The Mathematisation of society: rethinking basic skills for adults

Twelfth Congress of the European Society for Research in Mathematics Education
February, 2-, 2022 | Online (Bozen-Bolzano, Italy)

Kees Hoogland (HU) & Javier Díez-Palomar (UB);
4 Feb. 2022

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

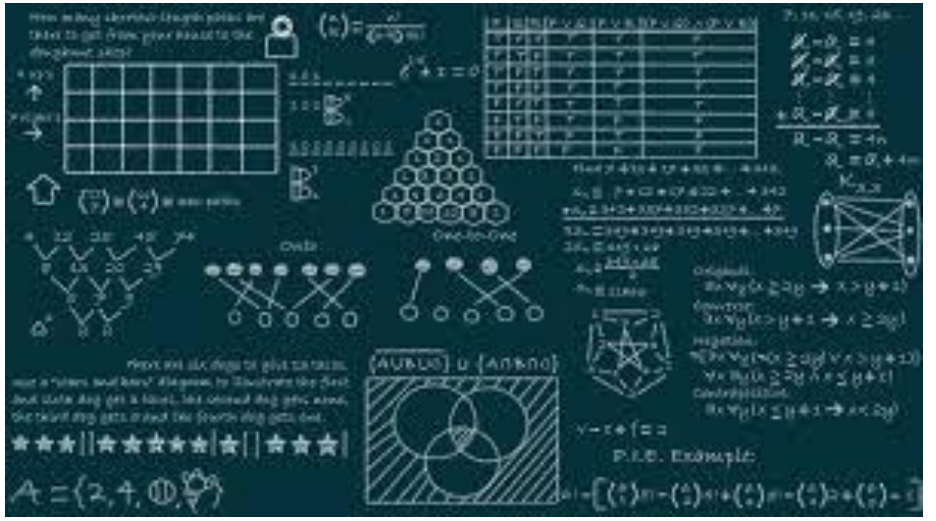
UNIVERSITY OF APPLIED SCIENCES UTRECHT

UNIVERSITAT DE BARCELONA

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

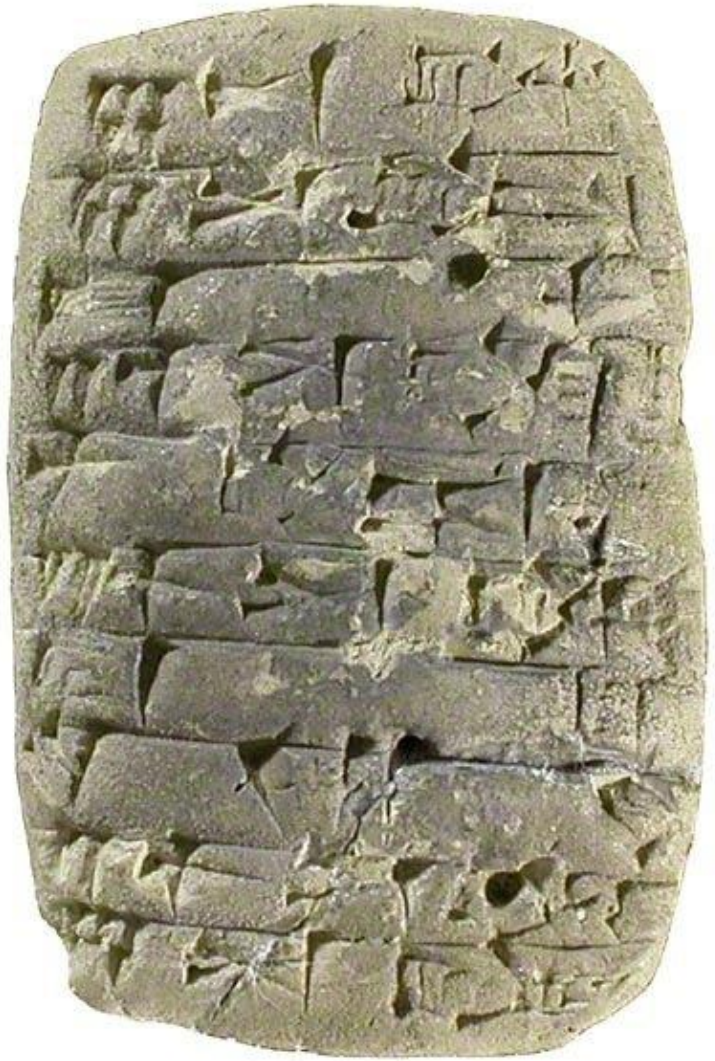
Individuals acting in numeracy/mathematical situations

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

- RECORD OF BEER DISTRIBUTED FROM THE OFFICIAL STORES ON THE 12TH AND 13TH DAYS OF A MONTH, MENTIONING BEST BEER AND ORDINARY BEER, FOR THE TEMPLE, FOR THE STORE AND FOR THE HOUSE OF LU-DINGIRRA



MS 1952/39
Beer distributed from the official stores.
Sumer, 2080-2010 BC

The Numerate world 21st c. AD
Examples in literature

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

- Zevenbergen (1996) Boat Building
- Evans (2000) Numeracy practices and emotions
- Coben (…) Nursing practices
- Bakker c.s (…): Airplane pilots, Bank personnel,
  - Laboratory workers
- Keogh (2018) Looking at numeracy at work
- Yasukawa e.a (Eds.) (2018): Kiwifruit orchards, Building stone walls, Managing debts
- Saló i Nevado (2021): Problem solving (cabinetmakers and farmers)

Numeracy

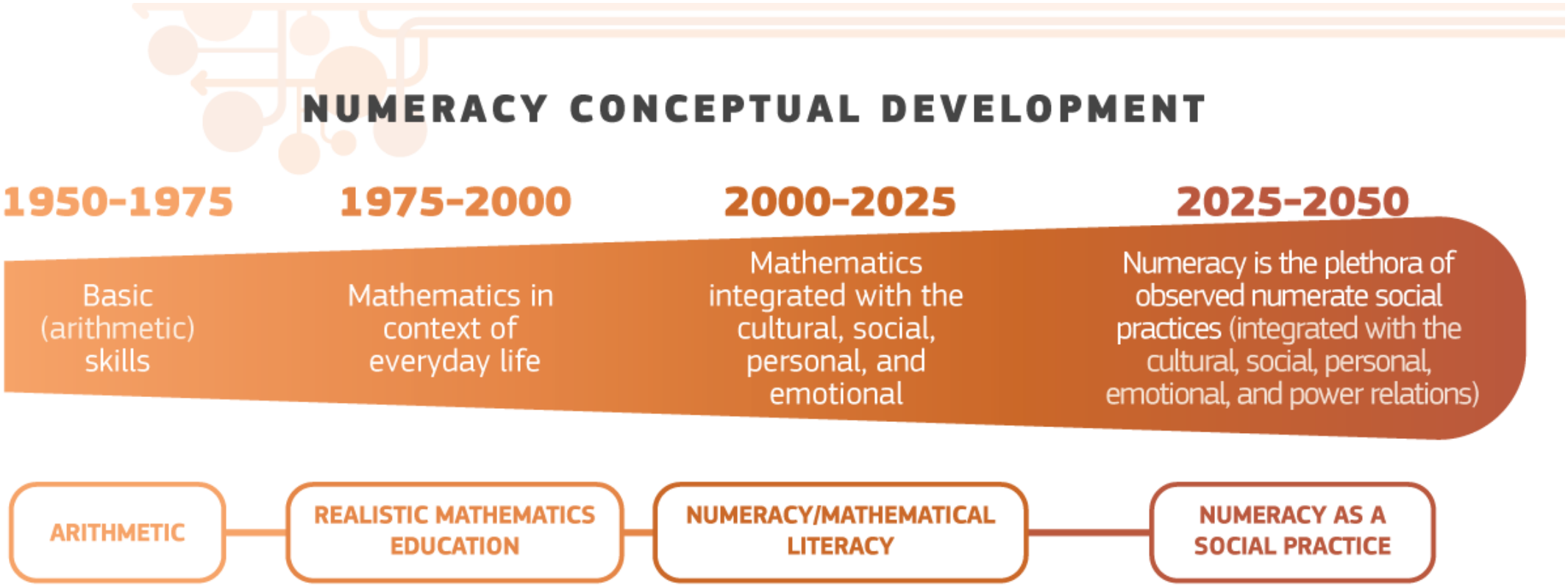
1950

2050

- Numeracy is basic skills in operations with numbers;
- Numeracy is functional mathematics, a subset of mathematics;
- Numeracy is defined by numerate behaviour of individuals;
- Numeracy is a social practice (regarding the quantitative aspects of life);

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

Numeracy Conceptual development



Numeracy as social practice (NSP)

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)

HOW ??

- Research-informed by
  - Situated cognition (Lave, 1988)
  - Cultural-historical activity theory (CHAT, …)
  - Literacy as social practice (LSP, …)
  - Ethnomathematics (D'Ambrosio)

(See Yasukawa et al.(Eds), 2018)

  - Pedagogy of the oppressed (Freire)

(see Freire, 1970, 1996)

Discussed in numerous articles e.g., by Coben, Yasukawa

CENF
Common European Numeracy Framework

erasmus+

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

UNIVERSITY OF APPLIED SCIENCES UTRECHT

bfi

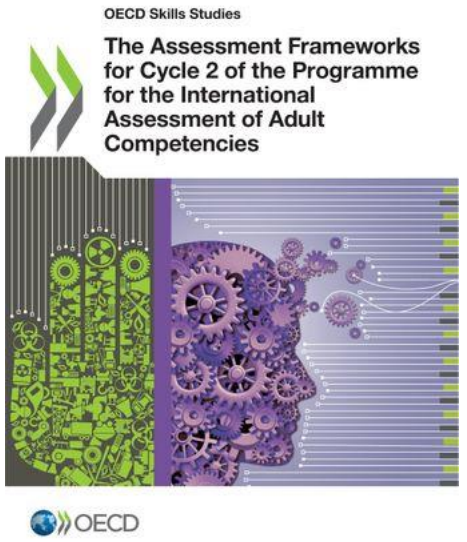
UNIVERSITAT DE BARCELONA

UNIVERSITY of LIMERICK

The Numerate world 21st c.AD

Numerate behaviour and practices

Cognitive processes	*Manifestations*
Interpretation	Product labels, advertisements, brochures, ….
Understanding of hidden algorithms	Apps, websites, …
Valuating	Money, prices, …
Measuring	Length, weight, …
Estimating	Ubiquitous, ….
Critical thinking	Politics, intimidation with numbers
Knowing reference numbers	Body, country, world
…	…
…	…
…	…



Redefining basic skills

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

Acknowledging that power relations play a role: exploitation, gate keeping and selection, inclusion and exclusion, gender stereotypes about handling numbers, formatting power (or terror) of school mathematics, …

CENF

Common European Numeracy Framework

Implies:

- Explicitly take into account in developing education
- Explicitly take into account in assessing and measuring
- Explicitly discuss such topics with learners: they are after all adult citizen

Integral (integrative, holistic,) perspective

Acknowledging “Numeracy as a social practice”

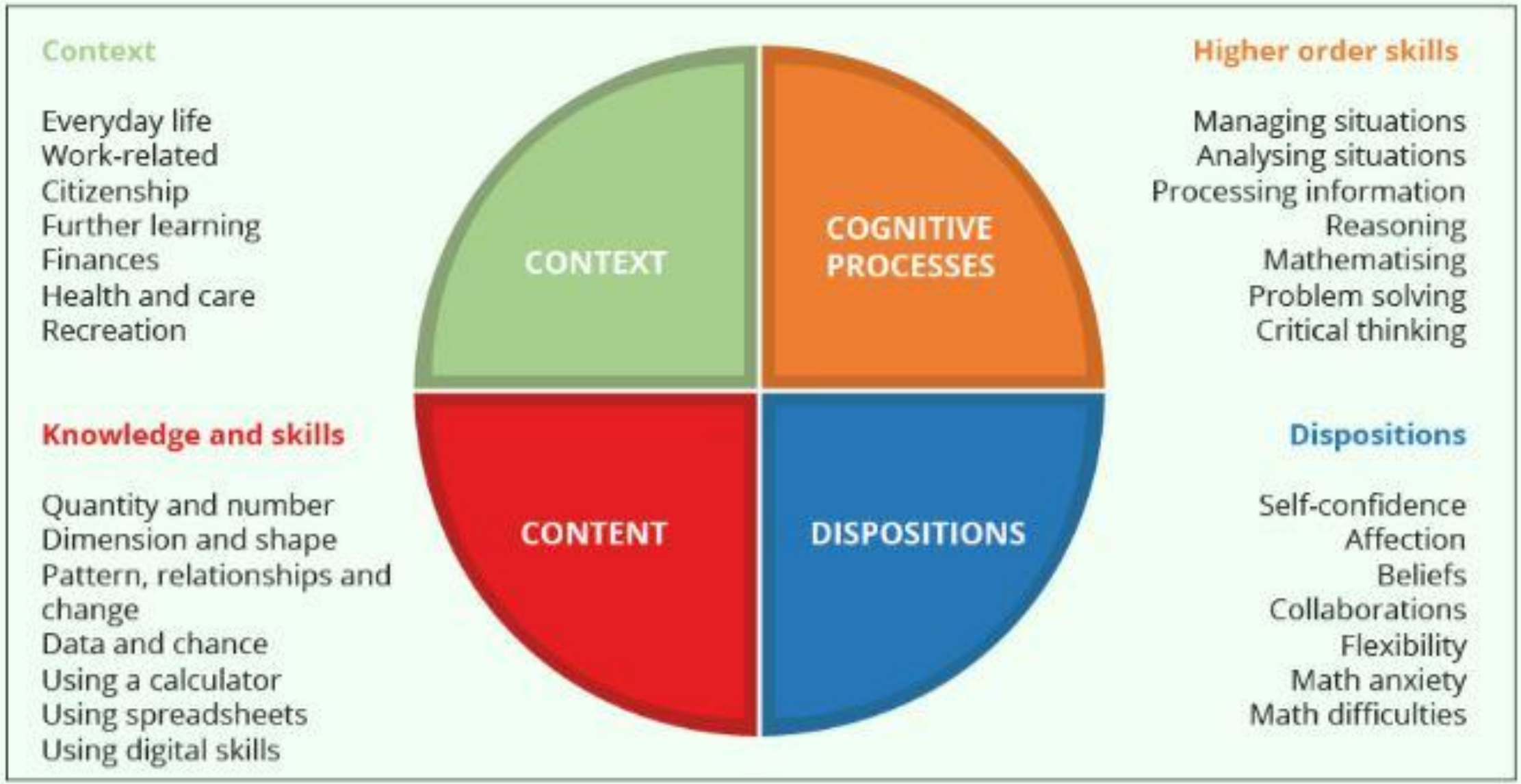
Implies: Multidimensional aspects

- cognitive and psychological aspects
- multidimensional individual profiles

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

erasmus+

What matters to improve numerate behavior



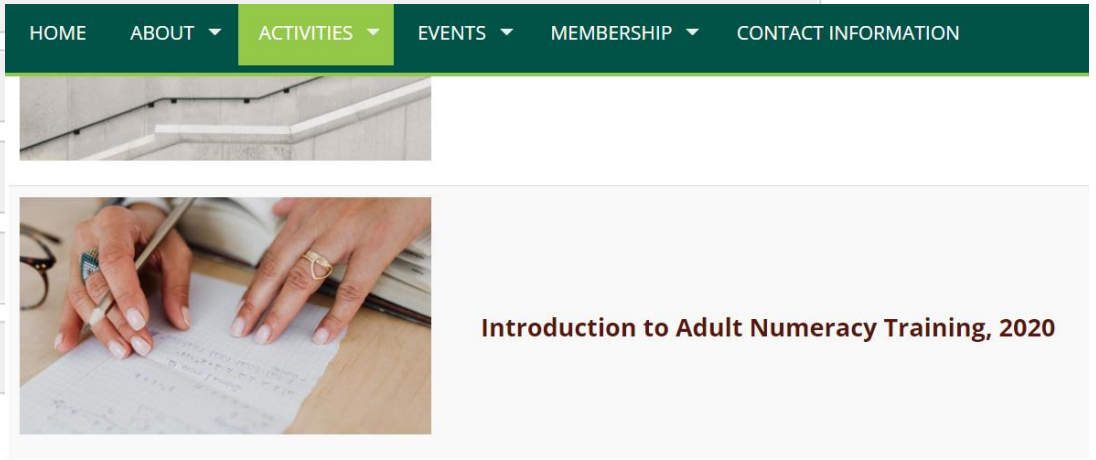
Professional development modules

- + 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 MOOCs

Set up:

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



https://epale.ec.europa.eu/en/blog/oer-introduction-adult-numeracy-training-landing-page

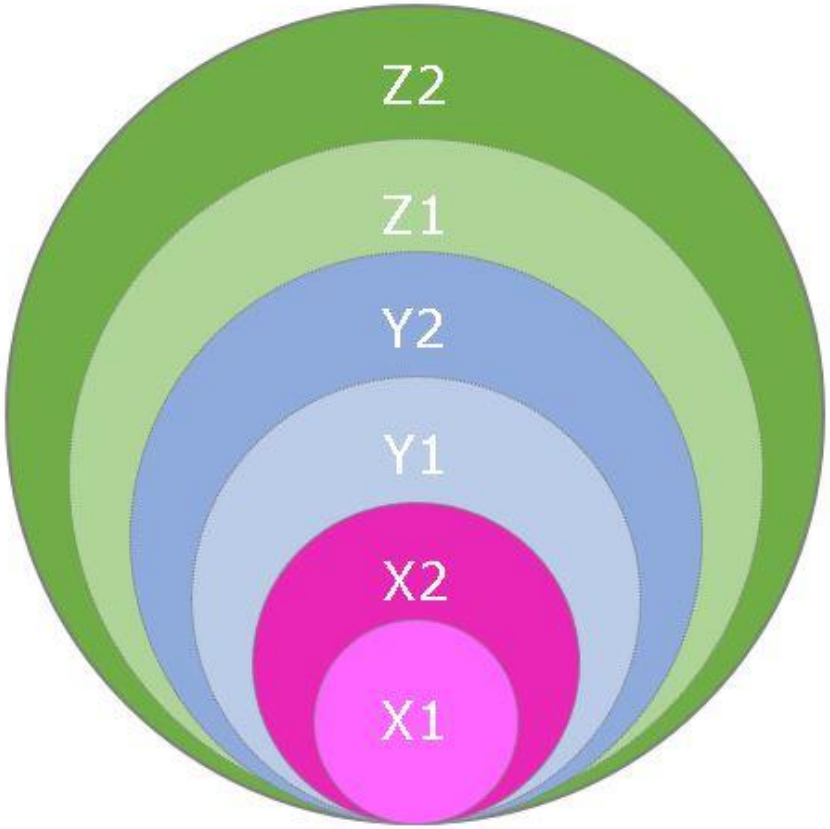
CENF - Overall levels (= categories ≠ thresholds)

C E
N F

Z
Specialized societal and work situations

Y
Societal and regular work situations

X
Daily-life situations



©CENF, 2021

Z2
... Manage situations which require intergrating multiple types of mathematical information where considerable translation or interpretation is required to come to decisions, draw inferences, and develop or work with mathematical arguments or models.
... Understand and use complex representations and abstract and form mathematical and statistical ideas, possibly embedded in applications, tools and texts.
... Justify, evaluate, and critically reflect upon problem assumptions, solutions, and choices
... Use sophisticated statistical and mathematical software in complex professional situations

Z1
... Manage situations which require analysis and more complex reasoning about quantities and data; statistic and chance; spatial relationship; and change, proportions, and formulas
... Understand and use a broad range of mathematical information that maybe complex, abstract, or embedded in unfamiliar contexts. These tasks involve undertaking multiple steps and choosing relevant problem -solving strategies and processes
... Communicate arguments and well-reasoned explanations for answers or choices.
... Use standard statiscal and mathematical applications for all kind of work situations.

Y2
... Manage situations which require several steps to interpret the situation and involves the choice of problem -solving strategies and relevant processes, such as the application of number sense and spatial sense; recognizing and working with mathematical relationships, patterns, and proportions expressed in verbal or nurerical form.
... Identify and act on mathematical information that maybe less explicit, embedded in familiair and unfamiliar contexts, tools and applications and use them to decide and actively communicate.
... Use various applications for work, householding, and leisure

Y1
... Manage situations which require the application of two or more steps or processes involving calculation with whole numbers and common decimals, percentages, and fractions; simple measurment and spatial representation; estimation.
... Identify and act on mathematical information and ideas embedded in a range of familiar contexts, tools, and applications consisting of relatively simple data and statistics in texts, tables and graphs and use them to decide and further communicate.
... Use some standard applications for work, householding, and leisure

X2
... Manage everyday life situations which require one-stop or simple processes involving counting, sorting, performing basic arithmetc operations required to decide and further communicate.
... Interpret elements of simple or common numerical, graphical, or spatial representations and use them to decide and further communicate.
... Use familiar and common digital devices, like mobile phones and some default applications.

X1
... Manage concrete, familiar situations where the mathematical problem is explicit with little or no processes required to decide.
... Interpret elements or simple numerical representations and use the to decide.
... Perform processes involving either counting, sorting, and basic arithmetic operations with whole numbers or money
... Use some digital devices occasionally

www.cenf.eu

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

UNIVERSITY OF APPLIED SCIENCES UTRECHT
bfi
UNIVERSITAT DE BARCELONA
UNIVERSITY of LIMERICK OLLSCOIL LUIMNIGH

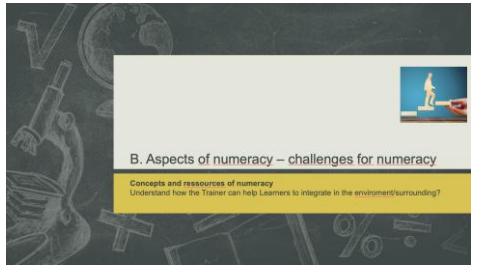
Common European Numeracy Framework

- Content
  - Domains (as in PIAAC, PISA; as in mathematics curricula)
  - Big ideas in Mathematics
- Cognitive processes (higher order skills / 21st century skills)
  - Problem solving, reasoning, modelling, ….
- Affective aspects
  - Attitudes / qualities: self-efficacy, self-confidence, no math anxiety, critical interpretation, …
- Contexts / Themes /Life
  - Work, daily-life, in house, in society, public domain (politics, media), private domain (shopping, economic domain (money, rent & mortgage, …)

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

CENF

Common European Numeracy Framework



Challenges for the adult numeracy community (and beyond)

- Redefine basic skills in (more) relevant cognitive processes and their manifestations (See e.g., PIAAC second cycle)
- Connect research and development with some common framework and ideas.
- Systematically acknowledge multidimensionality when dealing with numeracy (research, teaching, professional development, ….)

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

CENF
Common European Numeracy Framework