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THE EFFECT OF CONTEXT ON PERCEIVED COGNITIVE LOAD AND STUDENTS' ACHIEVEMENTS IN THE PROBLEM SOLVING TASKS IN PRIMARY SCHOOL CHEMISTRY TEACHING

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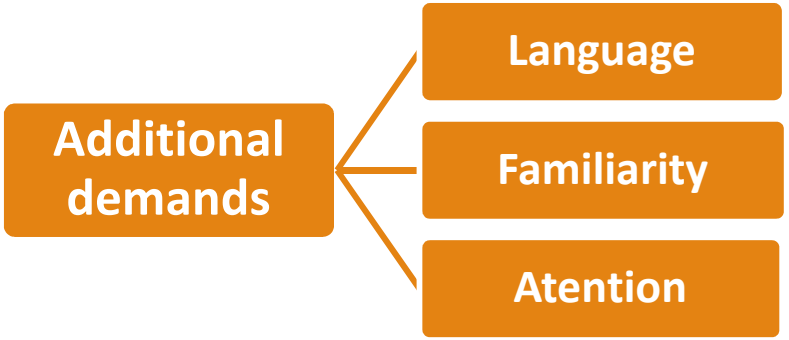
Context-rich problems

1. Increment of students' motivation

2. Concretization of teaching materials



Ahmed & Pollitt, 2007

Aim of the research

The aim of of this research was to examine the effect of context on students' achievements as well as on perceived cognitive load

Participants

161 primary school students

Instrument

- Test for evaluation of knowledge
- Seven point Likert-type scale for evaluation of perceived cognitive load, measured as subjective assessment of mental effort

Test

Tasks belonged to the teaching topic Solutions and solubility and were designed in three levels of the context complexity:

- Tasks without context

  Contain no important additional information

- Tasks with moderate context

  Number of important additional information varies from two to three

- Context-rich tasks

  Number of important additional information varies from four to six

Iresspective of the complexity of the context, tasks are solving in the same manner and by the same procedure

Example

Task without context

What is the mass percentage of a sugar in solution that is created by adding 10 grams of sugar to 400 g of 25% solution of sugar?

Task with moderate context

Mannitol is a sugar alcohol which is highly-soluble in water. In emergencies, when it is needed to quickly lower the elevated pressure in the brain of patients, they should be given a 10% aqueous solution of mannitol. In 200 g of 5% mannitol solution, 20 g of pure mannitol is added. Is the mass percentage of the resulting solution higher or lower than the one which is commonly used for therapeutic purposes?

Context-rich task

Mannitol is a sugar alcohol, highly-soluble in water. It is found in a wide variety of natural products, particularly in the juice of the plant ash and some algae. It is used in medicine as a 10% aqueous solution and it is given in emergency situations, through infusion to the patients with high blood pressure in the brain. Could the mannitol solution, obtained by adding 9 g of pure mannitol to 150 g of a 5% aqueous solution, be used for therapeutic purposes?

Results and discussion

Descriptive statistics

Table 1. *Descriptive statistic for test and subtest achievements and perceived cognitive load*

	T(a)	T(cl)	S_1(a)	S_1(cl)	S_2(a)	S_2(cl)	S_3(a)	S_3(cl)
Min	0	1	0	1	0	1	0	1
Max	100 %	7	33.33 %	7	33.33 %	7	33.33 %	7
Average	62.28 %	3.79	70.68 %	3.47	59.17 %	3.86	57.17 %	4.03
SD	5.90	1.30	1.99	1.33	2.16	1.36	2.08	1.33

ANOVA

Achievements P = 0.0009 (<0.05) → **Statistically significant**

Perceived CL P = 0.0001 (<0.05) → **Statistically significant**

Table 2. *Results of Tukey test*

	A	CL	A	CL	A	CL
Contrast	**S1–S2**		**S1–S3**		**S2–S3**	
Difference	0.6832*	0.7391*	0.8075*	0.8944*	0.1242	0.1552

A-achievement; CL-perceived cognitive load; *- statistically significant difference

Simple regerssion analysis

Achievement — Perceived cognitive load

Table 3. *Parameters of the regression analysis*

	Correlation coefficient	Equation of the regression analysis
T	– 0.68	a=1.32–0.18·cl
S1	– 0.80	a=1.37–0.19·cl
S2	– 0.53	a=0.98–0.10·cl
S3	– 0.16	a=0.91–0.08·cl

- Additional cognitive demands
- PISA results for students' performance in reading
- Poor functional literacy

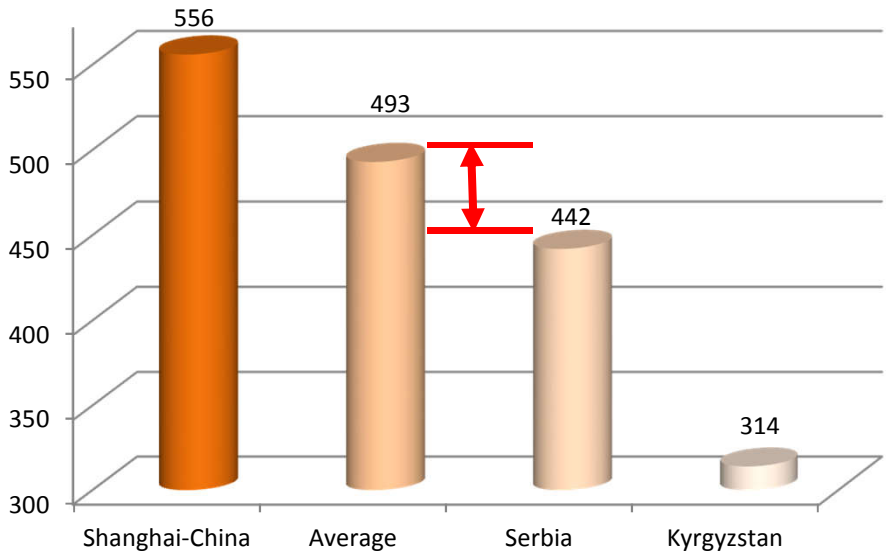


Fig 1. *Extract from PISA 2009 results*

- The lowest performance in category ***Reflect and evaluate*** where students are supposed to stand back from a text and relate it to their own experience

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Summary

- Effect of context on student's achievements
  The higher is complexity of context the lower is achievement

- Effect of context on student's perceived cognitive load
  The higher is complexity of context the higher is perceived cognitive load

- Relationship between students' achievements and perceived cognitive load
  Linear relationship (correlation coefficient decreases with the growing complexity of the context)

Implications

It should be examined how the ability of functional reading affects the solving of context-rich tasks

Acknowledgement

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Thank you for your attention

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