



Characterising pre-service primary teachers' posed Fermi problems

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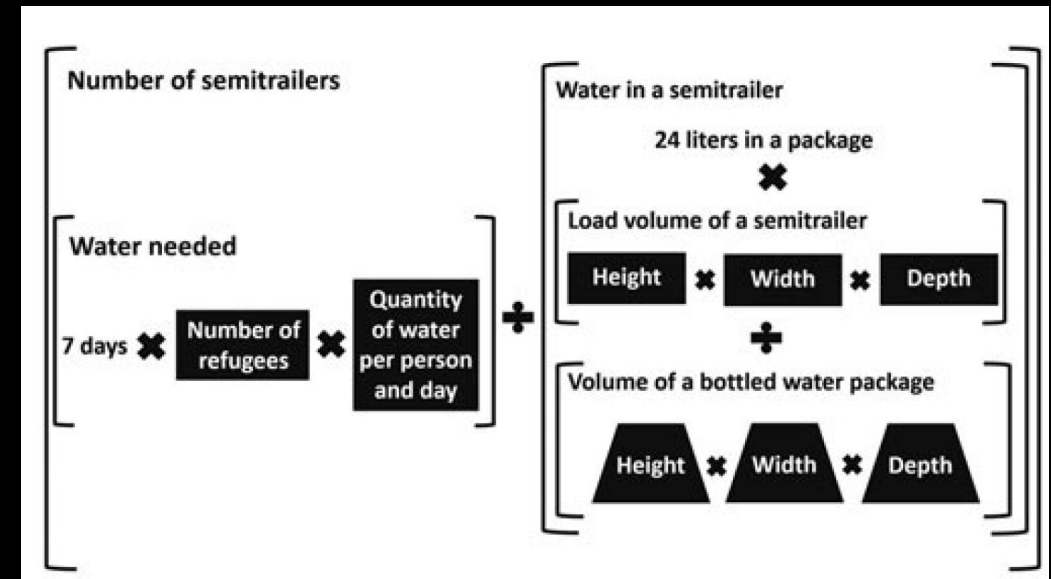
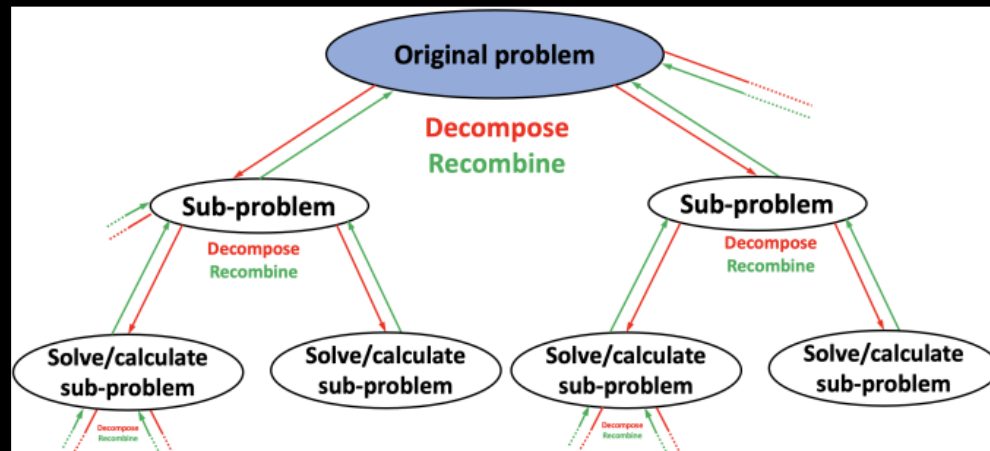
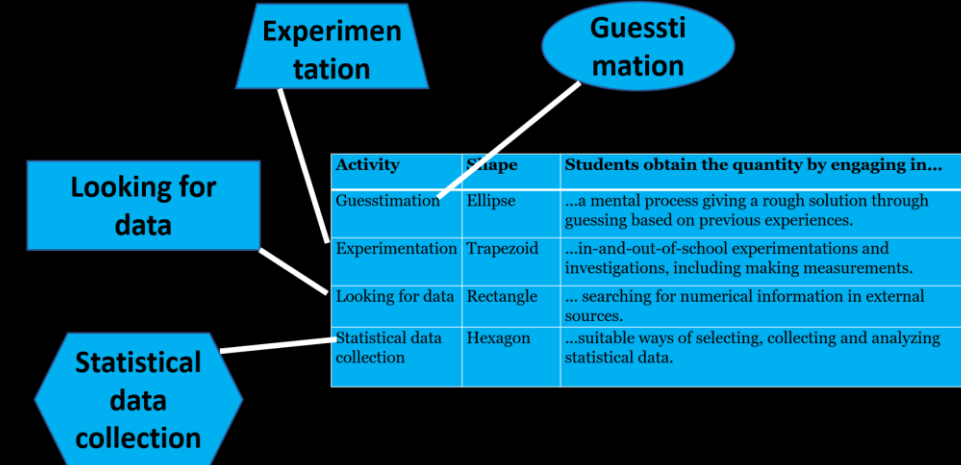
Introduction

- One way to make modelling and mathematics relevant to students, is for teachers to connect their everyday mathematics teaching to interesting real-life contexts and current affairs and topics in the news in ways that normally transcends what is offered in textbooks and traditional curricula materials.
- *Problem posing* has become a relevant topic within the research on teaching and learning of mathematical modelling that recently have gain more interest (Hartmann et al., 2021).
- There is a close relationship between the type of tasks students had been working on and solving, and the type of problems they posed (Baumanns & Rott, 2019).

Background: Fermi problems (FPs)

...are miniature-modeling problems in the sense that they are smaller, more well-defined and delimited real-world problems (Robinson 2008).

...at first glance seem impossible to solve, but that could be tackled by the *Fermi (estimates) method*:



Setting

Data from a 3-hour teacher training workshop on FPs for grade 4–6 pre-service primary teachers (PSPTs) in Sweden. Three phases:

- (i) a general introduction to FPs, PSPTs solving a ‘starter FP’ (*How many SMS are sent in Sweden in a year?*)
- (ii) PSPTs working in three stages on The Toilet Paper Problem, including the introduction of the FpAT framework
- (iii) formulating two FPs per group on their own and constructing a potential solution of their FPs in terms of FpATs.

3 years data → 58 FPs posed by PSPTs in phase (iii)

Research questions:

(RQ1) To what extent are the posed FPs clearly formulated and authentic for grade 4–6 students?

(RQ2) To what extent are the posed FPs inviting to, or setting up an introduction to, a curriculum relevant mathematical concept or content, or some relevant aspect of the real world?

(RQ3) What situations and contexts are used in the posed FPs?

Results

Extensive quantity (total 28)		Pre-intensive quantity (total 30)		
Number	Amount	Number per time	Amount per time	Other
20 (71%)	8 (29%)	15 (50%)	13 (43%)	2 (7%)

Context	Student	Generic person	Family	Class	School	City	Municipality	Country	Other
Own	0	0	0	9	14	5	1	9	0
Generic	2	4	2	3	2	0	0	0	0
Total	2	4	2	12	16	5	1	9	7

Conclusions

- Creating a FpAT impose constrains to the FP posed
- Challenges such as ambiguous formulations and the distinction between extensive and intensive quantities arise
- The study highlights the importance of close-to-home contexts and suggests FPs as a valuable approach to connect real-world situations with mathematics in primary education classrooms
- Improvements are needed to clarify the nature of Fermi problems and enhance the selection of real contexts

References

- Albarracín, L., & Ärlebäck, J. B. (2019). Characterising mathematical activities promoted by Fermi problems. *For the Learning of Mathematics*, 39(3), 10–13.
- Ärlebäck, J. B., & Albarracín, L. (2019). The use and potential of Fermi problems in the STEM disciplines to support the development of twenty-first century competencies. *ZDM – Mathematics Education*, 51(6), 979–990. <https://doi.org/10.1007/s11858-019-01075-3>
- Albarracín, L., Segura, C., Ferrando, I., & Gorgorió, N. (2022). Supporting mathematical modelling by upscaling real context in a sequence of tasks. *Teaching Mathematics and its Applications*, 41(3), 183–197. <https://doi.org/10.1093/teamat/hrab027>
- Baumanns, L. & Rott, B. (2018). Is problem posing about posing “problems”? A terminological framework for research into problem posing and problem solving. In A. Kuzle, I. Gebel, & B. Rott (Eds.), *Proceedings of the 2018 Joint Conference of ProMath and the GDM Working Group on Problem Solving* (pp. 21–31). WTM.
- Hartmann, L.-M., Krawitz, J., & Schukajlow, S. (2021). Create your own problem! When given descriptions of real-world situations, do students pose and solve modelling problems? *ZDM – Mathematics Education*, 53(4), 919–935. <https://doi.org/10.1007/s11858-021-01224-7>
- Robinson, A. W. (2008). Don’t just stand there – teach Fermi problems! *Physics Education*, 43(1), 83. <https://doi.org/10.1088/0031-9120/43/01/009>

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Thank you!

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