

## International Perspectives on Mathematical Literacy

Eva Jablonka  
Freie Universität Berlin

Jablonka@zedat.fu-berlin.de

mathematical literacy      gecijfertheid      E.Jablonka

### Numeracy as

“An understanding of the scientific approach to the study of phenomena – observation, hypotheses, experiment, verification ... the need in the modern world to think quantitatively, to realise how far our problems are problems of degree even when they appear as problems of kind.”

‘The Crowther Report’. London: HMSO 1959

- Optimistic vision of the power of science
- Demanding in terms of knowledge

mathematical literacy      gecijfertheid      E.Jablonka

### Innumeracy as

“An inability to deal comfortably with the fundamental notions of number and chance ... a lack of numerical perspective, an exaggerated appreciation for meaningless coincidence, a credulous acceptance of pseudosciences, an inability to recognize social trade-offs.”

Paulos, J.A.: Innumeracy - mathematical illiteracy and its consequences. New York: Hill and Wang 1988

- Critical vision of the power of science
- Includes social dimension

mathematical literacy      gecijfertheid      E.Jablonka

### Culture-free views in international testing

TIMSS-95 (not included in TIMSS-99), PISA

- Economic goal: developing human capital
- Context is interchangeable
- Pedagogic implications:
  - Teaching mathematics in a better way
  - Perhaps include new mathematical topics

#### TIMSS

Included no explicit definition of ML;  
The test items of the ML-test (population 3) implicitly convey the math.-oriented perspective on ML:  
- Unsolvable tasks if the context were relevant  
- Typical reverse-given-find-tasks

mathematical literacy      gecijfertheid      E.Jablonka

A10. Using the set of axes below, sketch a graph which shows the relationship between the height of a person and his/her age from birth to 70 years. Be sure to label your graph, and include a realistic scale on each axis.



mathematical literacy      gecijfertheid      E.Jablonka

D12. Brighto soap powder is packed in cube-shaped cartons. A carton measures 10 cm on each side.

The company decides to increase the length of each edge of the carton by 10 per cent.

How much does the volume increase?

- A. 10 cm<sup>3</sup>
- B. 21 cm<sup>3</sup>
- C. 100 cm<sup>3</sup>
- D. 331 cm<sup>3</sup>

mathematical literacy      gecijfertheid      E.Jablonka

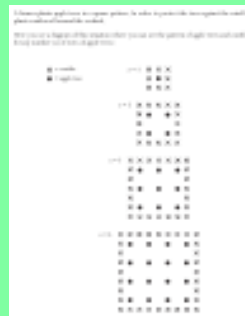
## PISA

### Mathematical literacy as

“The capacity to identify, to understand and to engage in mathematics and make well-founded judgements about the role that mathematics plays, as needed for an individual’s current and future life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen.”

Measuring Student Knowledge and Skills: A New Framework for Assessment. Paris: OECD 1999.

mathematical literacy      gecijfertheid      E.Jablonka



Contrast of test items and definition of ML:

Contextual knowledge is backgrounded

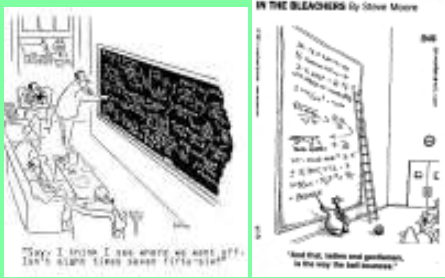
Evaluation of other people’s mathematics is not included

Assumption:

The same ML-oriented curriculum can be implemented in all countries

mathematical literacy      gecijfertheid      E.Jablonka

Can mathematicians be mathematically illiterate?



mathematical literacy gecijfertheid E.Jablonka

### Numeracy versus Calculus

“Even individuals who have studied calculus often remain largely ignorant of common abuses of data and all too often find themselves unable to comprehend (much less to articulate) the nuances of quantitative inferences. Although calculus and all that flows from it is a fundamental tool of modern science, it is not calculus but numeracy that is the key to understanding our data-drenched society.”

Steen, L. A., Mathematics and Numeracy: Two Literacies, One Language. To appear in The Mathematic Teacher, Singapore Association of Teachers of Mathematics.

mathematical literacy gecijfertheid E.Jablonka

### Cultural, regional views

ML has to reflect:

- Techniques used in the workplace
- Ethnomathematical practices
- Problems of practical and material importance for the community

Imply pedagogical change: activities and projects

Examples:

- Borba (1995): project on fund raising for soccer games with children from slums
- Knjnik (2000): project with settlers of the Landless People's Movement (MST) in Brazil

mathematical literacy gecijfertheid E.Jablonka

### Social critique views

Egalitarian goals: mathematics for democracy  
 Imply: democratisation of mathematics  
 pedagogical change

Contexts: of political and social relevance  
 Include: critical evaluation of use of mathematics

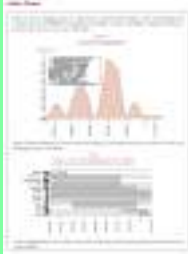
Examples:

- Skovsmose & Nielsen (1996)
- Frankenstein & Powell (1989)
- Shan & Baily (1991)

mathematical literacy gecijfertheid E.Jablonka

### Perspectives on implementation of ML

Integrate in all subjects



Subject	Mathematical Literacy	Mathematics	Science	Language	History	Art	Physical Education	Life Sciences
Grade 7	15%	25%	10%	10%	10%	10%	10%	10%
Grade 8	20%	30%	15%	15%	15%	15%	15%	15%
Grade 9	25%	35%	20%	20%	20%	20%	20%	20%
Grade 10	30%	40%	25%	25%	25%	25%	25%	25%
Grade 11	35%	45%	30%	30%	30%	30%	30%	30%
Grade 12	40%	50%	35%	35%	35%	35%	35%	35%

mathematical literacy gecijfertheid E.Jablonka

### Establishing ML as a new subject

Example: South Africa

Areas of learning in the 'Curriculum 2005'

- Language, Literacy and Communication
- Mathematical Literacy, Mathematics and Mathematical Sciences
- Human and Social Sciences
- Natural Sciences
- Technology
- Arts and Culture
- Economic and Management Sciences
- Life Orientation

mathematical literacy gecijfertheid E.Jablonka

Field: Physical, Mathematical, Computer and Life Sciences

Sub-field: Mathematical Literacy, Unit standards at NQF levels 2

Title	Cr
1. Demonstrate understanding of rational and irrational numbers and number systems	3
2. Use mathematics to investigate and monitor the financial aspects of personal and community life	2
3. Work with a wide range of patterns and basic functions and solve related problems	2
4. Use mathematical models to represent and deal with problems that arise in real life contexts	2
5. Identify, describe, compare, classify, calculate shape and motion in 2-and 3-dimensional shapes in different contexts	3
6. Apply basic knowledge of statistics and probability to influence the use of data and procedures in order to investigate life related problems	4
<b>Total credits</b>	<b>16</b>

mathematical literacy gecijfertheid E.Jablonka

### 2. Use mathematics to investigate and monitor the financial aspects of personal and community life

Specific outcome 1: Use mathematics to plan and control personal and/or household budgets and income and expenditure

Specific outcome 2: Use simple and compound interest to make sense of and define a variety of situations

Specific outcome 3: Investigate various aspects of financial transactions

Embedded knowledge

(The possession or lack of the knowledge can be inferred directly from the quality of the candidate's performance against the standards.

Budgets, Terminology and definitions associated with financial situations, Estimation and approximation, Compound increase and decrease

mathematical literacy gecijfertheid E.Jablonka

---

**6. Apply basic knowledge of statistics and probability to influence the use of data and procedures in order to investigate life related problems**

- Specific outcome 3: Use probability and statistical concepts in solving routine problems from real-world situations and draw conclusions
- Range: Performance in this specific outcome includes the requirement to:
  - Source and interpret information from a variety of sources including nested or layered tables
  - Decide whether an argument based on statistics and probability is fair
  - Describe the use and misuse of statistics and probability in society
  - Use probabilities to make predictions and judgements

---

mathematical literacy    gcijferheid    E.Jablonka

---

Embedded knowledge:

- Methods for collecting, organising and analysing data
- Techniques for representing and evaluating statistics
- Probability concepts

---

mathematical literacy    gcijferheid    E.Jablonka



THE Philippines ranks low in terms of scientific and mathematical literacy...

In the meantime, however, the country should emphasize acquiring language skills in our educational system. While we may concede China and India's superiority in mathematics and the sciences for the moment, we can gain a competitive advantage over them in linguistics.

---

mathematical literacy    gcijferheid    E.Jablonka