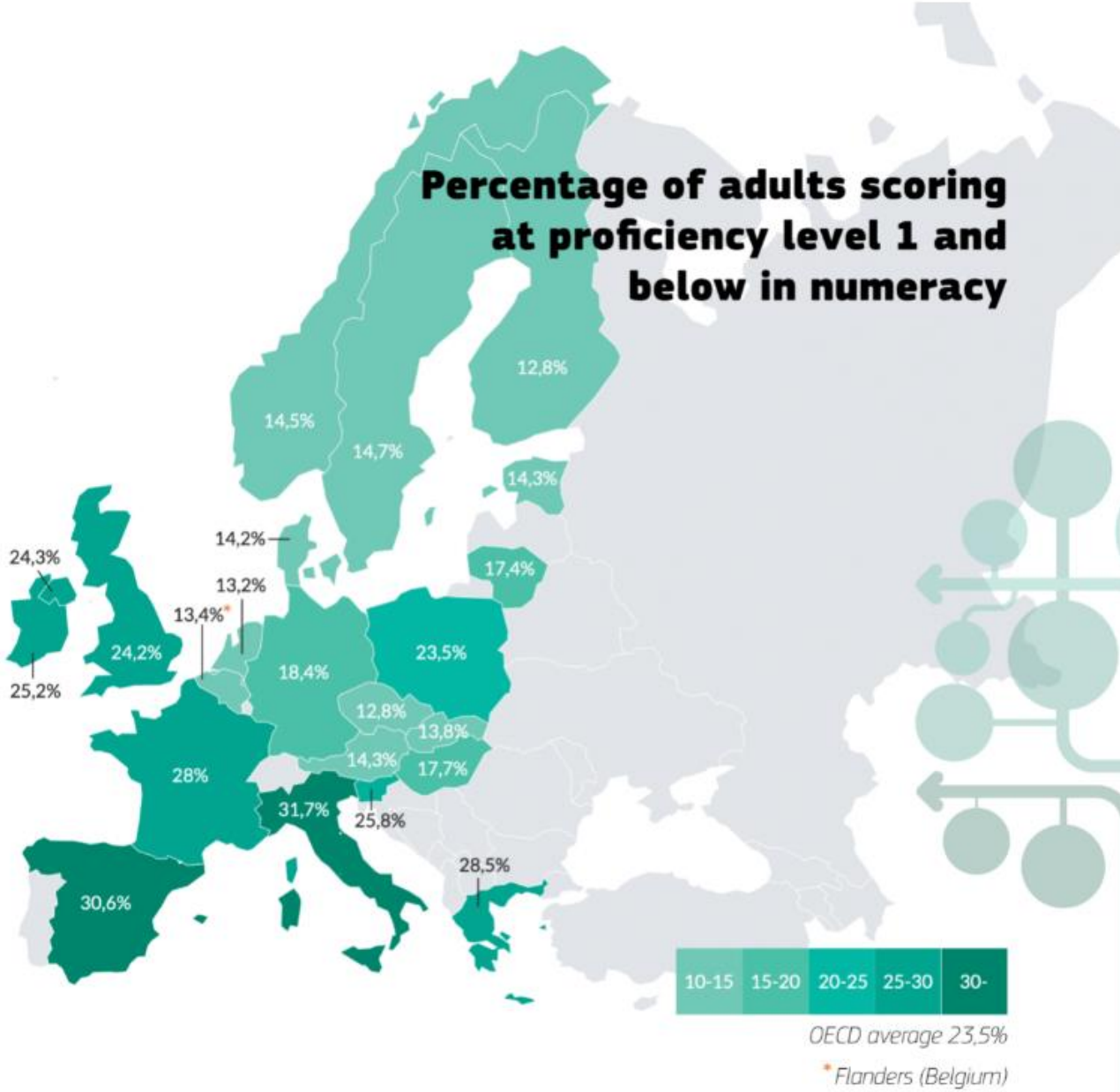
Serious challenges

Too many European citizens lack the necessary numeracy competencies to participate autonomously and effectively in our technologized and number-drenched society…..

- …. and consequently many citizens are overlooked for certain jobs and have problems in their daily life, dealing with the abundance of number-related issues (OECD, UNESCO, EU)
- Awareness of the importance of numeracy for personal empowerment and becoming a critical citizen.



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.

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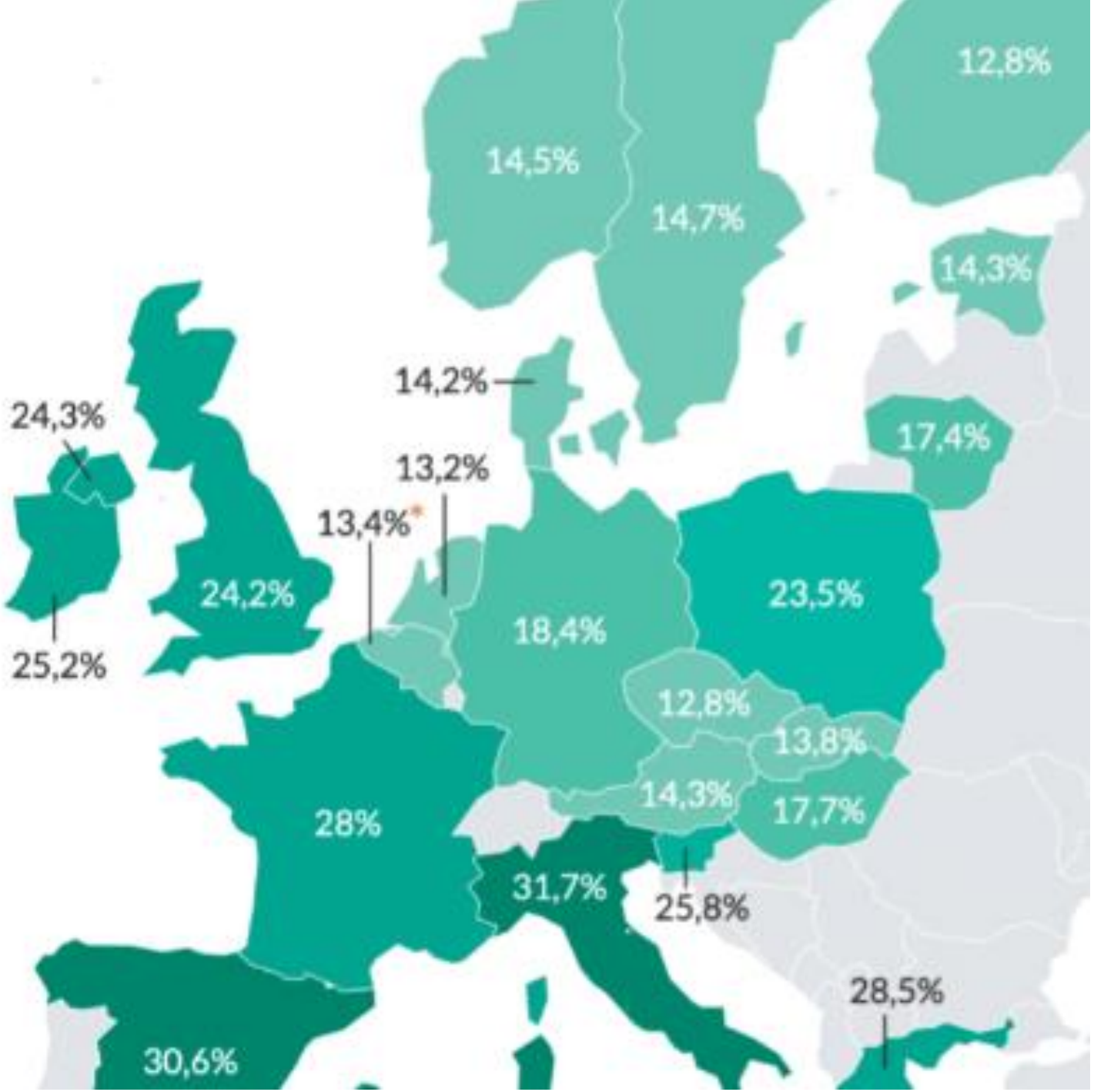


Source: Survey of Adult Skills (PIAAC) (2012, 2015, 2018) as indicated in Table A2.3 in Skills Matter Additional results from the survey of Adult skills (Annex A) – OECD 2019.

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

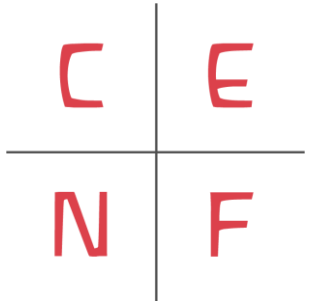
10-15	15-20	20-25	25-30	30-

OECD average 23,5%

Developing the CENF in Erasmus+

- Policy input
  - The **2019 European Numeracy Survey** across Europe (UL, Ireland) IO2/4
  - Personal en professional networks around adult numeracy education
- Theoretical input
  - **Systematic Literature Review** on Numeracy (UB, Spain) IO1
  - Existing supranational frameworks
    - PIAAC (1st and 2nd cycle), PISA, IALS, ALL
    - Principles and Standards (NCTM, USA)
    - ACARA, Australia
- Empirical Input
  - **Professional development modules and trials** (BFI, Austria) IO5/6

IO3



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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)

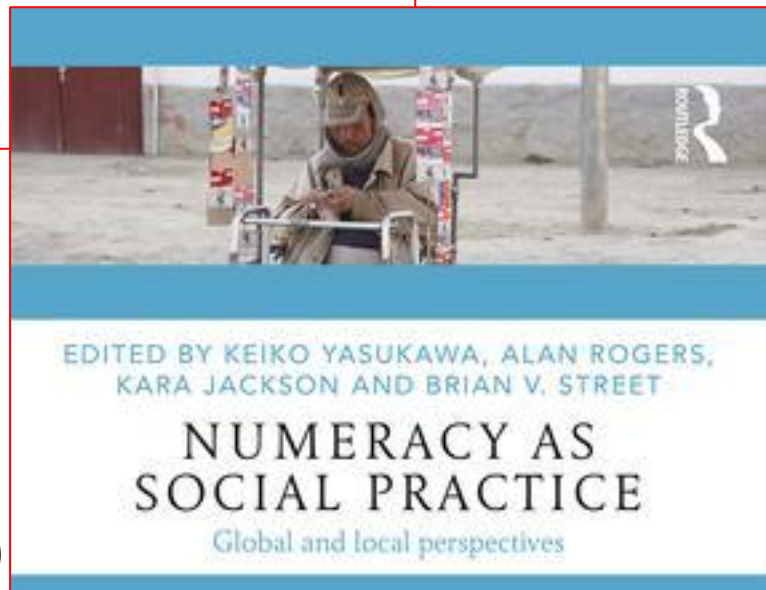
Conceptually inspired by:

- 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)

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



(See Yasukawa et al., 2018)

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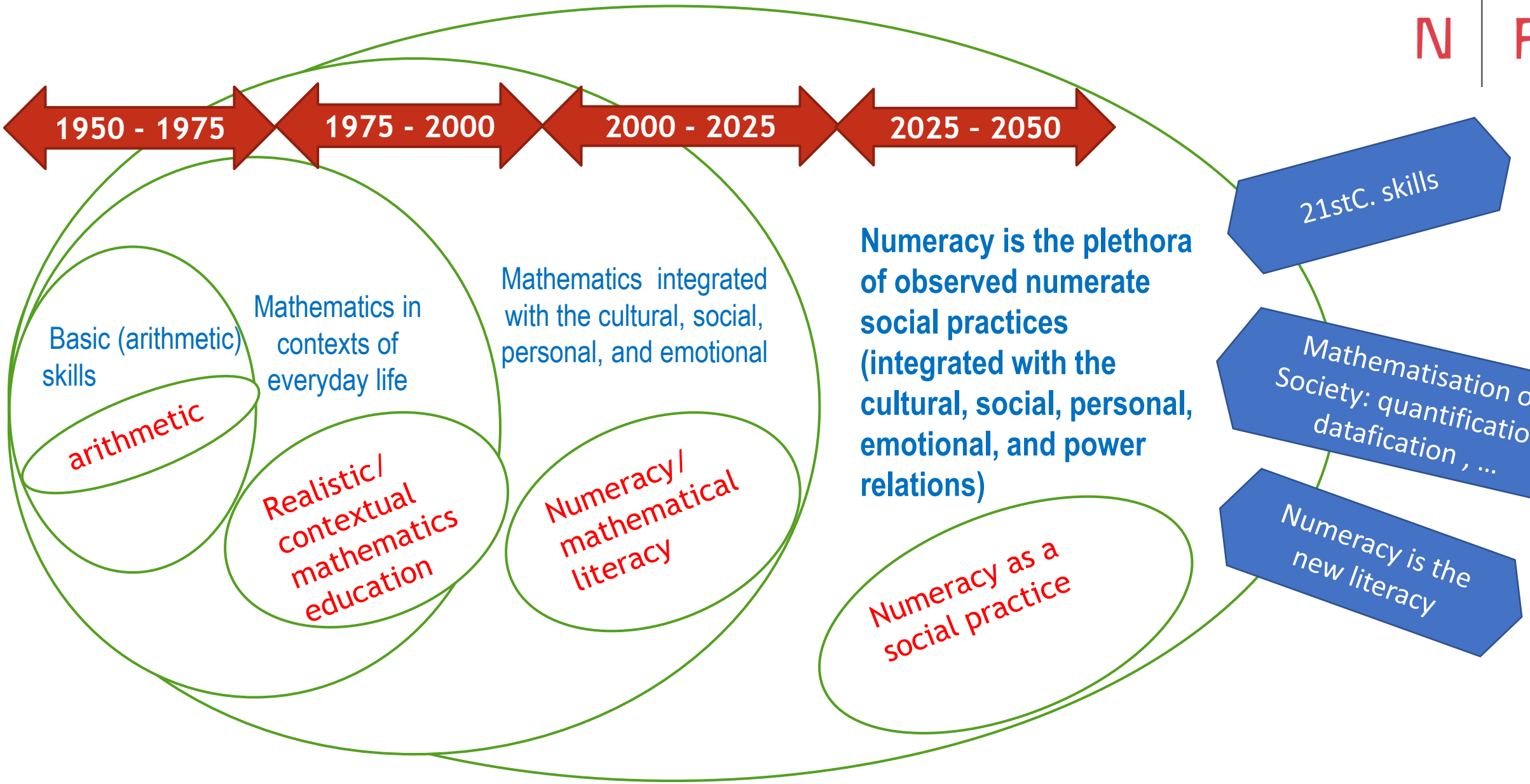
Numeracy conceptual development



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

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Google
1 3/4 x 7 1/5 =
Alle
Shopping
Afbeeldingen
Nieuws
Video's
Meer
Instellingen
Tools
Ongeveer 1.460.000.000 resultaten (0,87 seconden)
(1 3/4) x (7 1/5) =
12.6

Implications for a framework

- **Many aspects , multifaceted, multidimensional**
  - Implies using cognitive and psychological **aspects**
  - Implies individuals have specific multidimensional profiles
  - implies describing behaviour in a “valued system”
- **Levels**
  - to define progress as a result of educational interventions
  - to categorise job requirements
  - to categorise assessment items
  - to connect to (psychological) scales
  - ….

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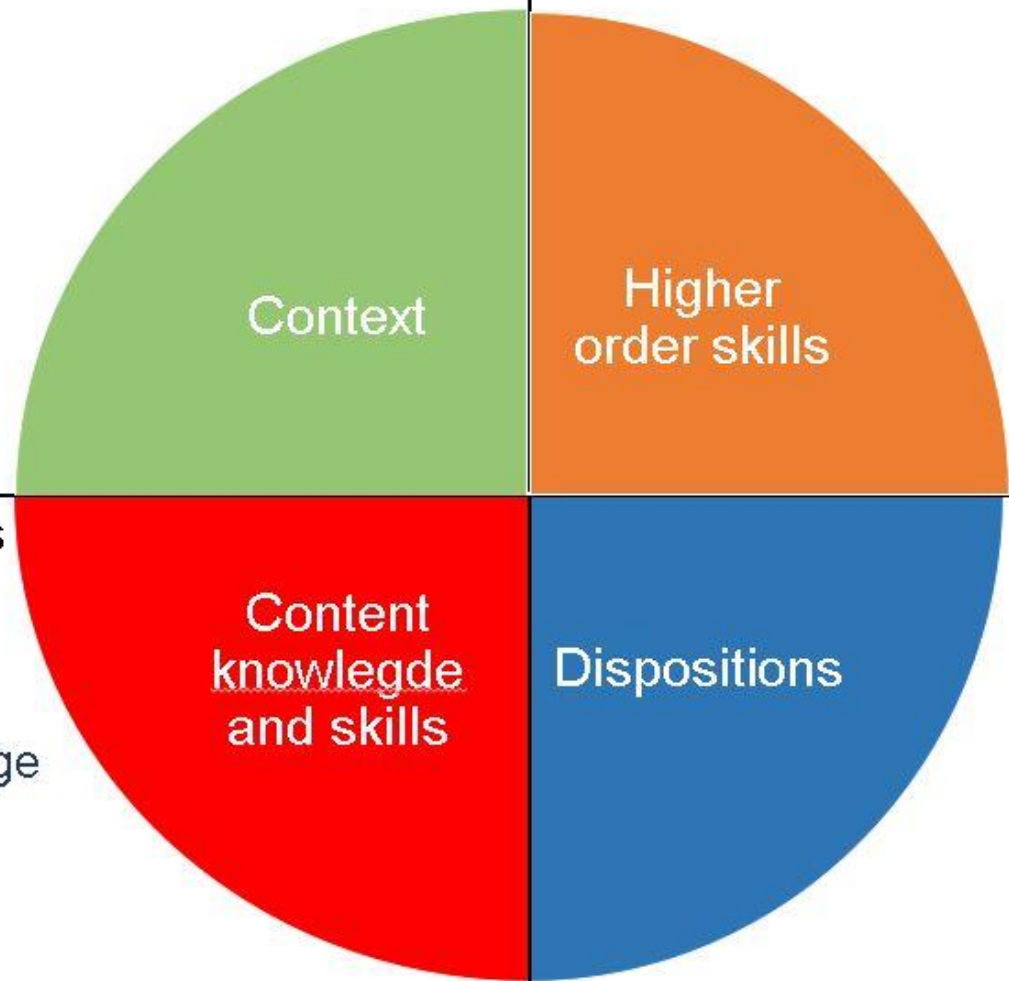
What matters to improve numerate behaviour

Context

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

Higher order skills

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



Content knowledge and skills

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

Dispositions

Self confidence
Motivation
Positive (self-)beliefs
Collaboration
Flexibility
Low math anxiety
Learnability

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Quali aspetti favoriscono la pratica del contare

Contesto

Vita di ogni giorno
Ambiente lavorativo
Cittadinanza
Formazione ulteriore
Economia/Finanza
Salute e Cura
Svago/Tempo libero

Abilità di livello superiore

Gestire le situazioni
Analizzare le situazioni
Elaborazione delle informazioni
Ragionamento
Trattare matematicamente
Problem solving
Pensiero critico

Conoscenza di contenuti e abilità

Quantità e numero
Dimensione e forma
Modelli, relazioni e cambiamento
Dati e probabilità
Uso della calcolatrice
Utilizzo di app e fogli di calcolo
Competenze digitali

Disposizioni

Fiducia in se stessi
Motivazione
Idee positive di sè
Spirito di collaborazione
Flessibilità
Bassa ansia rispetto alla matematica
Desiderio di apprendimento

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¿Qué es lo que importa para mejorar el comportamiento numérico?

Contexto

Vida cotidiana
Relacionado con el trabajo
Ciudadanía
Aprendizaje a lo largo de la vida
Finanzas
Salud y cuidados
Ocio

Habilidades de orden superior

Gestionar situaciones
Analizar situaciones
Procesar información
Razoanar
Matematización
Resolución de problemas
Pensamiento crítico

Conocimiento y habilidades del contenido

Cantidades y numeración
Dimensión y forma
Patrones, relaciones y cambio
Datos y probabilidad
Usar una calculadora
Usar aplicaciones y hojas de cálculo
Habilidades digitales

Disposiciones

Autoconfianza
Motivación
Creencias positivas (propias)
Colaboración
Flexibilidad
Ansiedad matemática baja
Capacidad de aprendizaje

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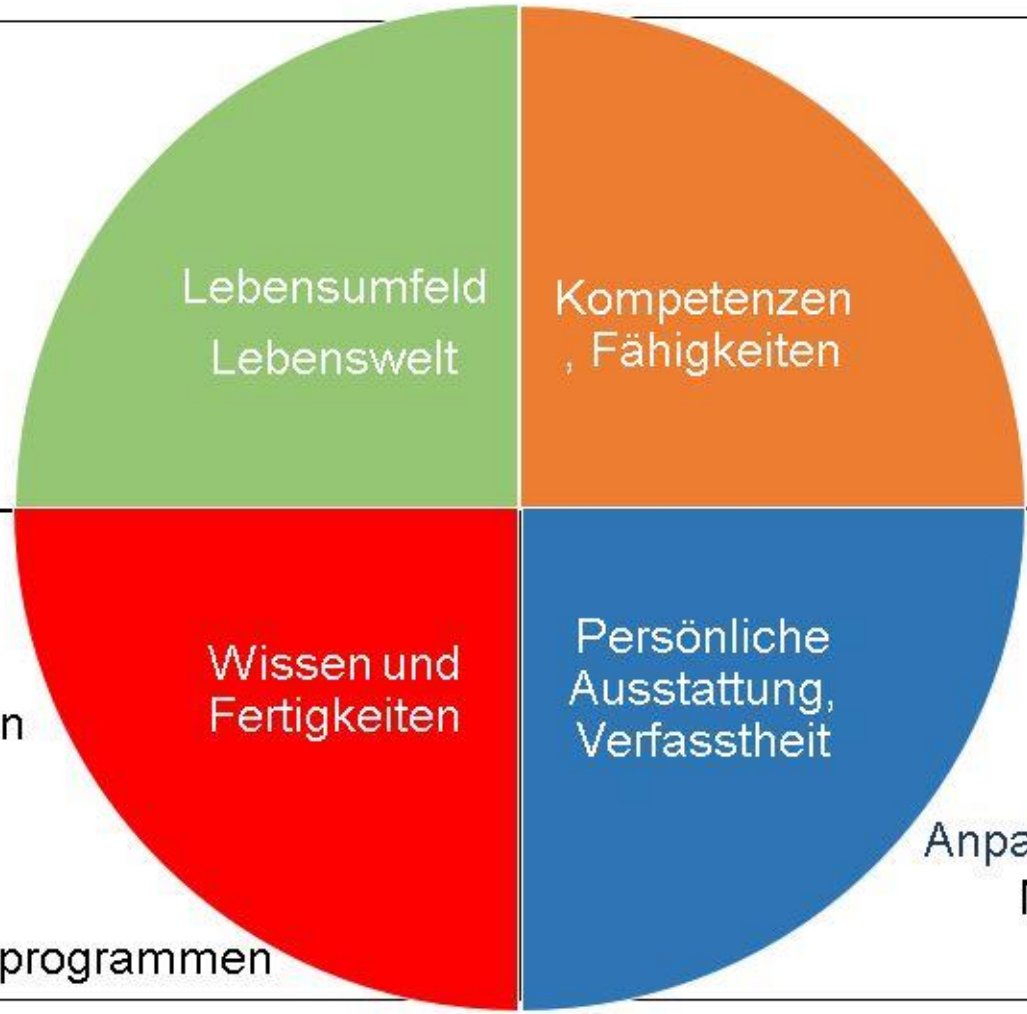
Worauf es ankommt, den Umgang mit zahlenbezogenen Sachverhalten zu verbessern

Umfeld
Alltagsleben
Arbeitswelt
(Staats-)Bürger*innenschaft
Lebensbegleitendes Lernen
(Haushalts-)Budget
Vorsorge und Gesundheit
Erholung

Fähigkeiten, Kompetenzen
Situationen bewältigen
Situationen analysieren
Informationen verarbeiten
Argumentieren
Mathematisieren
Probleme lösen
Kritisches Denken



Wissen und Fertigkeiten
Anzahl und Menge
Größe und Form
Muster, Beziehungen, Veränderungen
Daten und Wahrscheinlichkeiten
Digitale Kompetenzen
Verwenden eines Taschenrechners
Verwenden von Tabellenkalkulationsprogrammen

Persönliche Verfasstheit
Selbstvertrauen
Motivation
(Positiver) Selbstwert
Zusammenarbeit
Anpassungsfähigkeit, Vielseitigkeit
Mathematikangst/Zahlenangst
Lernvermögen/Lernpotenzial

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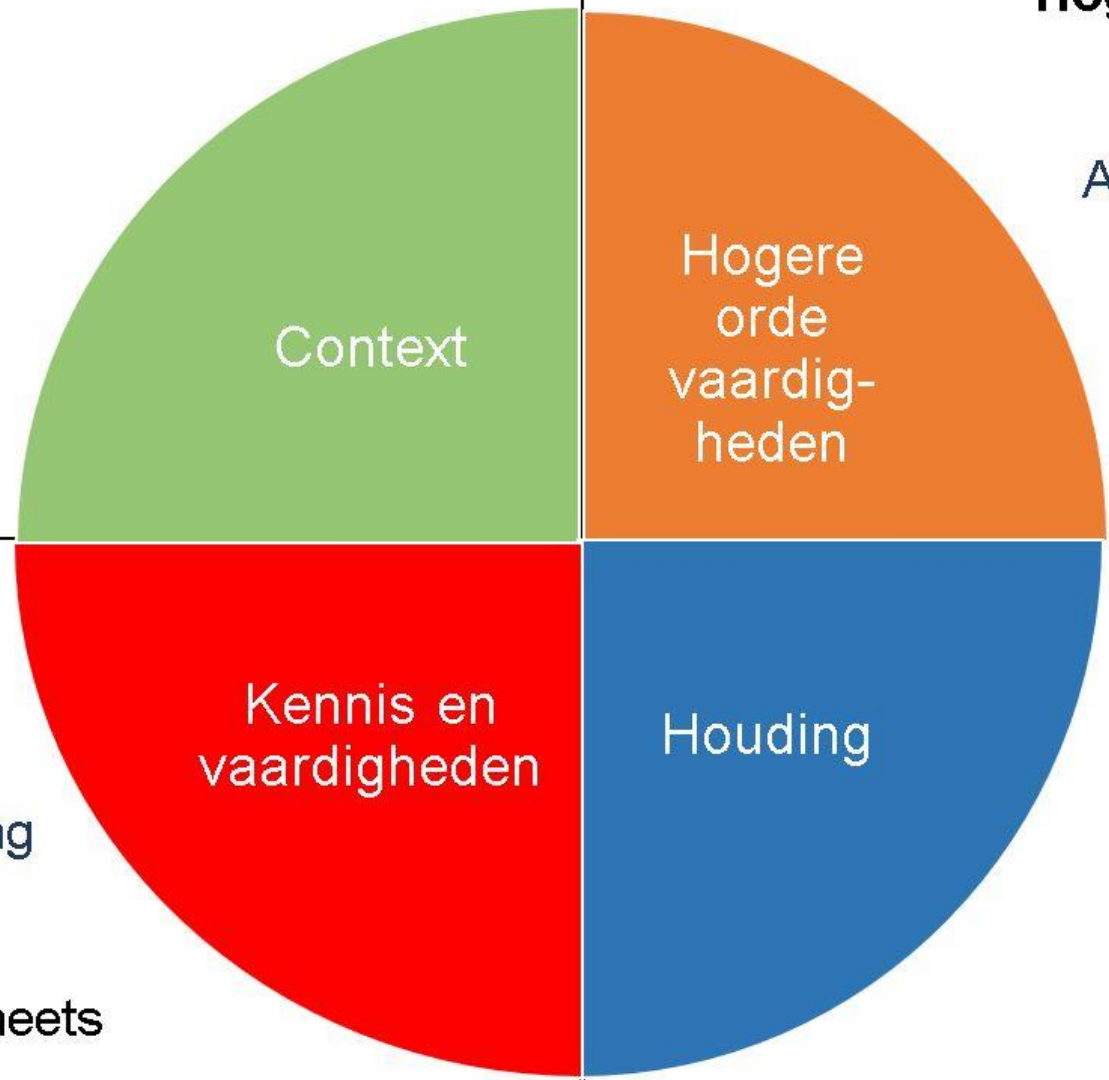
Factoren die gecijferd gedrag verbeteren

Context

Dagelijks leven
Werksituatie
Burgerschap
Verder leren
Financiën
Gezondheid en welzijn
Recreatie / Spel

Hogere orde vaardigheden

Hanteren van de situatie
Analyseren van de situatie
Informatie interpreteren
Redeneren
Mathematiseren
Probleemoplossen
Kritisch denken



Kennis en vaardigheden

Hoeveelheden en getallen
Afmeting en vorm
Patronen, relaties en verandering
Data en kans
Gebruik van rekenmachine
Gebruik van apps and spreadsheets
Digitale vaardigheden

Houding

Zelfvertrouwen
Motivatie
Positief zelfbeeld
Samenwerking
Flexibel
Weinig rekenangst
Leerbaar

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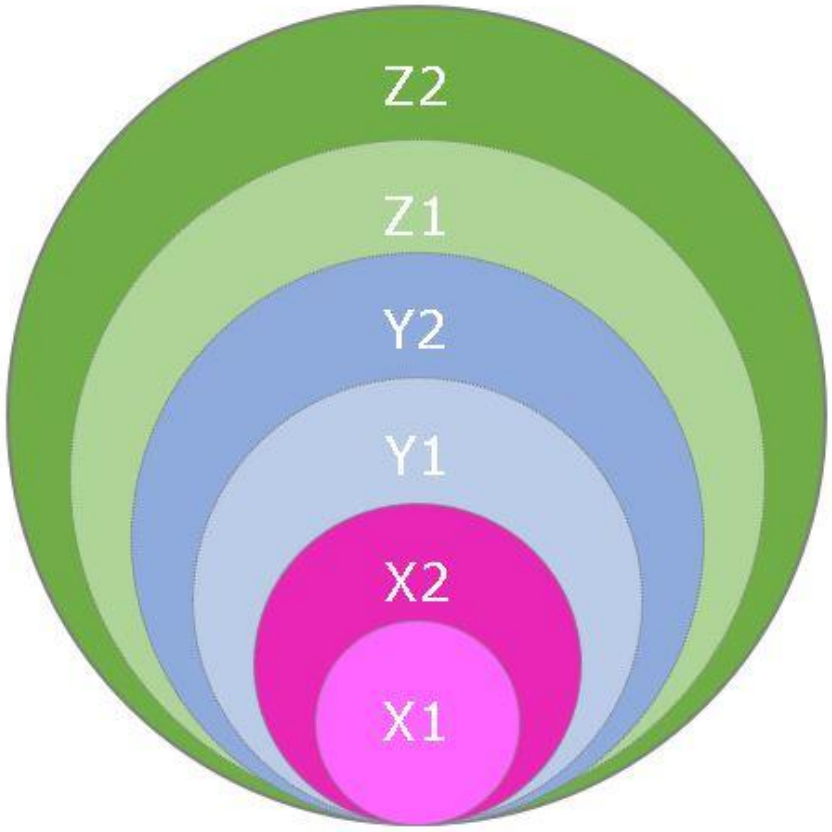
Overall levels (= categories ≠ thresholds)

Z
Specialized societal and work situations

Y
Societal and regular work situations

X
Daily-life situations



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Common European Numeracy Framework

It is:

- Aspects which matter for numerate behaviour
- Rubrics with descriptions of numerate behaviour
- Suggested measuring tools, when available
- Input for professionals development courses

It is not:

- A curriculum
- A programme
- A course

Aim:

CENF as a reference framework

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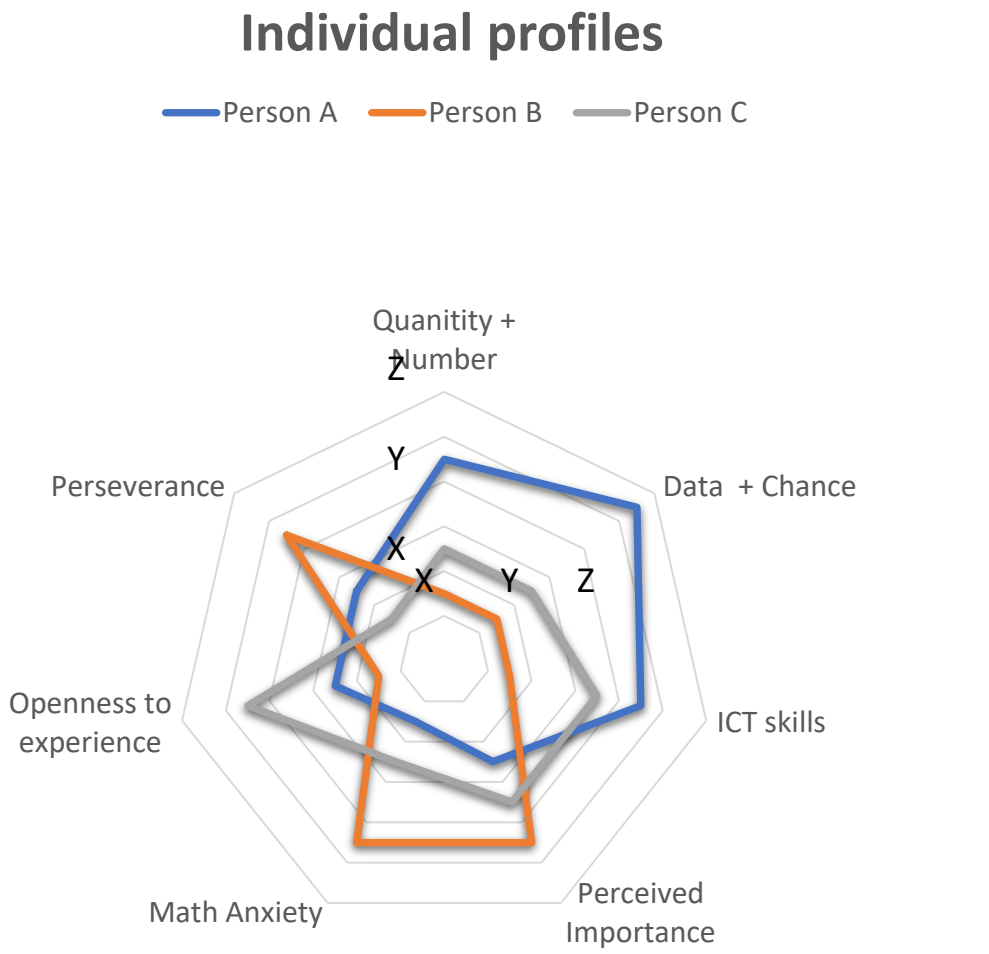
Individual multidimensional profiles



N.B. Fictional profiles

Content

- Quantity + Number
- Space + Shape
- Relationship + Change
- Data + Chance

Other Skills

- ICT skills

Attitude

- Enjoyment
- Perceived importance
- Intrinsic value
- Usefulness
- Confidence in learning
- Math Anxiety

Personality

- Openness to experience
- Conscientiousness
- Perseverance

For each aspect sources are mentioned for “measuring” tools: tests, observations, portfolio proofs, self-evaluations, ….

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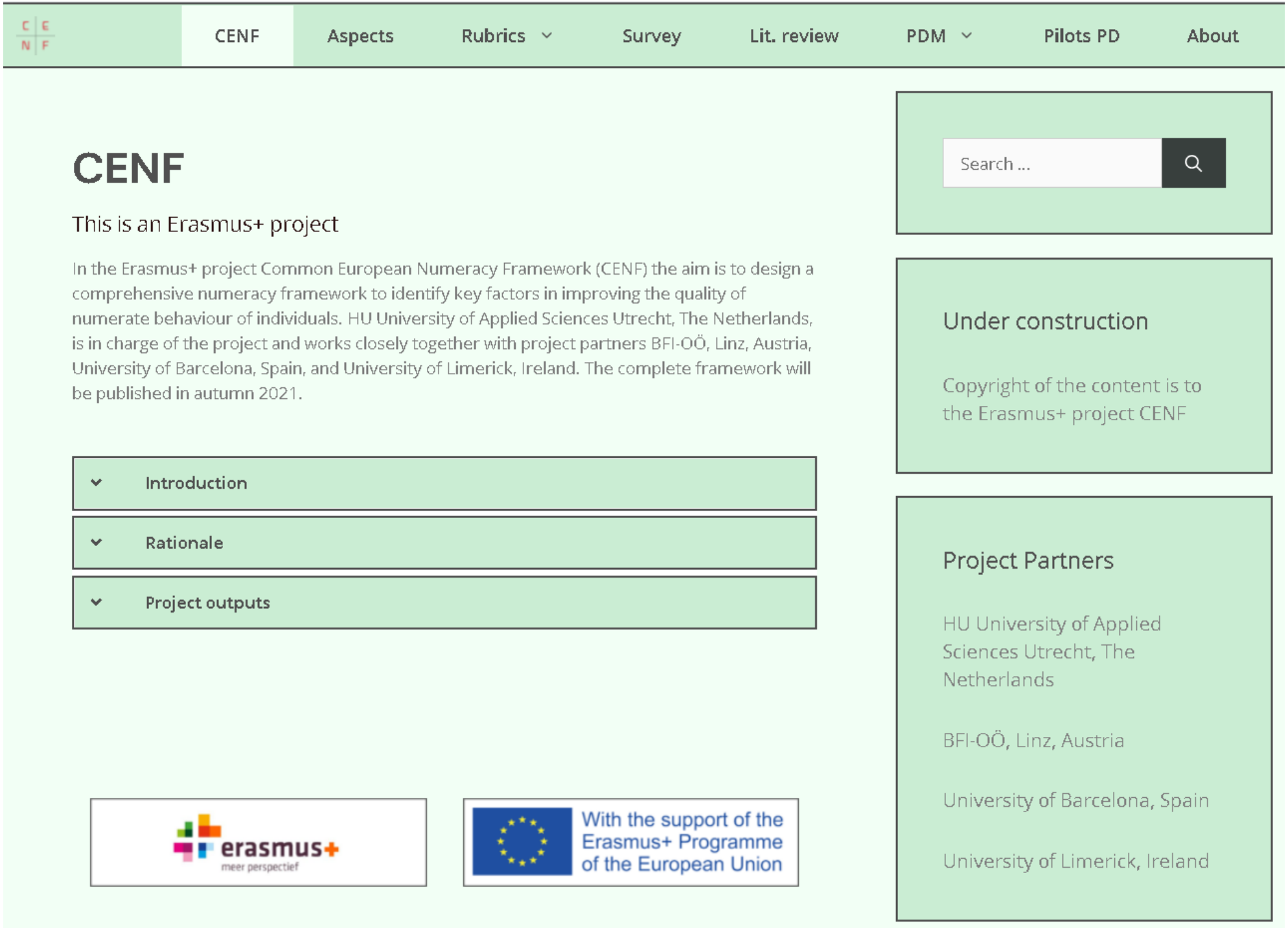
Professional development modules

- + Challenges of the 21st century
- + Aspects of Numeracy
- + Prior knowledge (Teachers and Participants)
- + Modeling problems in everyday life
- + Analysing situations
- + Managing situations
- + Reasoning
- + Problem Solving
- + Further Learning
- + Motivation and affection
- + Math anxiety
- + Vulnerable groups

Can be used as a MOOC (?)

Set up:

- Introduction
- Relation to CENF
- Key issues
- Suggestion for PDM meetings
- Self study
- Resources
- Literature / References



Sneak preview

Under construction

Delivery date:
October 2021

- Link to the website

Nuts to crack

1. Critical reflection on main descriptors
2. Which label to use for such table of descriptors
3. Which labels to use for the (sets of) levels: X, Y, Z
4. Priorities in themes in Professional Development Modules?
5. Priorities in strategic dissemination choices

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Critical reflection on main descriptors

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You can see the main descriptors in the padlet:
https://nl.padlet.com/kees_hoogland/4my7q6f5sji85nzp

Read them and please add (just click on the wall)

- Remarks
- Suggestions

- On distinction X, Y, Z etc. we wil talk in next “nuts”.

Positive label for addressing increasing levels in descriptors

- Rubric?
- Developmental pathway?
- Increasing complexity of numerate behaviour?
- Increasing sophistication of numerate behaviour?
- …
- …

CENF Aspects Rubrics Survey Lit. review

Aspect: Critical thinking

This aspect is in the main category: Higher order skills

Level	Descriptor
Z2	… does active fact checking on quantitative information
Z1	… sees quantitative information for what it is worth, and gives counterexamples or counter-reasoning
Y2	… sees quantitative information as possibly objective and true.…
Y1	… sees most quantitative information as objective and true.
X2	… sees quantitative information as truth.
X1	… interprets a limited amount of quantitative information encountered.

Explanation

Critical thinking is mentioned in most lists of 21st century skills. It is also frequently mentioned in mathematics curricula as one of the more societal goals of mathematics education .

References

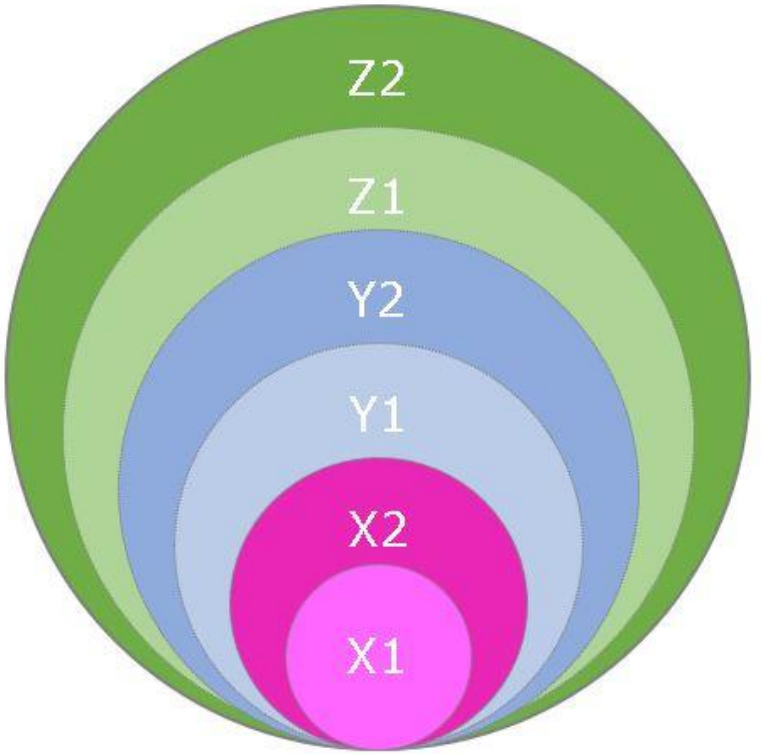
Jain, P. & Rogers, M. (2019). Numeracy as critical thinking. Adults Learning Mathematics: An International Journal, 14(1), 23-33. pdf
Sellars, Maura (2017) Numeracy across the curriculum – a pathway to critical thinking. pdf

Positive labels for each (set of) levels: X, Y, Z

- X personal, Y citizen, Z professional
- X personal space, Y societal space, Z work space
- …
- …
- …

Not

- Basic, moderate, advanced
- Basic, average, excellent
- Low-numerate, numerate, high-numerate



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Crucial themes in Professional Development Modules

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1. You have to choose two priorities from this list.
Write in the chat.

2. You can add two more themes:
Which are they? An with which priority?
Write in the chat.

+ Challenges of the 21st century
+ Aspects of Numeracy
+ Prior knowledge (Teachers and Participants)
+ Modeling problems in everyday life
+ Analysing situations
+ Managing situations
+ Reasoning
+ Problem Solving
+ Further Learning
+ Motivation and affection
+ Math anxiety
+ Vulnerable groups

Priorities in strategic dissemination choices around numeracy

A. Awareness
B. Provisions
C. Professional development

You are in charge of distributing the money. Which percentage to which category in 2020-2030? Write in the chat, for instance 40-20-40

Same question for 2030-2040.

Call for action, looking for partners

A. to work on awareness of the important role numeracy plays for the inclusion and wellbeing of European citizens by outreach activities using the CENF.

B. to enhance the quality and quantity of adult numeracy education (in formal and informal settings) by using and piloting the CENF and the accompanying professional development modules.

C. to further validate and enhance the Common European Numeracy Framework (CENF).

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End of workshop

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

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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

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