



LATVIJAS
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Analytical competences and positioning - experiences and results from Latvia

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The goal of the study

To make an investigation into the relationship between pupils' performances in mathematics and their beliefs and positioning as doers of mathematics in lower-secondary classrooms in Latvia as a starting point for the future joint comparative study.

The research questions

1. What is the relationship between pupils' performances in mathematics and their beliefs in Latvia (grade 9) like?
2. What is the relationship between pupils' performances in mathematics and their positioning as doers of mathematics in Latvia (grade 9) like?
3. What is the relationship between pupils' beliefs and their positioning as doers of mathematics in Latvia (grade 9) like?

- **‘Analytical competence’** refers to *being a doer of mathematics* (Cobb, Gressalfi & Hodge 2009);
- **Beliefs** as a *phenomenon* or as a *situated process and action* (Schoenfeld 1985 and 1992; Goldin 2002; Goldin et al. 2009; Leder et al. 2002; Kislenko et al 2007; Maass and Schlöglmann 2009; Perrenet & Taconis 2009);
- Concept of **positioning** (Davies & Harré 1990) as a *basic component* in the understanding, describing and planning of *classroom activities and interactions* (Wagner & Herbel-Eisenmann 2009).



Research methodology

- Voluntary participants of urban schools –
343 pupils from lower-secondary (grade 9)
16 classrooms of different types of schools.
- 231 girls and 112 boys.

Project design on the national level:

- Performance of internal assessment
- Semi- structured interview:
 - 1) *What is mathematics?*
 - 2) *What is mathematical thinking?*
 - 3) *How to solve a mathematical problem?*
- *Six pupils (two from each level group) were interviewed by the researchers;*
- Interviews were transcribed;
- Analysis of written responses and interviews;
- Performance of external assessment.
- Beliefs and positioning of collected data were related with pupils' performances.

Research stages

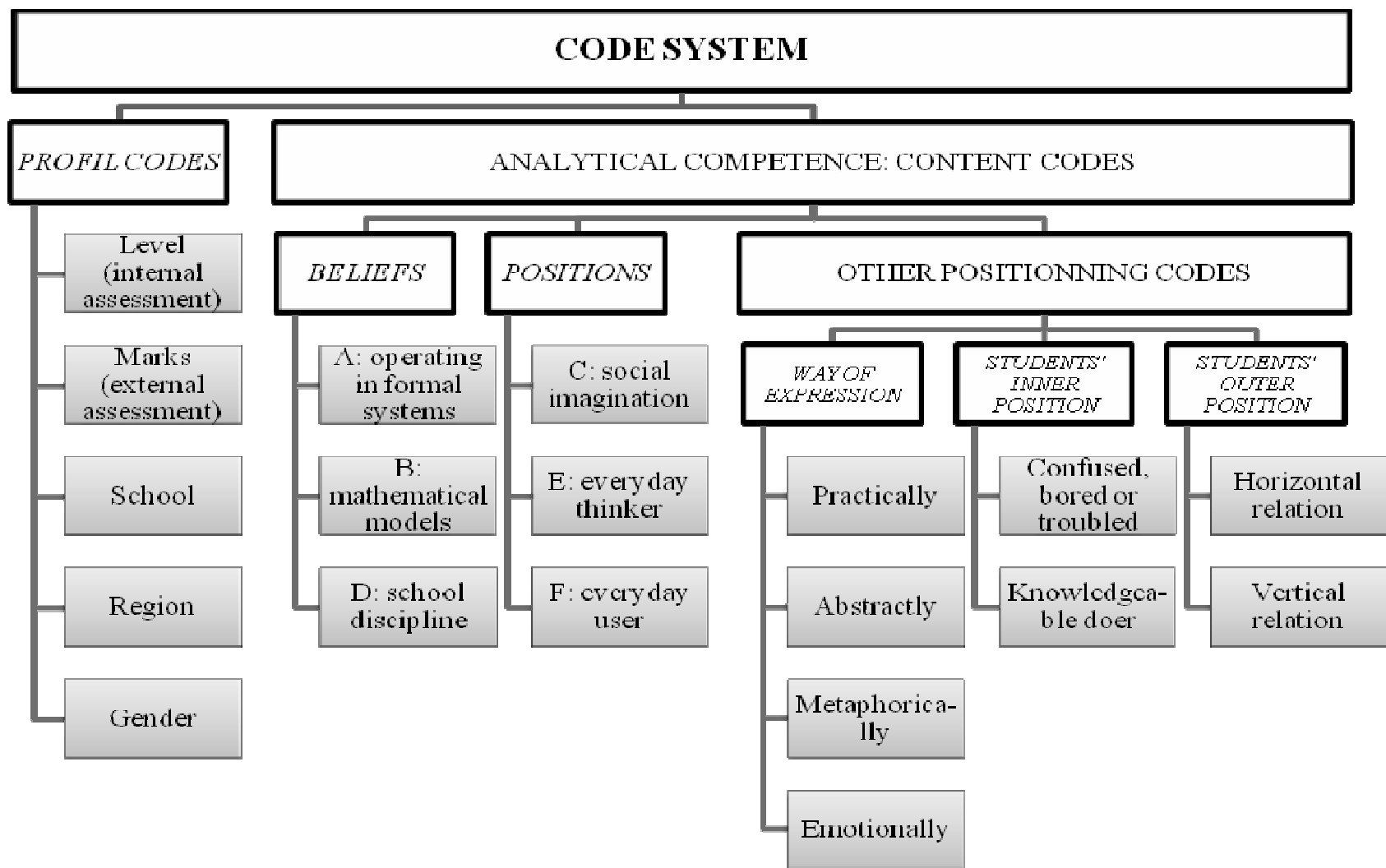
- A semi-structured interview for qualitative and the performance assessment of mathematics for quantitative data collection – **spring, 2010;**
- Primary and secondary qualitative and quantitative data processing - **summer, 2010;**
- Data analysis and interpretation -**autumn, 2010**

Primary and secondary qualitative data processing

Qualitative data processing

- coding of notes,
- metacoding,
- finding of linkages, implicants and
- interpretation was done implementing *AQUAD 6 software*.

The statements were coded according to the structural components of analytical competence:



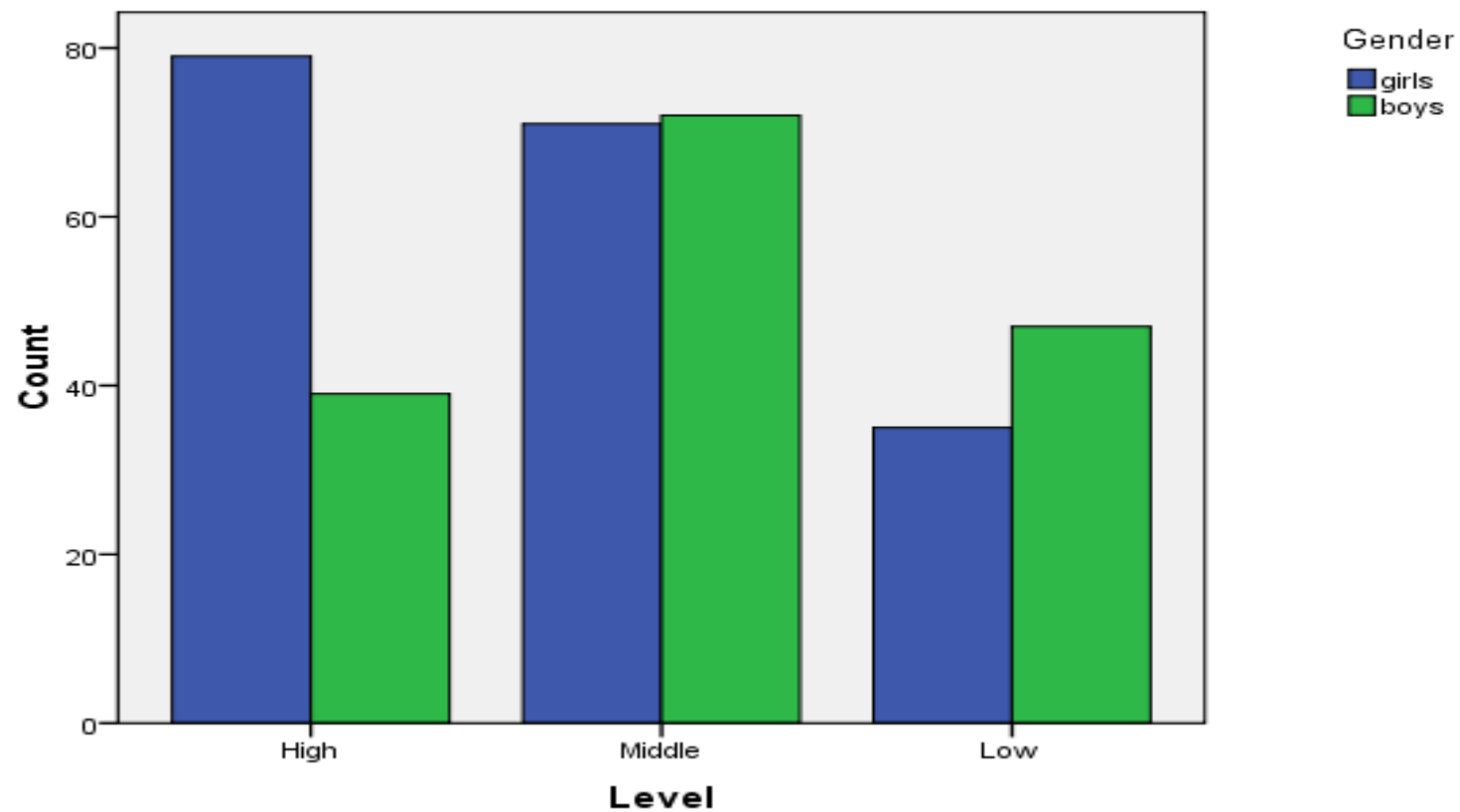
- **Primary data analysis** was done implementing **descriptive statistics** (analysis of frequencies, central tendency, variability, crosstabs).
- **Secondary data processing** was done taking into account the exact sample, **non-parametric statistical methods** were used (Spearman's rank correlation coefficient, Kolmogorov-Smirnov Z test), etc.

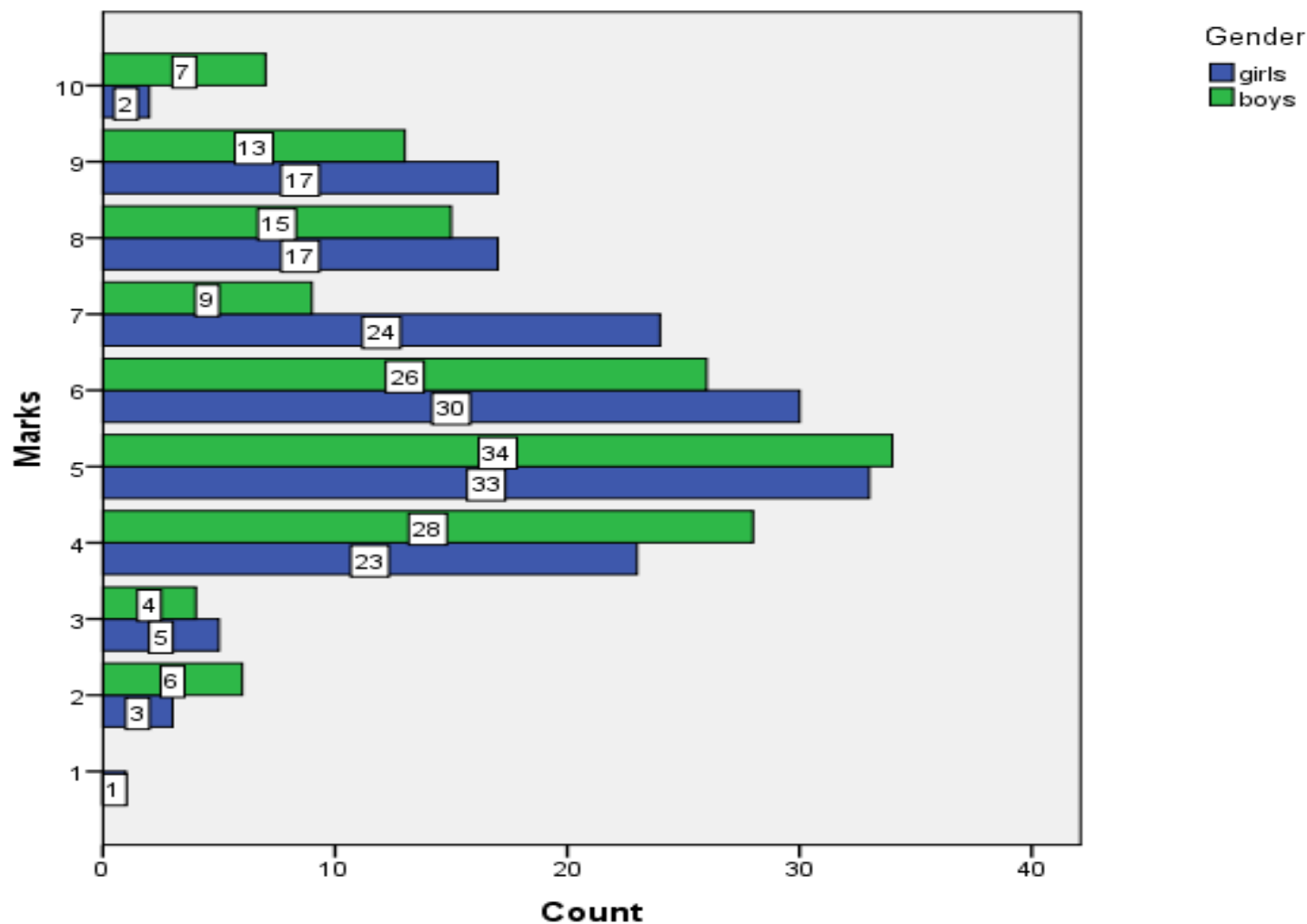


1. What is the relationship between pupils' performances in mathematics and their beliefs in Latvia (grade 9) like?

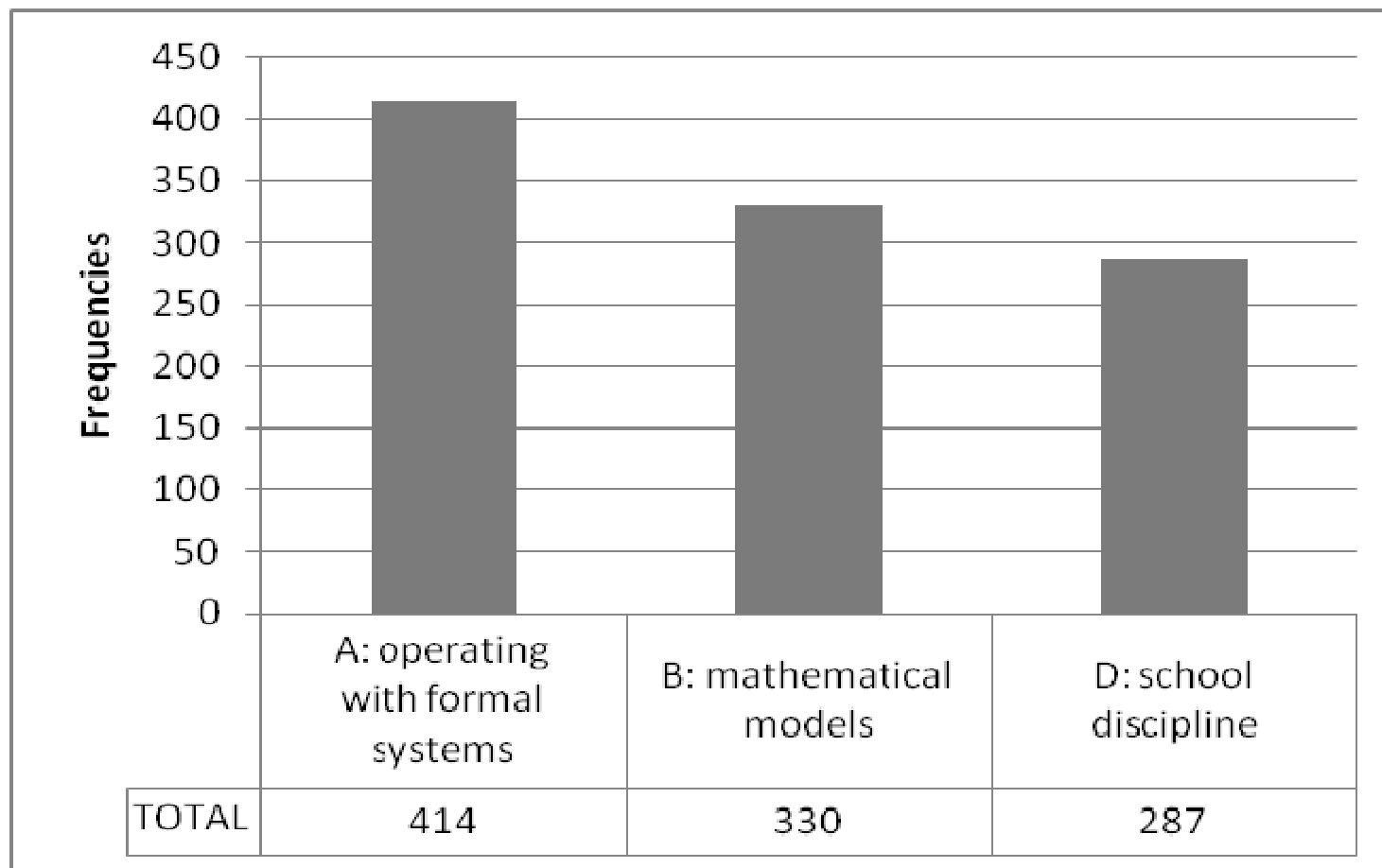


Internal assesment





Frequencies of beliefs



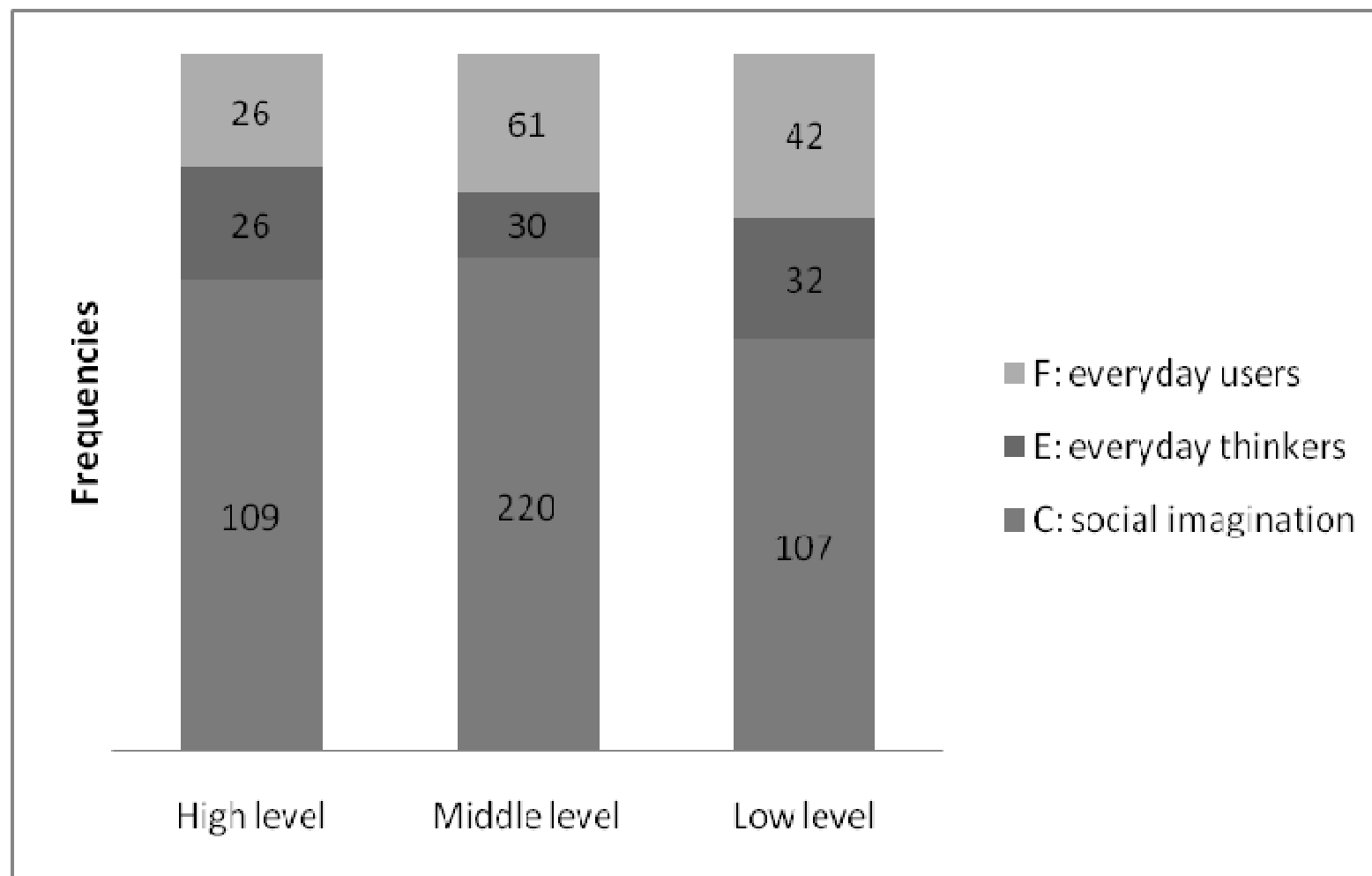
Spearman rank correlation among internal (level), external assessment (marks), gender and beliefs conceptual codes

Codes	Level	Marks	Gender	Bel_A_op_f orm_syst	Bel_B_cre at_models	Bel_D_ma th_school
Level	1	-,68**	,19**	-,29**	-,03	,25**
Marks	-,68**	1	-,05	,18**	,03	-,23**
Gender	,19**	-,05	1	-,17**	-,12*	,02
Bel_A_op_ form_syst	-,29**	,18**	-,17**	1	-,05	-,09
Bel_B_crea t_models	-,03	,03	-,12*	-,05	1	,30**
Bel_D_mat h_school	,25**	-,23**	,02	-,09	,30**	1

* p<0.05; ** p<0.01 Asymp. Sig. (2-tailed)



2. What is the relationship between pupils' performances in mathematics and their positioning as doers of mathematics in Latvia (grade 9) like?



Pupils whose position is that of
Knowledgeable doer express
themselves practically .

Highly performing pupils consider
mathematics as a game:

*“Mathematics for me is as a game of
figures, if you know how to play this game,
then you can apply, use*

*the figures and calculate as
necessary and you can satisfy yourself that
you can do it and you are maybe higher than
others, because you can do the task but others
can't. Sometimes it is difficult.”*

Middle performing pupils demonstrates what has been learnt in tasks, as well as the pupil thinks of its application in everyday life:

“Thinking, to compile everything as it is, to do everything right. Step by step as in the tasks, as one incorrect step can spoil everything, change the result. It is.....

you get concentrated on the task, think about figures, think that you will solve it and how, and in what way, like a stitch, you continue and continue and continue pick up a stitch, then the next, see the relations in some task.”

A low performing pupil reveals that he/she finds that the teacher initiates solving of mathematical problems and the acquired abilities are applied in everyday life:

It depends on the pupil, in fact, the teacher gives mathematical formulae and ... we can sit at them as long as we solve the problem.”

“this is clear now that what we learn at school, it is the fundamentals, which remain in any case as the same problem solving approaches are used both in everyday life and at school ... They do not change at once, if I have learnt it at school, for example, I sum in a column, then I don't know at home in everyday life I do not do it in a different way, well maybe I use a calculator.”

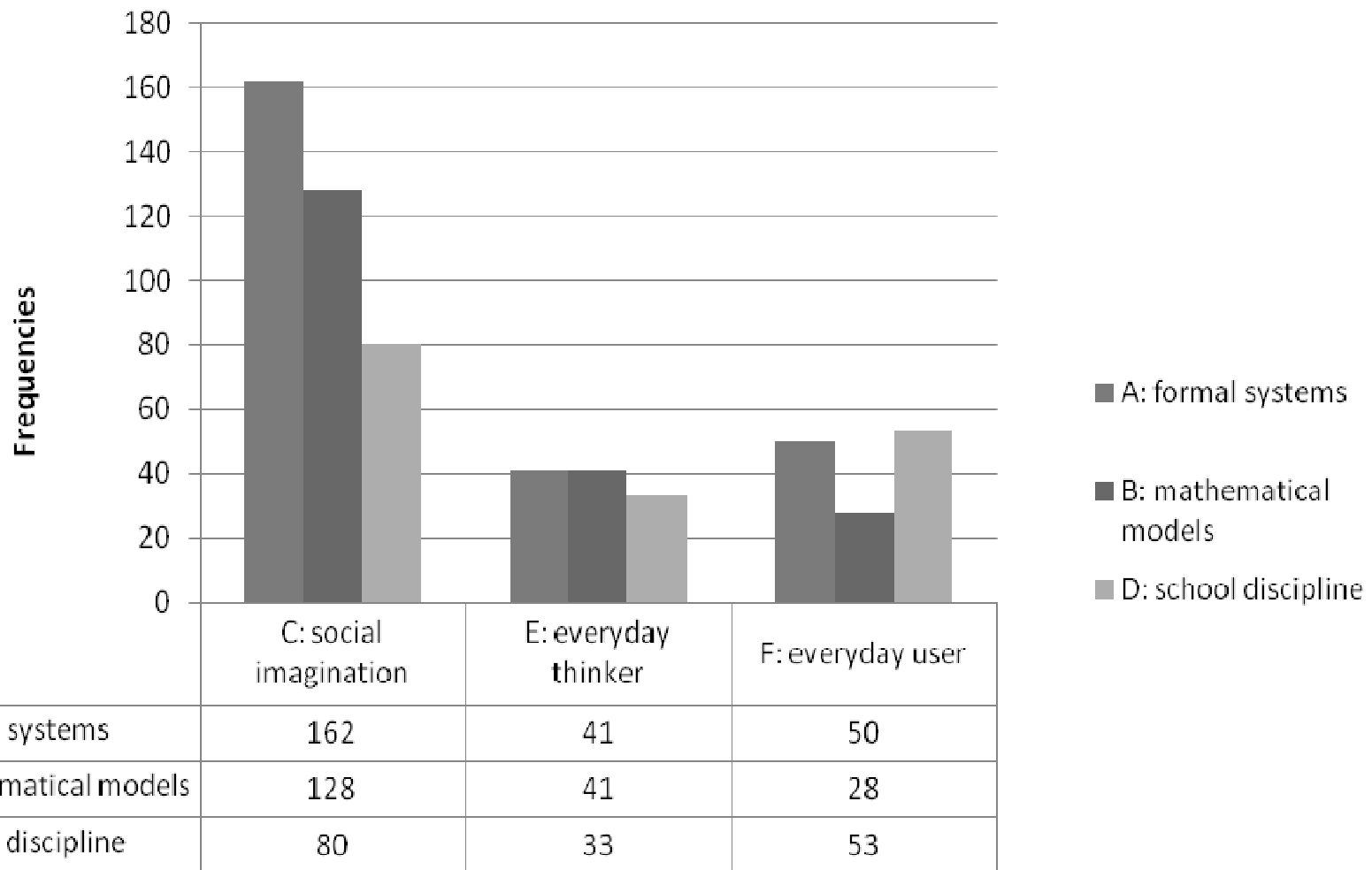
*Spearman rank correlation among the
internal (level), external assessment
(marks) and position conceptual codes*

Codes	Level	Marks	Pos_C_imag_thinker	Pos_E_everyday_thinker	Pos_F_everyday_user
Level	1	-.68**	-.12*	.07	.03
Marks	-.68**	1	.09	-.03	-.14**
Pos_C_imag_thinker	-.12*	.09	1	.04	.05
Pos_E_everyday_thinker	.07	-.03	.04	1	.05
Pos_F_everyday_user	.03	-.14**	.05	.05	1

p<0.05; ** p<0.01 Asymp. Sig. (2-tailed)



3. What is the relationship between pupils' beliefs and their positioning as doers of mathematics in Latvia (grade 9) like?



Spearman rank correlation among the beliefs and position conceptual codes

Codes	Bel_A_op_ form_syst	Bel_B_ creat_ models	Bel_D_ math_ school	Pos_C_ imag_ think_ er	Pos_E_ everyday_ thinker	Pos_F_ everyday_ user
Bel_A_op_ form_syst	1	-.05	-.09	-.05	-.15**	-.04
Bel_B_ creat_ models	-.05	1	.30**	-.01	.16**	-.08
Bel_D_ math_ school	-.09	.30**	1	-.12*	.01	.04
Pos_C_ imag_ thinker	-.05	-.02	-.12*	1	.04	.05
Pos_E_ everyday_ thinker	-.15**	.16**	.01	.04	1	.05
Pos_F_ everyday_ user	-.04	-.08	.04	.05	.05	1

p<0.05; ** p<0.01 Asymp. Sig. (2-tailed)



Unexpected findings: internal and external assessment and interpersonal positioning

Codes	Level	Marks	Gender	Exp_rel_H	Exp_rel_V	PKnow_d_o	P_Conf_tr_bor
Level	1	-.68**	.19**	-.12*	.06	-.06	.23**
Marks	-.68**	1	-.05	.01	-.14**	.06	-.23**
Gender	.19**	-.05	1	-.03	-.03	.02	.02
Exp_rel_H	-.12*	.01	-.03	1	.36**	-.01	.15**
Exp_rel_V	.06	-.14**	-.03	.36**	1	-.10	.52**
PKnow_do	-.06	.06	.02	-.01	-.10	1	-.08
P_Conf_tr_bor	.23**	-.23**	.02	.15**	.52**	-.08	1

p<0.05; ** p<0.01 Asymp. Sig. (2-tailed)

1. The higher level performing pupils more believe that mathematics is about *operating in formal systems and processes*; they mention less that mathematics is *a school discipline*.

2. Internal and external assessment of performance allows concluding that *the lack of personal imaginative positioning* is characteristic of the lower level performing pupils. The pupils' position as *everyday thinkers* in mathematics has significant relationship with low external assessment.

3. The more pupils position themselves as *imaginative* thinkers or doers having a personal way of understanding or dealing with mathematics, the less they have the belief that mathematics is a *school discipline*.

4. Boys had lower internal assessment and they less mentioned their beliefs, but girls more mentioned their beliefs that mathematics is about operating in formal systems and processes, and that mathematics is about creating, comparing and checking models.

5. Higher level performing pupils more express *themselves in horizontal relationship*, but pupils, who had lower external assessment more express *themselves in vertical relationship*.

Analytical competence refers to *being a doer of mathematics*,

it is characteristic for this competence that the pupils believed that mathematics is about **operating in formal systems**, but not a school discipline, they positioned themselves as **imaginative thinkers or doers** having a personal way of understanding or dealing with mathematics, they *did not express* themselves abstractly when speaking about mathematics, but they had **practical expressions** about how to use mathematics in everyday contexts or in school-related work, they express the use of **collaborative work** with other pupils.

Thank you for attention!

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