

# Adults solving realistic problems

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ALM24 July 2017



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# Introduction (1)

✓ Adults

Low numeracy skills are associated with poor outcomes in employment, health, wages, crime, personal and social skills  
(PBE, 2014).

## Process of creative solution

Planning  
Incubation  
Enlightment  
Validation (Wallas, 1926;  
Gazit, 2012)

✓ Solving

✓ Realistic

...connect subject areas with students' everyday lives...(Lee, 2012)

...someone is not immediately in possession of direct methods sufficient to answer it... (Blum & Niss, 1991)

✓ Problems

# Introduction (2)

- **Numeracy:** the ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life *(OECD, 2013)*.

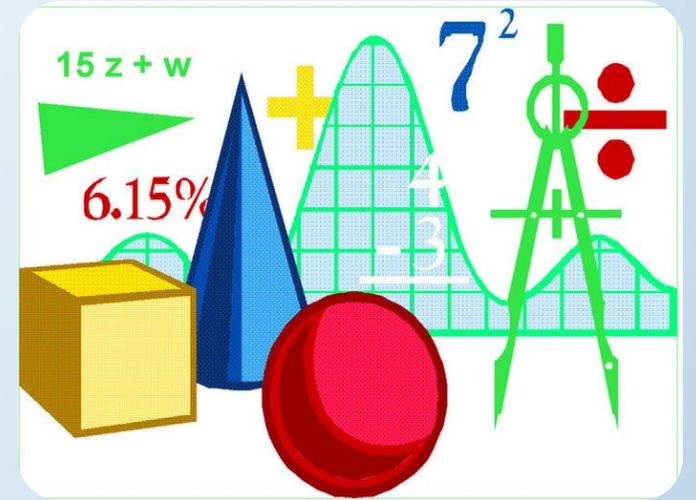
The abilities of a **numerate adult** are: calculation, use of fractions/decimal numbers/percentages, use of calculator, chart presentations, use of advanced mathematics or statistics *(PIAAC, 2013)*.

**Numerate behaviour** includes, apart from numerical skills, the association with realistic problems, critical thinking and the ability to make sense from non-mathematical contexts seen from a mathematical point of view *(Geiger, Goos & Forgasz, 2015)*

# Introduction (3)

In our study the numerate adult should:

- carry out basic operations.
- use proportions.
- use and understand percentages.
- make assessments.
- draw the necessary information from a chart.
- understand the information given in a problem.
- solve a problem.
- take into consideration everyday life data.



# Aim of the study

- We observed:
  - How adults respond to realistic problems.
  - What kind of mathematics they use.
  - What factors they take into account, when they face everyday situations.
  - What parameters affect the ability of solving realistic problems.

# Methodology

## Participants

- 100 adults
- 46 men, 54 women
- Age range: 25-40
- Educational level: middle school – PhD
- Meeting where they wanted.

## Pilot Study

- 20 adults
- change in two problems and omission of a problem

## Questionnaire

### Part A

- ❖ Information on age, sex, profession, educational level, use of free time, perceptions of use and importance of mathematics, experience of school mathematics (five-point Likert scale)

### Part B

- ❖ Six realistic problems

We encouraged the participants to **face some situations!**

# The study (1)



## • Situation 1

*“The weekly transportation card costs 15 €. Which is the best value for money choice for you, buying a ticket daily or buying the weekly transportation card?”*

Common question:  
*How many days do I work?*

Interesting answer:  
*It depends on how many times per day I use the bus. For everyday use, it is preferable the weekly transportation card. For less than 12 times per week, the ticket is preferable.*

## Characteristics:

- ✓ Similar to Frankenstein’s problem (2009)
- ✓ Use of realistic pictures in order to help the solvers (Hoogland, 2009)
- ✓ It is a common problem.
- ✓ Use of second person
- ✓ The solver has to:
  1. obtain necessary information.
  2. do mathematical operations.
  3. compare.
  4. take into consideration daily parameters in order to make the decision.

# The study (2)

- **Results**

Three categories of answers

1. Simple or meaningless answers

→ 17 answers

2. Answers with justification

→ 51 answers

3. Answers with assumptions

→ 32 answers

- **Observations**

- It was the most difficult problem for the most participants.
- Three solvers did wrong mathematical operations.

# The study (3)

## • Situation 2



*“You are thinking of buying a pair of trainers and you decide to go shopping during the sales period. In the first local shop you find the shoes you want at the initial price of 120 €, while the same shoes cost 140 € at the local department store. Where will you choose to buy your shoes from and why? On the same day you made a withdrawal of five 50 € banknotes. How much change will you take from the shoes' purchase?”*



Common question:  
*How much discount do they have?*

Interesting answer:  
*In the local shop the final price is 72 €. In the local department they cost 70 €, if the discount applies to these shoes. I will choose the local shop in order to strengthen the local market. My change will be  $250 \text{ €} - 72 \text{ €} = 178 \text{ €}$ .*

## Characteristics:

- ✓ People see very often mathematics in shopping (Oughton, 2008).
- ✓ Use of realistic pictures in order to help the solvers (Hoogland, 2009)
- ✓ Use of second person
- ✓ The solver has to:
  1. combine information from pictures and text.
  2. do mathematical operations.
  3. compare.
  4. think critically.

# The study (4)

- **Results**

Three categories of answers

1. Wrong prices - wrong change

 22 answers

2. Right prices – wrong change

 47 answers

3. Right prices/ (-to) – right change

 31 answers

- **Observations**

- Many participants didn't notice the pictures.
- 27 participants chose the local shop in order to strengthen the local market.
- Other parameters: fuel, distance, online shopping
- Three wrong mathematical operations.

# The study (5)

- Situation 3

*“You are having a family lunch on Sunday and the main course will be ‘mantilakia’. There will be about 15 people and you must buy the necessary things from the grocery. What will you buy and in which quantity?”*



Common question:  
*What is ‘mantilakia’?*

Interesting answer:

*I will buy four times the amount of the things I believe I need...The extra portion is for a poor man...I will need for salad...*

Characteristics:

Cooking is a field where someone needs mathematical skills (Duchhardt et al., 2017).

The solver has to:

1. understand the information in the text.
2. choose the necessary things.
3. use the proportions.

# The study (6)

- **Results**

Three categories of answers

1. More things – wrong quantity

→ 58 answers

2. More things – right quantity

→ 17 answers

3. Things from grocery – right quantity

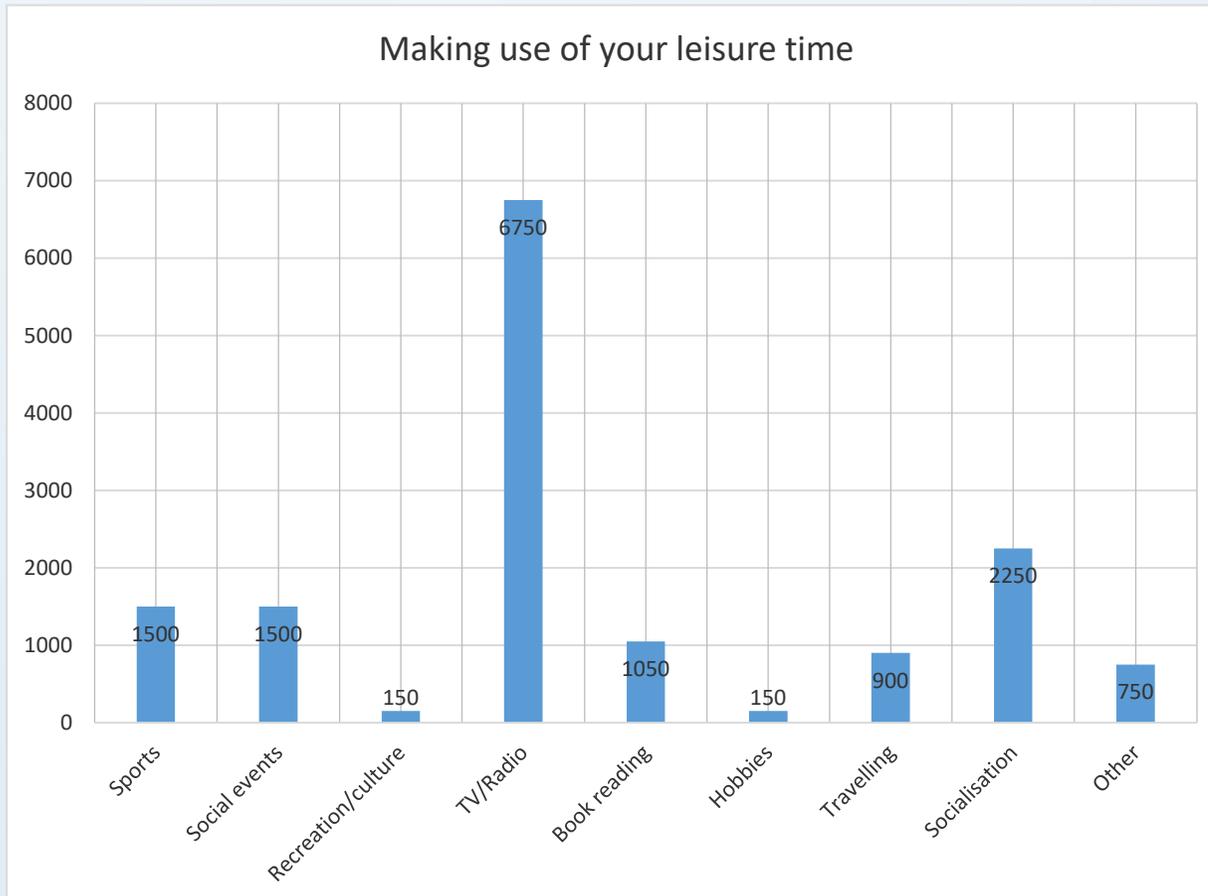
→ 25 answers

- **Observations**

- Most of the participants wrote the whole recipe for 16 people.
- In order to find the quantities they used:
  1. proportion (x 4, x 5 or x 3,75)
  2. reduction in the unit
  3. approximation
  4. rule of three
- The most unrealistic answers (ex. I will buy 4 cloves of garlic...)

# The study (7)

- **Situation 4**



*This chart shows how adults aged 20-64 make use of their leisure time according to a research carried out in 2013.*

- 1. How many more adults are occupied with TV/Radio in relation to those who do sports?*
- 2. How many adults took part in the research?*
- 3. How many adults are occupied with Travelling/Book reading and Hobbies?*
- 4. Which is the most popular way of making use of one's free time?*
- 5. Which is the fifth most popular way of making use of one's leisure time?*

# The study (8)

- **Results**

Three categories of answers

1. 0-2 right answers

→ 15 answers

2. 3-4 right answers

→ 43 answers

3. All answers right

→ 42 answers

- **Observations**

- Nine solvers wondered about how many choices the participants had.
- Seven solvers thought that the participants were 8000.
- The most common difficulty was the fifth most popular way of making use of one's leisure time.
- 21 participants did wrong mathematical operations.

# Problems' answers



# Conclusions

- The participants faced with success, in general, the problematic situations, despite the fact that the majority of them didn't enjoy mathematics.
- Concerning the educational level, the percentage of participants that have at least a bachelor degree is bigger in the problem with the chart.
- The problems gave the opportunity to the participants to make fruitful discussion.
- The next step of the study is to organize focus groups and find more relationships between the questions of Part A and the problems' answers.



# Interesting reactions

*“Do we have to do mathematical operations?”*

*“So...we have to think...”*

*“Ohh!! Numbers!”*

*“I haven’t done any mathematics since my son was six...!” (five years ago)*

*“It’s not very specific...!”*

*“These problems are really vague...!”*

*“Obviously from the store with 120 €...!!!”*

*“It needs clear mind!”*

*“I would like to know the answers!”*

*“There will be a score? We’re gonna  
embarrass ourselves!”*

*“Could you give me similar problems every week?”*

*Thank you for your  
time and your  
attention!!*



# Adults solving realistic problems

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