

**Adults Learning Mathematics – An International Research Forum
ALM24 – Conference, Rotterdam, The Netherlands
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Investigating adults' Statistical literacy in a Second Chance School



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Second Chance Schools in Greece

- ▶ Second Chance School (SCS): Main public institutions related to Adults' Basic Education programs in Greece.
- ▶ SCS' s basic aim: combat the social exclusion of adults who have not completed the compulsory secondary education.
- ▶ SCSs considered to be innovative: They operate without pre-specified curricula, use new teaching and evaluation methods and offer counseling to students.

Second Chance Schools in Greece

- Duration: 2 academic years.
- Weekly programme: 25 teaching hours.
- Mathematics: Taught for three hours every week in A and B cycle (grade).
- Teaching of Mathematics  students' numeracy.
- Guidelines: statistical notions  statistical literacy.

Statistical literacy

- ▶ **Element of adults' numeracy** (Garfield and Ben-Zvi, 2008).
- ▶ Interpretation, evaluation and communication skills about statistical information.
- ▶ **Not only knowledge elements but also dispositional** (e.g. Gal, 2002) .

Our study

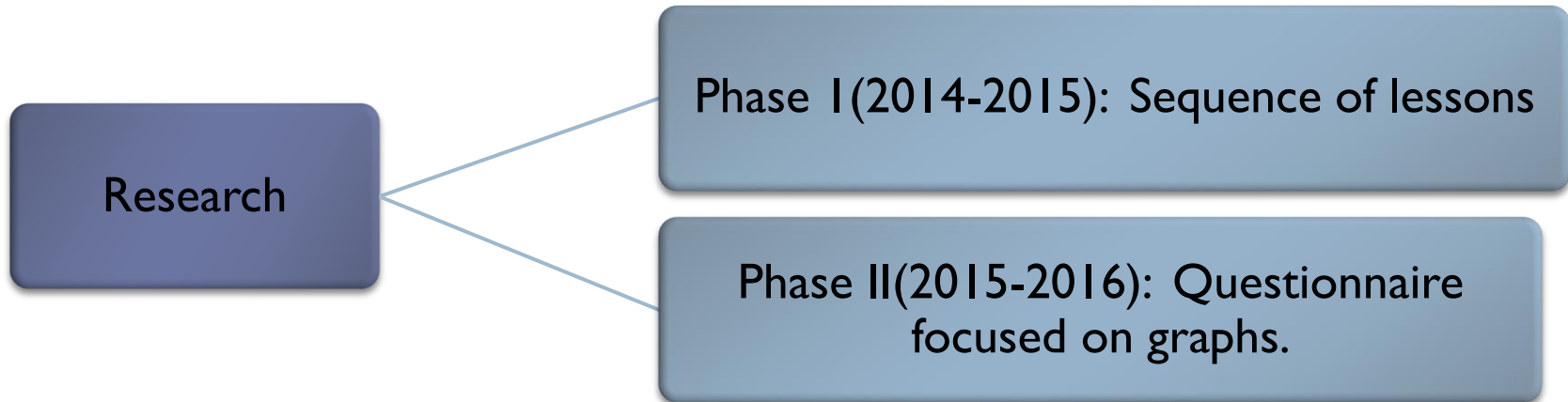
- ▶ Objective : assess the progress of adults' statistical knowledge during the teaching of basic statistical notions.
- ▶ Research: in light of the statistical literacy's necessity for adults, as a sub-category of numeracy.
- ▶ Our research took place during the academic years 2014-2015 and 2015-2016.

Context and Methodology

Participants-students:

- ▶ 43 adults aged from 25 to 65, in three different classes with 10 to 14 students each.
- ▶ School certificate/ attended the first year of a SCS (lower secondary) in a small town, with mainly rural population, in North-West Greece.
- ▶ Mathematical skill levels: varied from basic elementary level through secondary level.

Context and Methodology



Phase I

12-hour sequence of lessons.

Tasks: (1) data collection, interpretation and organization, (2) reading and interpretation of basic data representations, (3) data description with statistical terminology, and (4) evaluation of arguments based on misleading graphs or incorrect statistical information.

Phase II

Design and completion of a questionnaire focused on graphs.

Context and Methodology

- Teacher – researcher.
- New material with brief lectures at the beginning of class.
- Students worked together with the teacher:
 - discussed statistical concepts, made conjectures, discussed the validity of specific arguments and applied the newly acquired knowledge to the next task.
- The teaching episodes were audio taped and transcribed.
- Episode about graph comprehension.

Research questions

Based on:

- The definition of graph comprehension (Friel et al., 2001)
- The ability to read, construct and interpret statistical graphs is an essential component of statistical literacy (Gal, 2002)

Research questions

- (a) What is the students' level of graph understanding?
- (b) Do they have a critical stance towards the statistical information presented by the graphs?

Analysis of answers

Graphical competence hierarchy (Wu, 2004):

- ✓ **(a) Reading graphs:** to extract data directly from one or more graphs and to generate information by calculating with data explicitly shown in graphs.
- ✓ **(b) Interpreting graphs:** to formulate opinions about graphs.
- ✓ **(c) Building graphs:** to present and edit data in graphic form.
- ✓ **(d) Evaluating graphs:** to evaluate the accuracy and effectiveness of a graph.

Results-Phase I

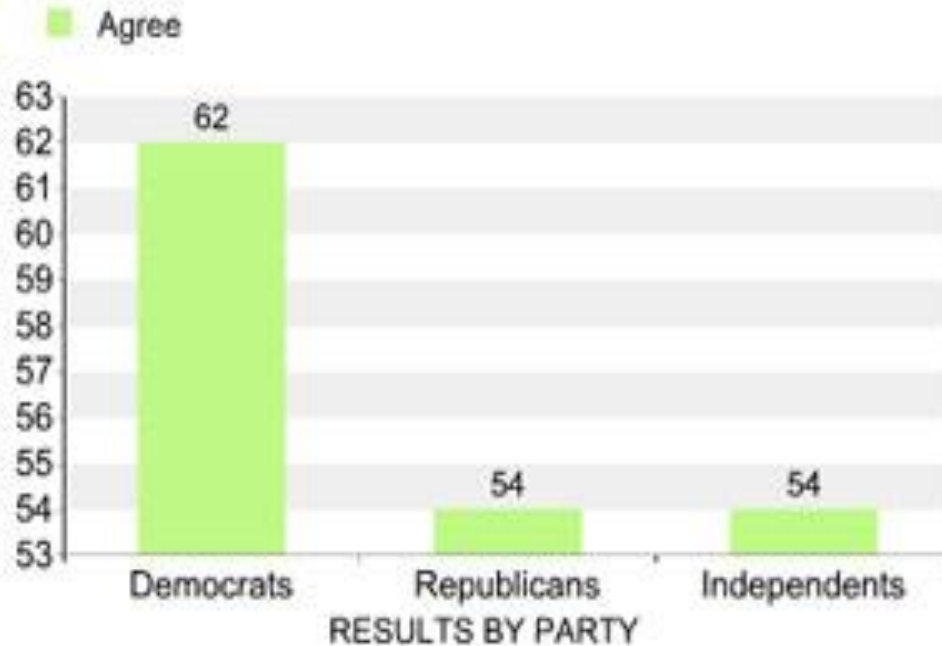
CNN.com

CNN/USA TODAY/GALLUP POLL

Results by party

← PREVIOUS

NEXT →



Question 2: Based on what you have heard or read about the case, do you agree with the court's decision to have the feeding tube removed?

In the United States, in 2005, CNN conducted a poll to test whether the voters of each party were in agreement with the court's decision about the Terry Schiavo's case and the next bar-graph was published. What is your conclusion based on this graph?

SAMPLE: Interviews conducted by telephone March 18-20, 2005, with 909 adults in the United States.

SAMPLIIG ERROR: +/- 7% pts

First Task (Media Matters, 2005)

Results-Phase I

1st reading level

John: No, it's more than 100.

Teacher: We have asked 909.

Helen: No, from 909 people, where does refer the 170?

Gregory: Maybe the percentage of the people asked is small?

Sophie: 170 say that they agree.

Gregory: Maybe the percentage of the people asked is small and we can't draw good conclusions?

2nd reading level

George and Harry: (they discuss) **In fact, it isn't true.**

Teacher: What do you mean?

Harry: Because in fact we have 10...yes 10...

George: Yes 10 lines. In fact if we notice it...I believe if there weren't any numbersif we had began from 0 in order to go up it shows much bigger than 62. 54 has nothing to do with 62.

Eva: This starts from the middle, the 53, if it started from 0 wouldn't the percentage be bigger? Or not?

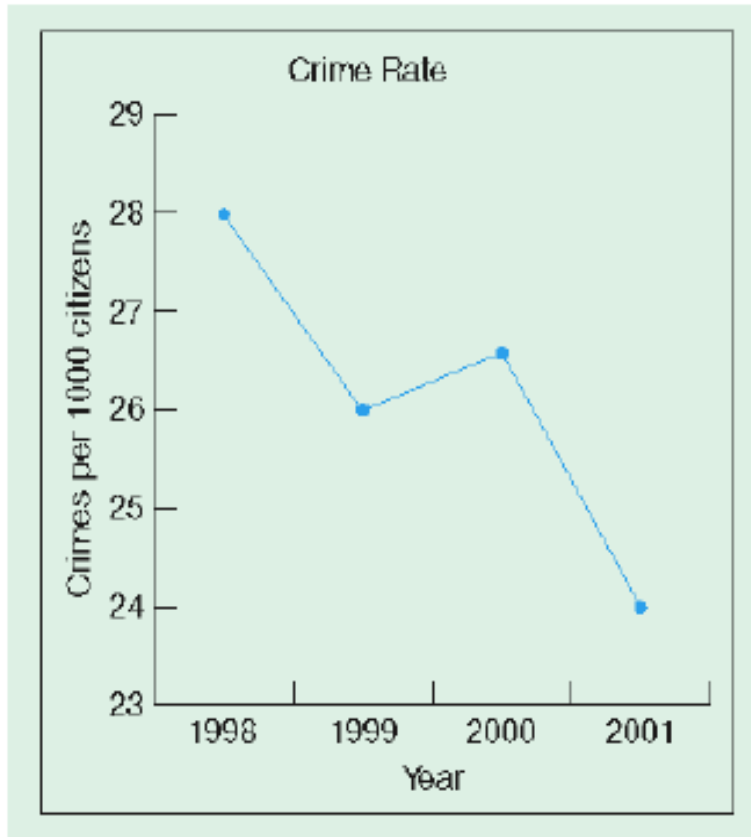
Harry: No it wouldn't. The graph would be just bigger.

George: By looking at the graph, what we can imagine....That the first bar looks much bigger than 54...The difference is not so...They should be bigger (They speak simultaneously)

George: It seems 10%, 12% to 80%.

Eva: So this graph begins from 53 while it should have began from 0 to understand it correctly. So, it's wrong the way it is.

Results-Phase I



In a local newspaper in 2001 we found the next graph about crime rate in the region from 1998 to 2001. The article concluded that crime rate had been reduced to a great extent. Do you agree with that? Justify your answer.

Second Task (Harper, 2004)



Results-Phase I

Eva: If we used bars wouldn't it look better?

Theo: It looks that the decrease was huge.

Helen: **But the difference isn't as huge at it looks like because the scale is 1. If the scale was 10 it would be....**

Eva: If we used bars from 28 to 24....Wouldn't be the same?

Teacher: If I construct it again and start from 0 what scale should I use?

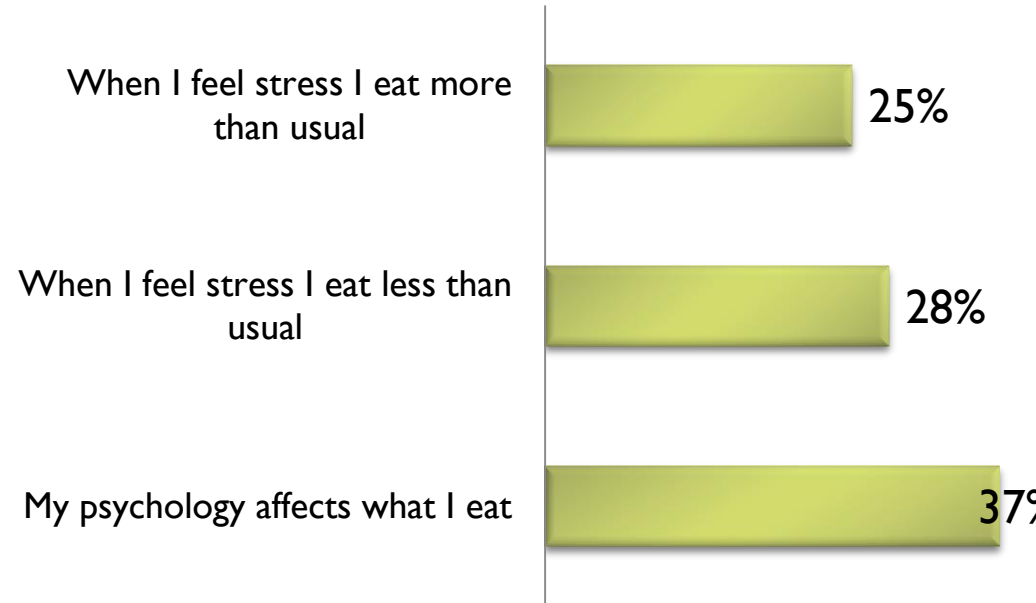
Helen: By 5.

Teacher: (Constructs it in the blackboard according to the students' suggestions). So, now, how it does it look?

Eva: **Now the decline doesn't look so big. While in the first graph (task) it looks like the decline was very big. Now it looks okay....**

Results-Phase II

- ▶ The **Institute of Retail Consumer Goods – GR** (IELKA) published a study about the dietary habits of Greeks as they are shaped today, based on a sample of 2,000 people from all over the country, aimed at analyzing. Some of the results are presented at the graph. Based on the graph, answer the following questions:
- ▶ A) What was the percentage of respondents who said that "my psychology affects what I eat" and what of them who responded "when I feel stress I eat less than usual"?
- ▶ B) How much more were the people that responded "when I feel stress I eat less than usual" than those who responded "when I feel stress I eat more than usual"?
- ▶ C) If we chose to ask another Greek citizen who did not participate in the above survey, what do you think would be his answer? Why?
- ▶ D) Based on the above graph, what conclusion can we make for all Greek citizens?



IELKA (Institute of Retail Consumer Goods – GR)

Results-Phase II

Answer 1:

C) 37% ...The prices are high .This fact affects the psychology of what I will eat ...

D) The psychology has a serious impact on the way we think about what and how much we eat.

Answer 2: C) When I am anxious I eat more than usual.

D) My psychology affects what I eat.

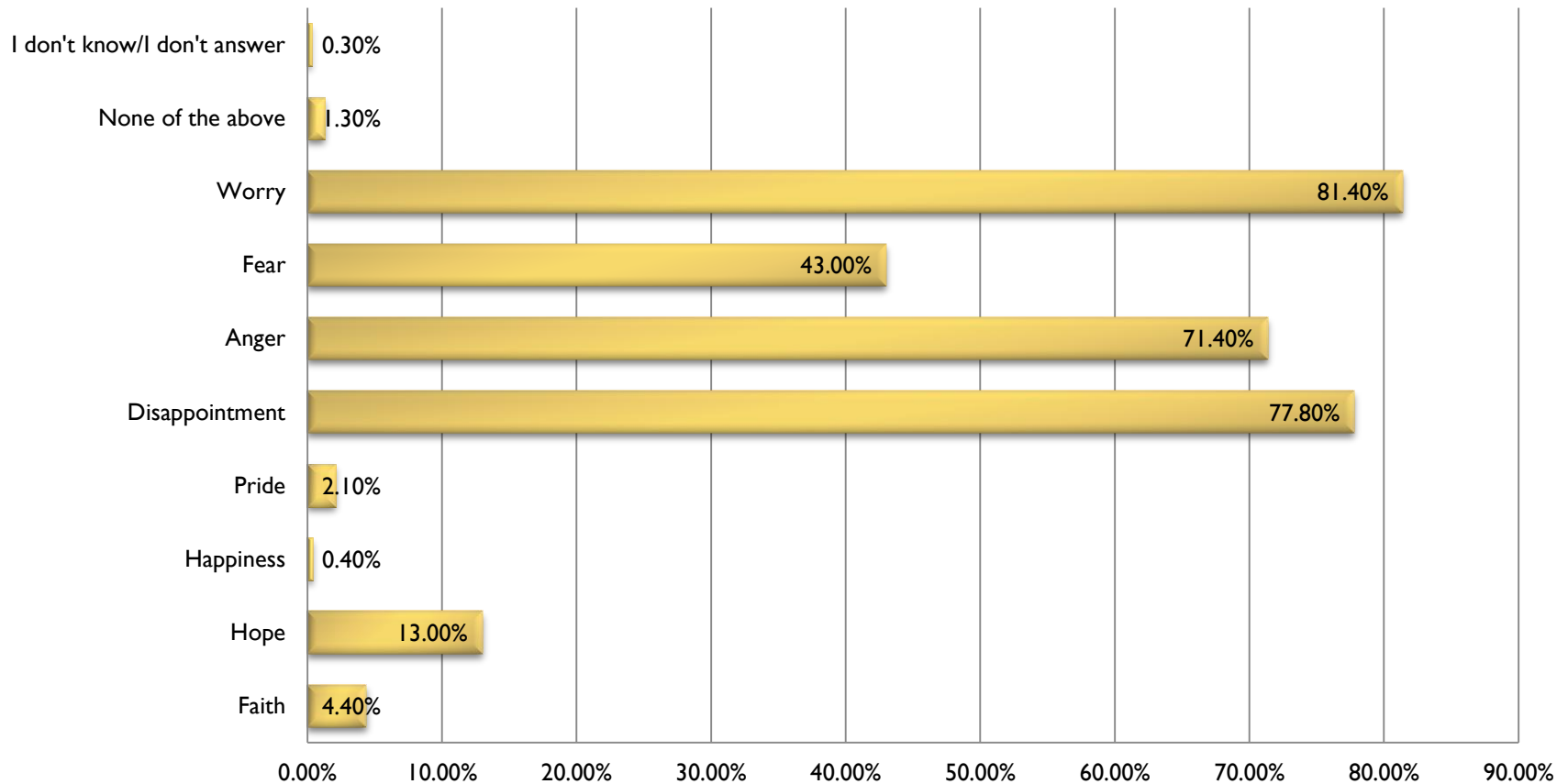
Answer 3:

C) I think the answer **could be that it does not affect my** psychology what I will eat.

D) **According to the graph, the conclusion that we can draw for the sample of 2000** people is that mental health affects the whole.

Results-Phase II

Nowadays which is your prevailing feeling regarding the country's state?



Results-Phase II

- ▶ According to a research conducted by Kapa Research and published in the newspaper Vima on Sunday (17-04-2016), society is concerned with anxiety, frustration and anger. Respondents' answer to the question are given in the graph below.
- ▶ A) Do you agree with the above conclusion?
- ▶ B) Can you justify your answer using data as shown in the graph?
- ▶ C) What else could you ask in order to have more information about the Greeks' emotional state?



Results-Phase II

Answer 4: B) Because nowadays times are difficult and oppressive.
C) If there was no crisis in the country what would be their feelings?

Answer 5: B) Because we do not know what will happen to us the next day.
C) Absolutely nothing. Everything is fake and we work for others.

Answer 6: B) In our country, nothing works properly in recent years and we cannot stand it anymore and our emotional state is negative.
C) What do we prefer to do individually and massively to feel better?

Conclusions

Students:

- Were able to read the graphs and to extract numerical information from these.
- Managed to use their previous knowledge to solve the next tasks and they recognized that creating a graph is a data representation that must meet certain requirements.
- Demonstrated at some extent the ability to critically evaluate graphs and to identify the limitations of misleading graphs.

Conclusions

Students

- Their personal opinions overwhelmed their knowledge of the graphs.
- Their critical stance was not so developed since the balance between their knowledge, beliefs and experience in interpreting the graphs was not achieved.
- The conclusion of research (Gal, 2002; Monteiro & Ainley , 2004) was confirmed that in the context of statistical literacy and numeracy, not only adults' knowledge but also beliefs are involved.

Thank you for your attention!

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