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The Role of Content and Context in PISA Interest Scales

A study of the embedded Interest Items in the
PISA 2006 Science Assessment

PISA Research Conference

Kiel, 14 September 2009

Overview

- The role of interests in learning processes
- Why embedded interest measures?
- Research Questions
- Results
 - Disaggregating Science Interest
 - Results for OECD countries
- Summary and Discussion

Overview

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The role of interests

Interests

- ... play an important role in initiating, steering, and retaining learning activities
- ... thus are, along with other attitudinal components, part of Scientific Literacy

A person's scientific literacy includes certain attitudes, beliefs, motivational orientations, sense of self-efficacy, values, and ultimate actions (OECD, 2006, p.35)

- ... have been conceptualized as a phenomenon that emerges from a person's interaction with an object or a certain content (Krapp, 1992)
- ... needs to be studied with regard to contexts, application situations and contents (Krapp 2002)

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Why embedded interest measures?

“Embedded”

... in the context of 18 (out of 37) science units in the Science Test

... in the context of a number of systematically differentiated contents

... in the PISA test situation after students have worked on the cognitive Items

... in a number of topics, objects and activities students have been confronted with just before

... in concrete examples from scientific contexts, aspects of scientific knowledge and competencies

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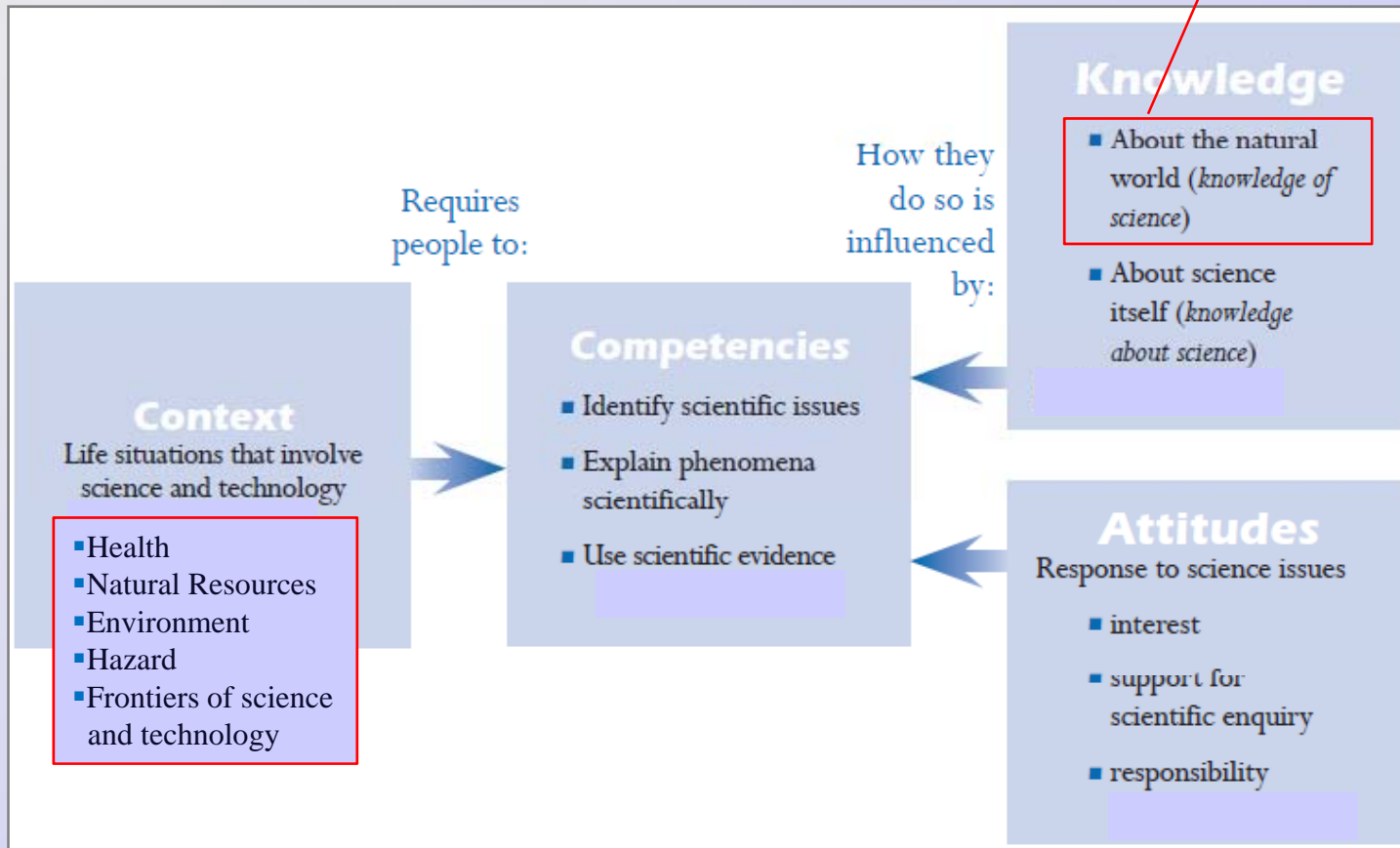
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Why embedded interest measures?

Components of Scientific Literacy



- Living Systems
- Physical Systems
- Technology Systems
- Earth and Space Systems

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Framework for the PISA Science Assessment (OECD, 2006, p. 26)



An Example

SCIENCE UNIT 6

Tobacco Smoking

Tobacco is smoked in cigarettes, cigars and pipes. Research shows that tobacco-related diseases kill nearly 13 500 people worldwide every day. It is predicted that, by 2020, tobacco-related diseases will cause 12% of all deaths globally.

Tobacco smoke contains many harmful substances. The most damaging substances are tar, nicotine and carbon monoxide.

Question 6.1

Tobacco smoke is inhaled into the lungs. Tar from the smoke is deposited in the lungs and this prevents the lungs from working properly.

Which one of the following is a function of the lungs?

- A. To pump oxygenated blood to all parts of your body
- B. To transfer some of the oxygen that you breathe to your blood
- C. To purify your blood by reducing the carbon dioxide content to zero
- D. To convert carbon dioxide molecules into oxygen molecules

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An Example

Question 6.4

Various methods are used to influence people to stop smoking.
 Are the following ways of dealing with the problem based on *technology*?
 Circle "Yes" or "No" in each case.

Is this method of reducing smoking based on technology?	Yes or No?
Increase the cost of cigarettes.	Yes / No
Produce nicotine patches to help make people give up cigarettes.	Yes / No
Ban smoking in public areas.	Yes / No

Question 6.5

How much interest do you have in the following information?
 Tick only one box in each row.

	High Interest	Medium Interest	Low Interest	No Interest
a) Knowing how tar in tobacco reduces lung efficiency	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
b) Understanding why nicotine is addictive	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
c) Learning how the body recovers after stopping smoking	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

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Research Questions

- Can Interest in Science be analyzed disaggregated with regard to specific components of Scientific Literacy (Contexts or Areas of Scientific Knowledge)?
- How are the disaggregated interests distributed with regard to country, gender, and science performance?
- Can we identify profiles of interests?

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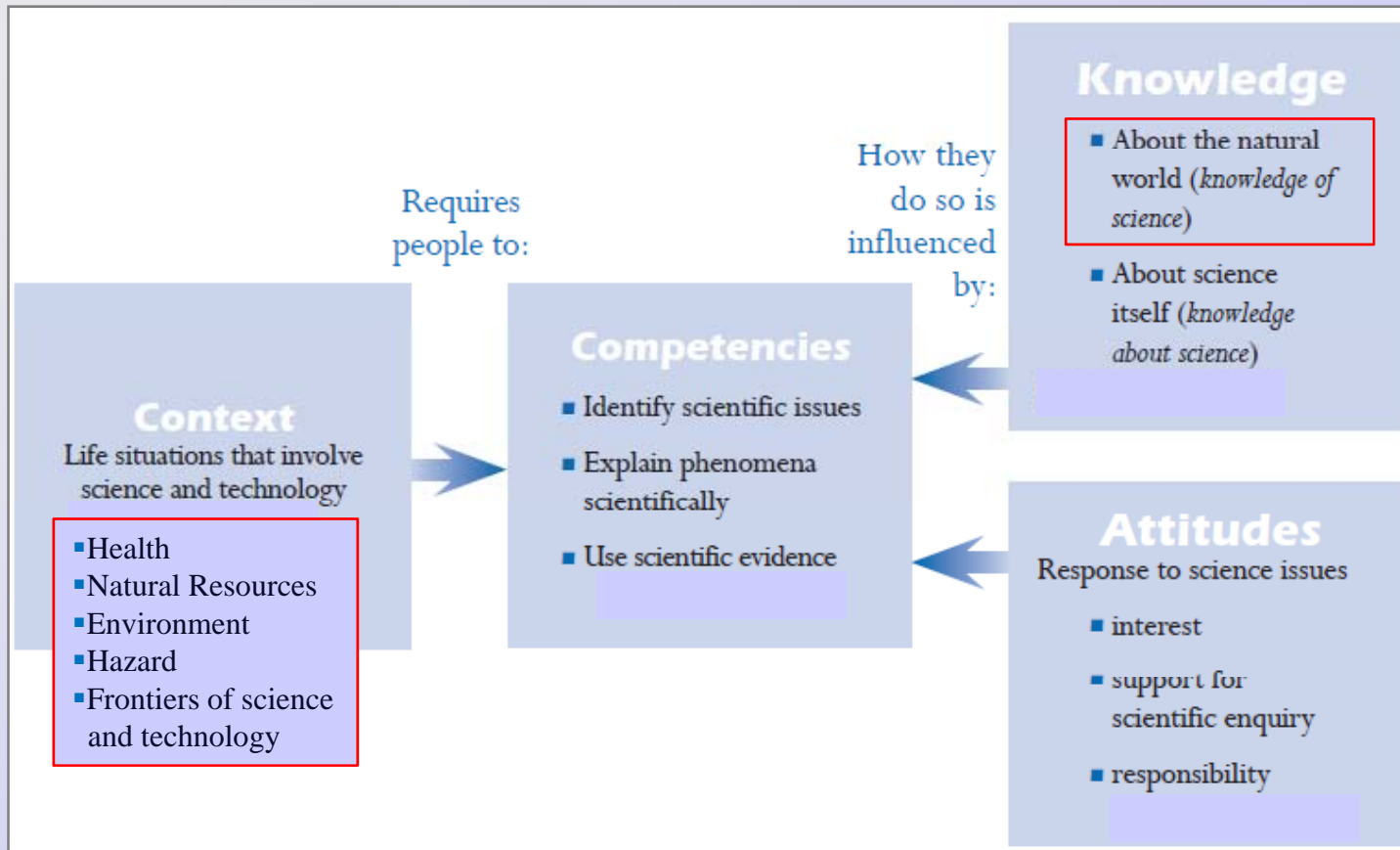
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Disaggregating Science Interests

Components of Scientific Literacy



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Disaggregating Science Interests

- Reorganisation of *Knowledge of Science*-Categories

Categories of <i>knowledge of science</i>	N of Items
Living Systems	24
Physical Systems	11
Technology Systems	9
Earth and Space Systems	5
not assigned to a category	3



Interest <i>Contents</i>	N of Items
Living Systems	30
Physical /Technology Systems	22

- Two-dimensional scaling of 52 Interest Items from 18 Science Units along specific contents of interest

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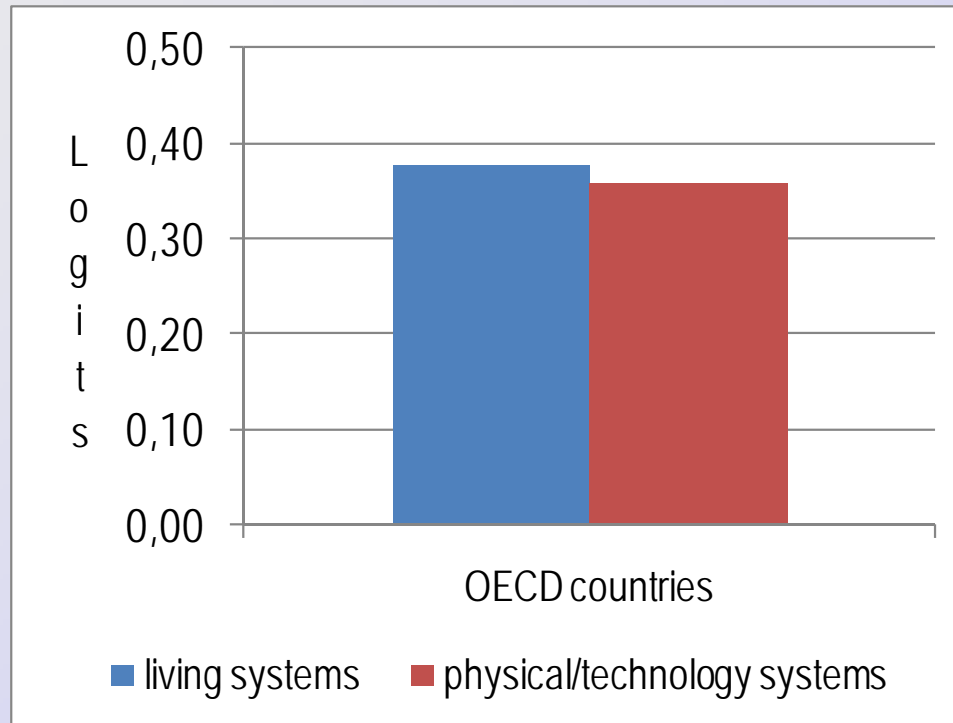
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Disaggregating Science Interest



Std. Dev.	OECD countries
Living Systems	1,57
Physical/Technology Systems	1,58

$$r_{\text{interest living systems, interest physical / technology systems}} = 0.80$$

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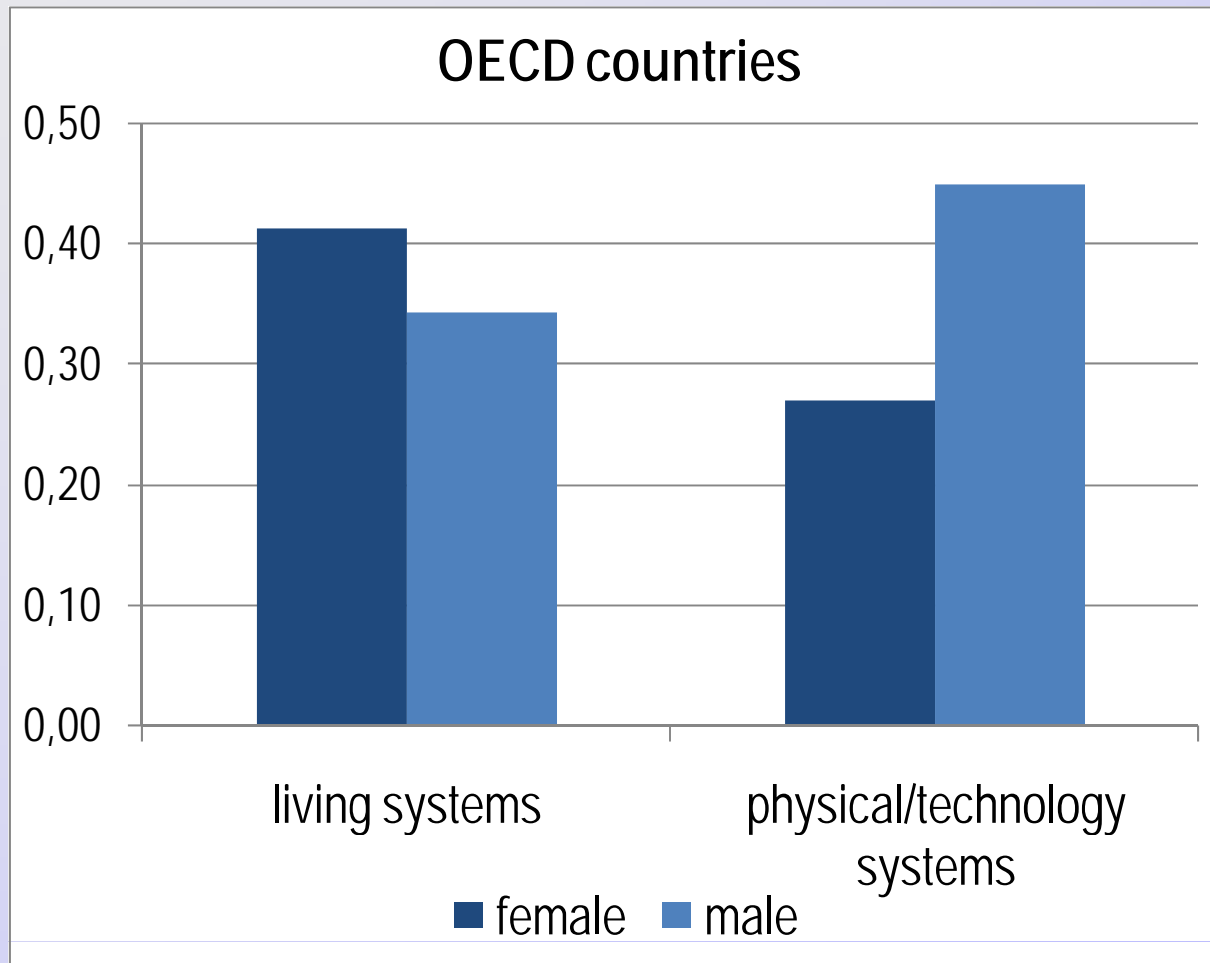
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Disaggregating Science Interest



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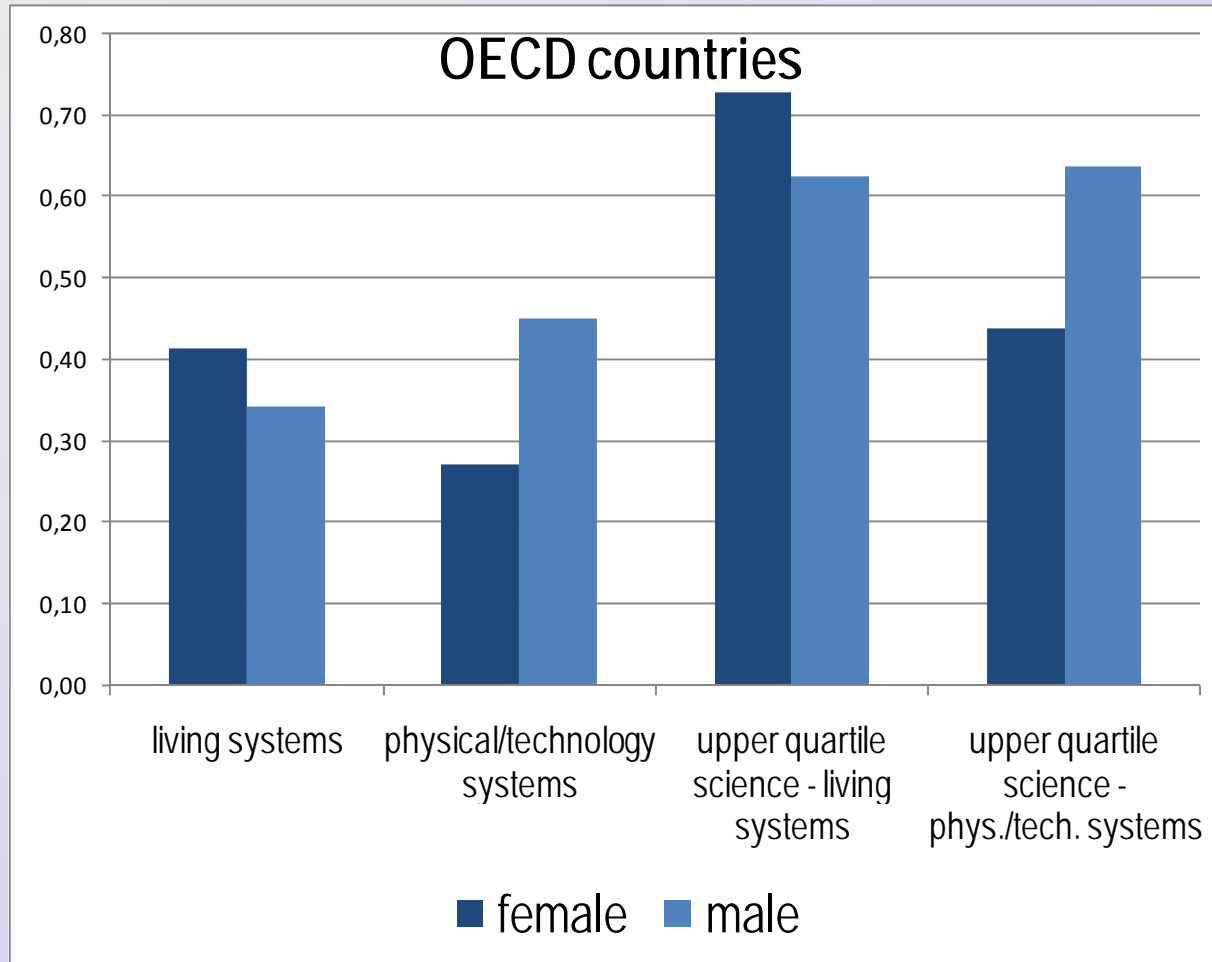
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Disaggregating Science Interest



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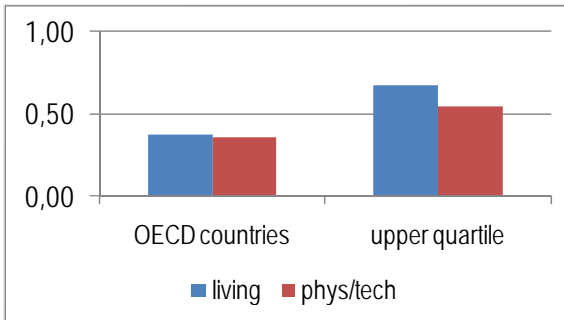
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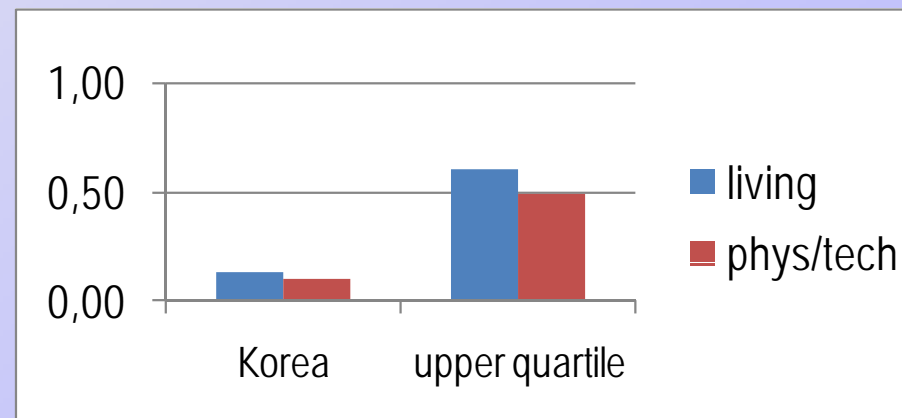
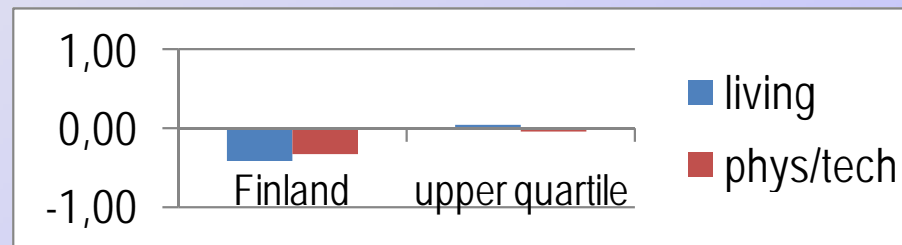
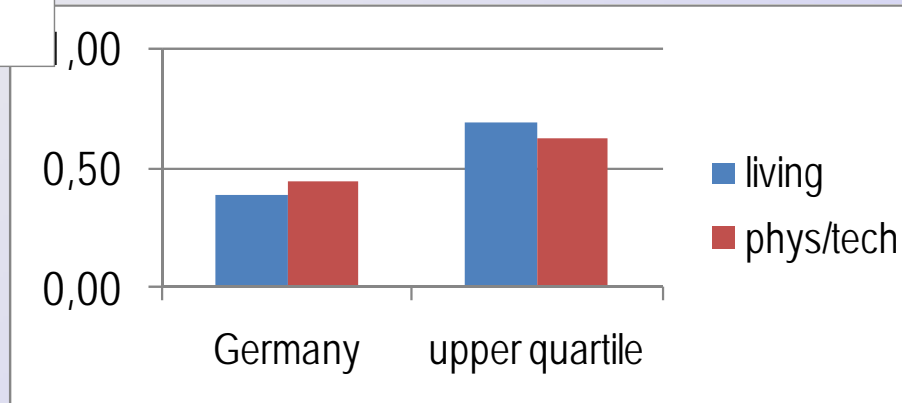
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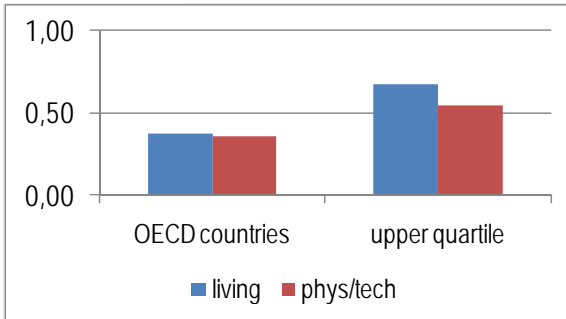
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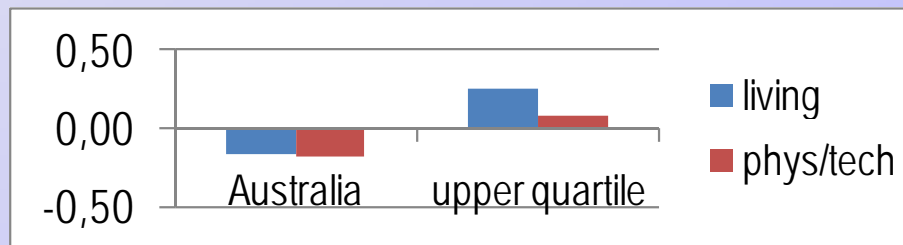
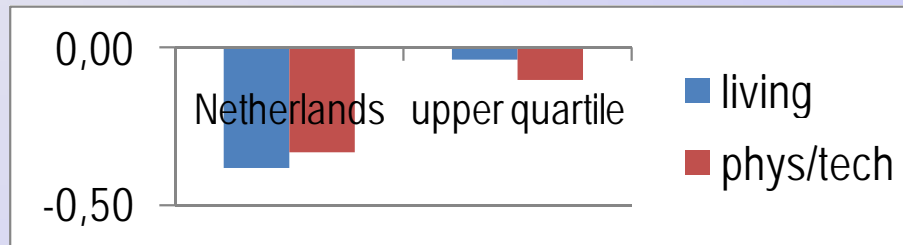
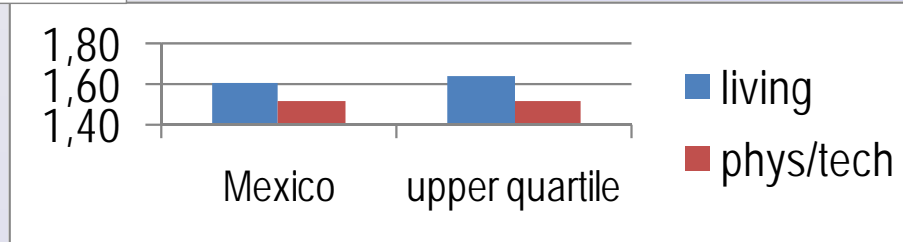
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Interest Profiles

Interest Profiles for selected countries (Mediansplit within OECD)

	Interest profiles in %				
	living ↓ phys/tech ↓	living ↓ phys/tech ↑	living ↑ phys/tech ↓	living ↑ phys/tech ↑	Ratio
OECD countries	45,0	5,0	5,0	45,0	1,00

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- Embedded interest measures seem to be appropriate to disaggregate interests and to draw a more precise picture of students' motivational situation.
- Science interest in PISA 2006 can be studied along the knowledge categories *living systems* and *physical/technology systems*.
- Differences are found for boys and girls, for different performance levels and for countries.
- Interest profiles along the two dimensions can be built on a country level in order to find out about learning preferences resp. about the need to foster interests.

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- Is the science test living systems oriented? Is this a problem for measuring interests?
- Small number of interest items, distributed over a complex multi-matrix-design does not support the analysis of further interest dimensions and their interrelations
- Should be thought of for future test constructions
- Further analyses
 - more precise description of the *profiled* interest groups (gender, science performance, performance subscales, HISEI)
 - Comparison with the traditional interest questionnaire data

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