Qualities and Effects of Teaching

Integrating findings across subjects and cultures

Eckhard Klieme
Deutsches Institut für Internationale Pädagogische Forschung

EARLI Sig Educational Effectiveness
Zurich, August 23, 2012

Qualities and Effects of Teaching

Towards a Conceptual Theory of Teaching

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Outline

1. „Quality talk“ in didactics and emprical research *(F,E)*
2. Qualities of Teaching: Finding a „latent“ structure by abduction (based on TIMSS-Video/Germany) *(D)*
3. Theoretical foundation for three „Basic dimensions of teaching quality“ *(C,B)*
4. Empirical Support for the latent structure of teaching (Oberservations, student perceptions)
5. Effects of teaching (Multi-level analysis of longitudinal data)
6. Application to international data sets (TALIS, PISA „2011“): Observable (OTL, practices) vs latent structure; dimensions vs. profiles vs. hierarchies; cultural differences

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Ways to talk about teaching, I: Didactics → Marketing of specific approaches to the „art“ of teaching

„ Interest in **student-centered learning** and **learner-centered design** has grown dramatically. The emergence of varied teaching-learning frameworks, coupled with technological developments such as the World Wide Weg, has made possible approaches that were heretofore impossible, infeasible, or unimaginable. **Open learning environments** (OLEs) have proven particularly intriguing.“

Hannafin, Land & Oliver, 1999

Ways to talk about teaching, II: Process-Product-Research in Educational Psychology
→ Lists / Taxonomies of „quality aspects“

1. A supportive classroom climate
2. Opportunity to learn
3. Curricular alignment
4. Establishing learning orientations
5. Coherent content
6. Thoughtful discourse
7. Practice and application activities
8. Scaffolding students' task engagement
9. Strategy teaching
10. Co-operative learning
11. Goal-oriented assessment
12. Achievement expectations

Brophy (2000)

Ways to talk about teaching, II: Process-Product-Research in Educational Psychology
→ Lists / Taxonomies of „quality aspects“

1. Appropriate expectations
2. Proactive and supportive classrooms
3. Opportunity to learn
4. Curriculum alignment
5. Coherent content
6. Thoughtful discourse
7. Scaffolding students‘ ideas and task involvement
8. Practice/application
9. Goal-oriented assessment

Good, Wiley & Florez (2009): Effective Teaching: An Emerging Synthesis.
In G. Dworkin (Eds.), International Handbook of Research on Teachers and Teaching. New York: Springer, pp. 803-816

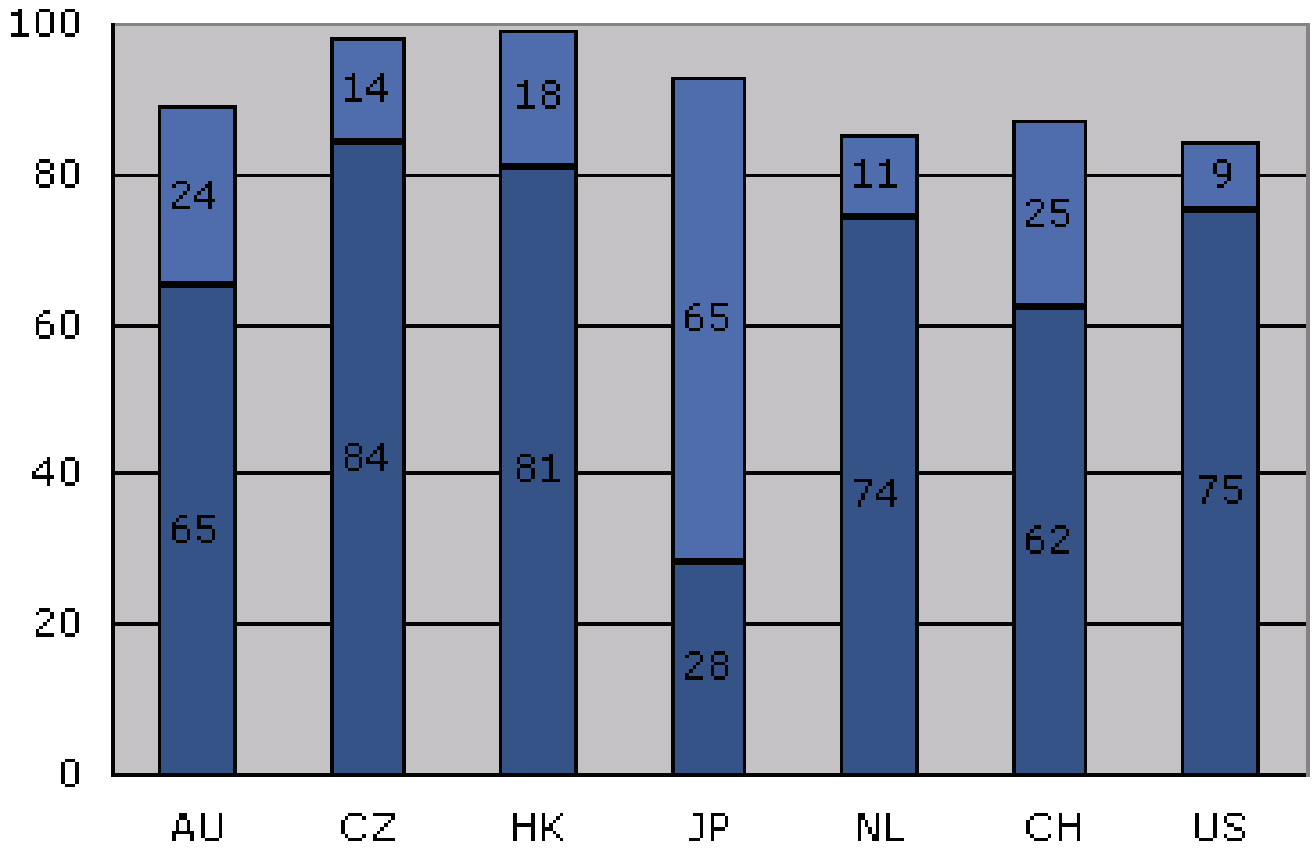
Ways to talk about teaching, III: Comparative
→Teaching as „cultural activity“

Scripts = generalized knowledge about an event that resides in the heads of participants.
These scripts guide behavior and also tell perticipants what to expect.
…learned through observation and participation.
Within a culture, these scrips are widely shared, and therefore they are hard to see.

Stigler, J. & Hiebert, J. (1999). The Teaching Gap., p. 85

Ways to talk about teaching, III: Comparative
→ Teaching as „cultural activity“

Percent of teaching time used for challenging tasks vs. practicing (TIMSS Video Study)



Ways to talk about teaching, III: Comparative
→Teaching as „cultural activity“

For Core instructional behaviors, most of the variation occurred within nations, not between nations.

Baker; D. & Le Tendre, G. (2005): The universal math teacher, p. 114

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2nd order factors of classroom practice

based on high-inference video-ratings (Clausen,Klieme & Baumert 2002)

(TIMSS-Video 1994 Germany: national sample, 100 + 86 lessons)

Structure and Classroom Management	Supportive climate	Cognitive Activation
Effective treatment of interruptions „teacher intervenes immediately, before disturbance may evolve“ Clarity of rules Interruptions (-) Waste of time (-) Monitoring Time on task Teacher Unreliability (-) **Clarity and structuredness of the Instruction**	Social orientation: „teacher takes care of his students‘ problems“ Teachers diagnostic competence with regard to social behavior **Individual reference norm in evaluation** Rate of interaction (-) Pressure on students (-)	Teacher’s ability to motivate students: „can present even abstract content in an interesting manner “ **Errors as opportunities** **Demanding tasks** Practicing by repetition (-)

Correlations with types of utterances

Structure and classroom management	Supportive climate	Cognitive activation
More public talk More teacher utterances *High proportion of teacher utterances:* Related to mathematical content Questions, especially about facts Reactions to student answers Positive evaluations	Less public talk Fewer teacher utterances *High proportion of teacher utterances* questions: describe/explain personal ideas	More public talk *High proportion of teacher utterances* related to mathematical content questions: decisions, describe/explain

Profiles for regions within Germany

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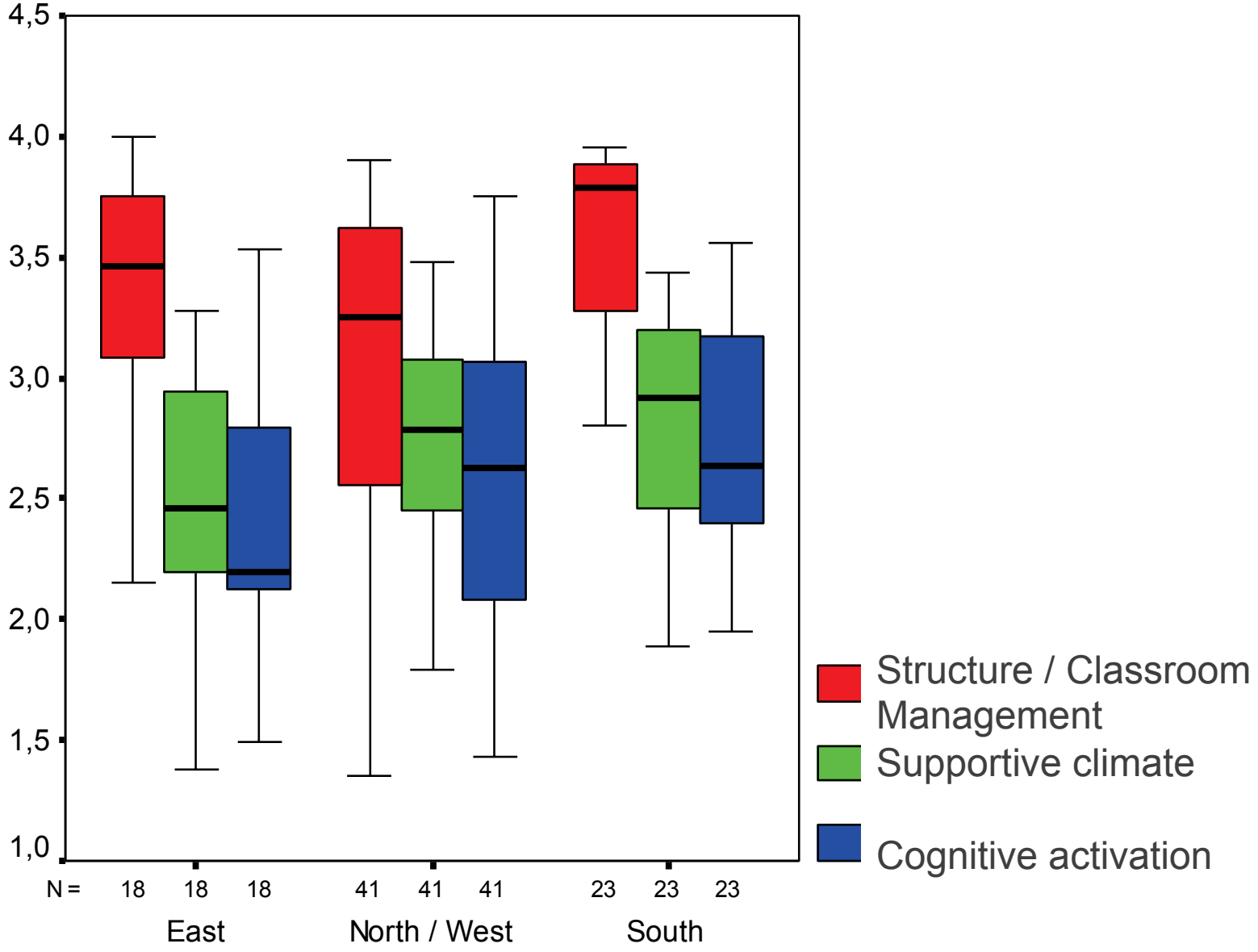
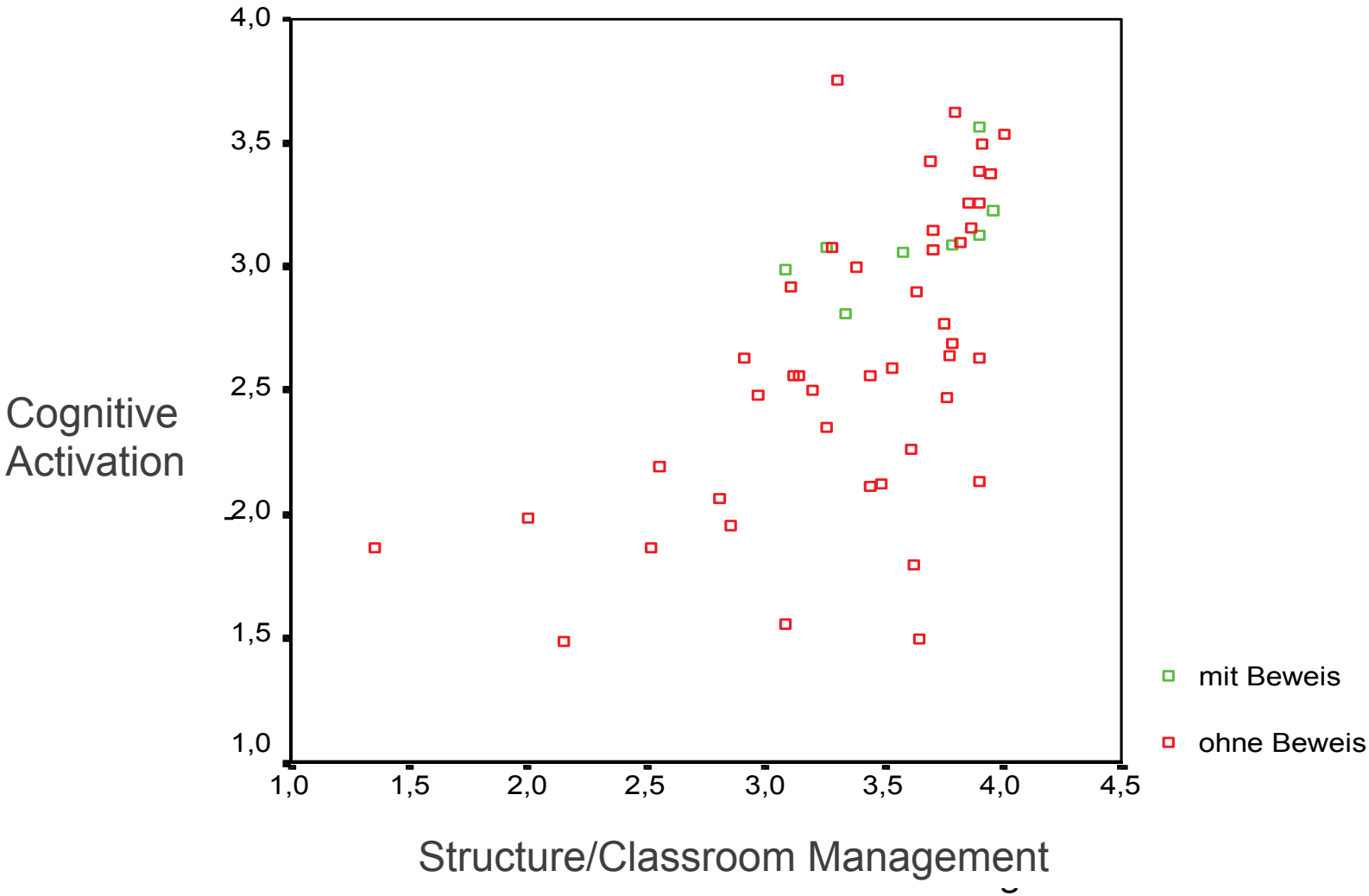


Structure/Classroom Management is a prerequisite for Cognitive Activation



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In G. Dworkin (Eds.), International Handbook of Research on Teachers and Teaching. New York: Springer, pp. 803-816

Opportunity to learn
→ available time, degree of student involvement
Curriculum alignment → visible and coherent plan
Goal-oriented assessment → focus on what is important

Proactive and supportive classrooms → caring communities
Appropriate expectations → help students to exceed

Coherent content → sufficient depth
Thoughtful discourse
Scaffolding students‘ ideas and task involvement
→ understand at a higher level)
Practice/application (→ concepts in diverse contexts)

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Historical paradigms in the theory of teaching

following Diederich/Tenorth (1997)

1. Herbart:
   well-structured course of instruction
2. Reform pedagogics:
   fostering student activity, self regulation and social embeddedness
3. Subject didactics:
   building up knowledge, understanding, and skills systematically

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Borrowing from psychological research

Process-Product-Research; Behavioral learning theory

→ **Classroom Management, Clarity & Structure**

Humanistic pedagogy and psychology;

Self determination Theory (Deci & Ryan)

→**Supportive climate & Structured learning environment**

Cognitive Theory (e.g. Brown 1997, Mayer 2004);

concepts from (moderate) constructivism

→ **Cognitive Activation & Deep Content**

Hypothesis

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- Structure/Classroom Management,
- Support and
- Challenge/Cognitive Activation

are basic qualities of teaching that encompass the „latent“ structure of (good ?) teaching in a non-redundant way. .

These dimensions may be related to observable features (practices, methods, types of utterances and interactions), but they are not reducible to any of those.

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Creemers & Kyriakides (2008)

The dynamic model of educational effeciveness

Classroom level factors

Overarching: „Management of time“ (-> Classroom Management)

Overarching: „Classroom as a learning environment“ (-> Support)

Specific factors:

Structuring – Orientation – Assessment (-> Structure/CM)

Modelling – Application – Questioning (-> Cogn. Activation)

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Klieme, Pauli & Reusser (2009): „Pythagoras“ study.

High Inference Ratings by Rakoczy & Pauli

	Cognitive Activation	Autonomy	Support	Class Manag
Challenging problems	,876			
Developing ideas from student conceptions	,718			
teacher delivering knowledge	-,714			
cooperative learning	,660	,527		
taking up student thinking styles	,609			
taking up pre-knowledge	,595			
content made relevant for students	,511			
student responsibility		,858		
individualized instruction		,856		
students can choose among alternatives		,835		
constructive feedback			,795	
Teacher support			,788	
learning from mistakes			,722	
preventing disruptions				,956
disciplinary problems				-,955

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Pianta & Hamre: Classroom oberservation scales.(CLASS)

- Classroom organization
- Emotional support
- Instructional support

Tschannen-Moran, M. & Woolfolk Hoy, A. (2001):

Ohio teacher efficacy scales (OSTES)

- Efficacy for classroom management
- Efficacy for student engagement
- Efficacy for instructional strategies

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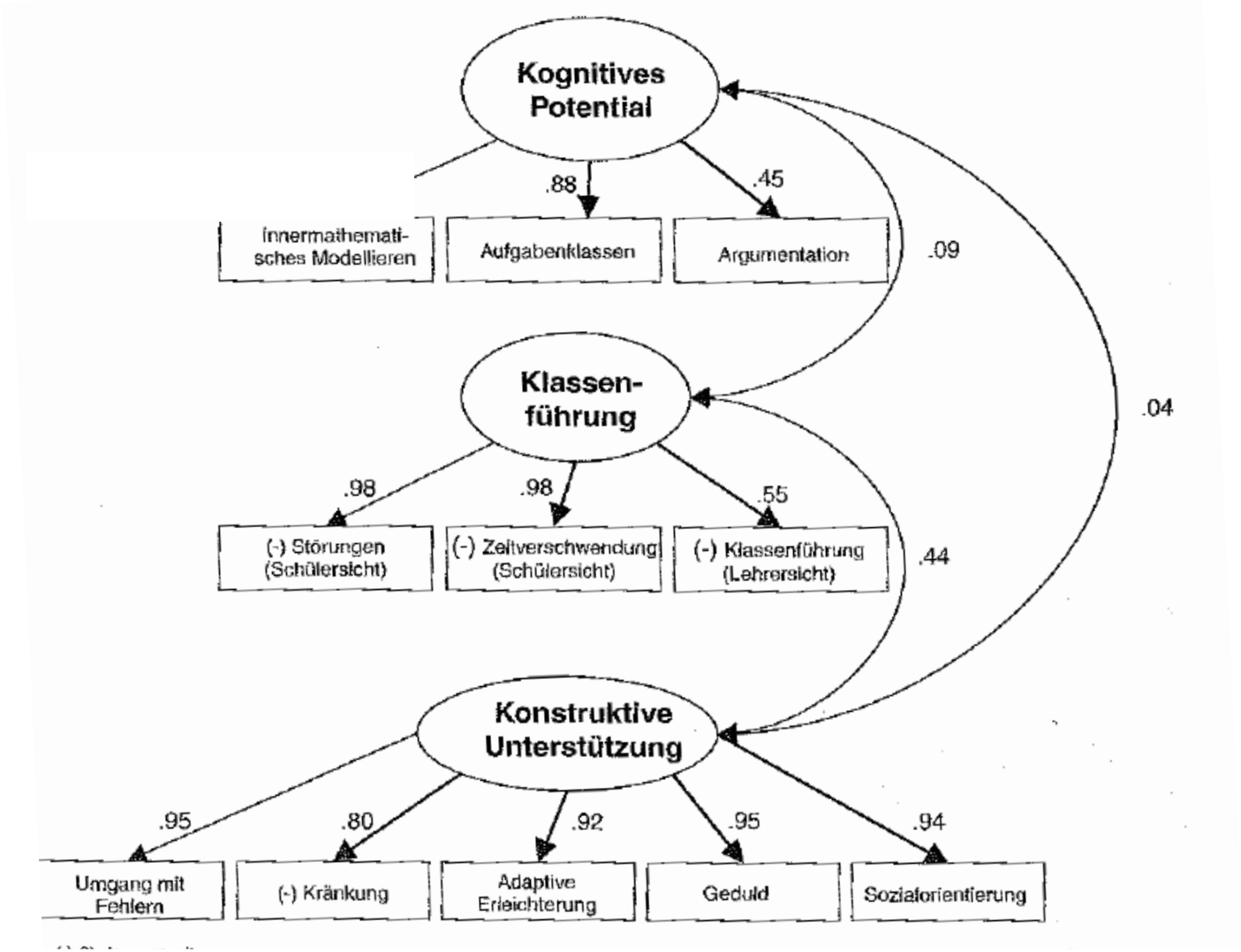
Tschannen-Moran, M. & Woolfolk Hoy, A.: Ohio teacher efficacy scales (OSTES)

- Efficacy for classroom management
- Efficacy for student engagement
- Efficacy for instructional strategies

Coactiv Study (linked to PISA 2003-Germany) Kunter, Baumert et al. (2005); Baumert et al. (2009)



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DESI Study (German National language Survey)
Klieme et al. (2008)
Student Questionnaires by A. Helmke et al.

Construct	**Item Example**	**Alpha**
Structure	At the end of a lesson, the teacher summarizes main issues	.79
Support	My teacher advises me how to improve.	.86
Cognitive Activation	My Teacher stresses that our writing should be gramatically correct	.89

IGEL Study - Classroom intervention: adaptive science education in primary schools

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(Hardy, Klieme, Warwas, Büttner, Hertel, Kunter, Lühken et al.)
Student Questionnaire developed by B. Fauth et al.

	Number of items	Example	Cronbach's α	ICC_1	ICC_2
Cognitive Activation	7	"Our science teacher asks questions I have to think about a lot"	.71	.15	.75
Classroom Management	6	"In our science class nobody disrupts the lesson".	.82	.20	.82
Supportive Climate	9	"Our science teacher is nice to me even though I might make a mistake"	.80	.20	.82

Sample: 1088 third grade students (mean age = 8.5 years) from 59 classes in 41 schools.

3/3 factor model of perceived instructional quality (Fauth 2012)

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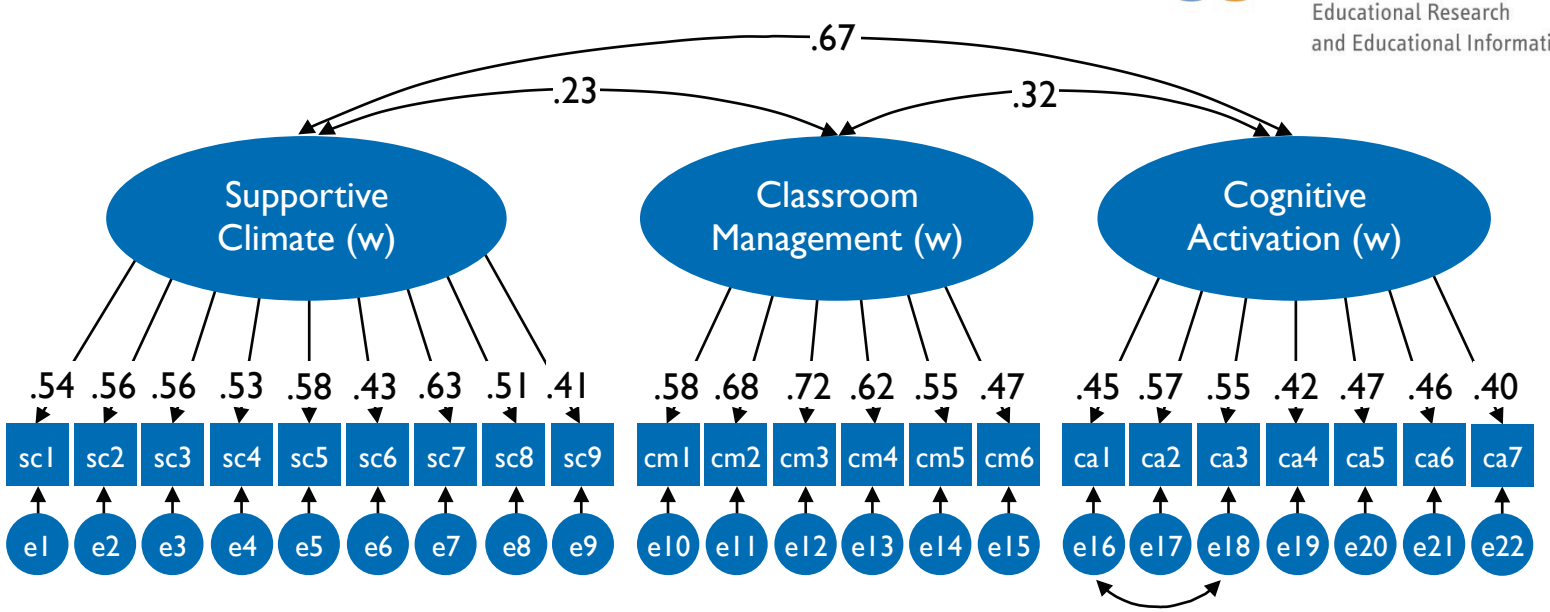
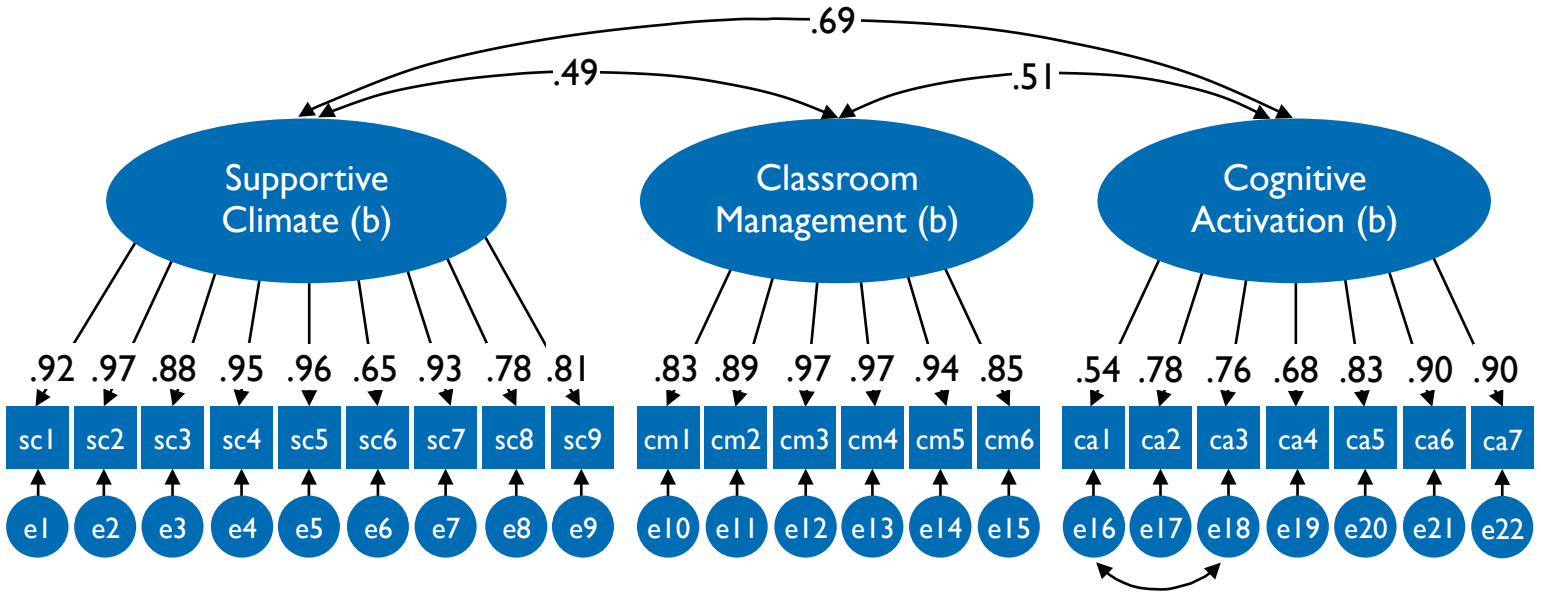
Within



Between



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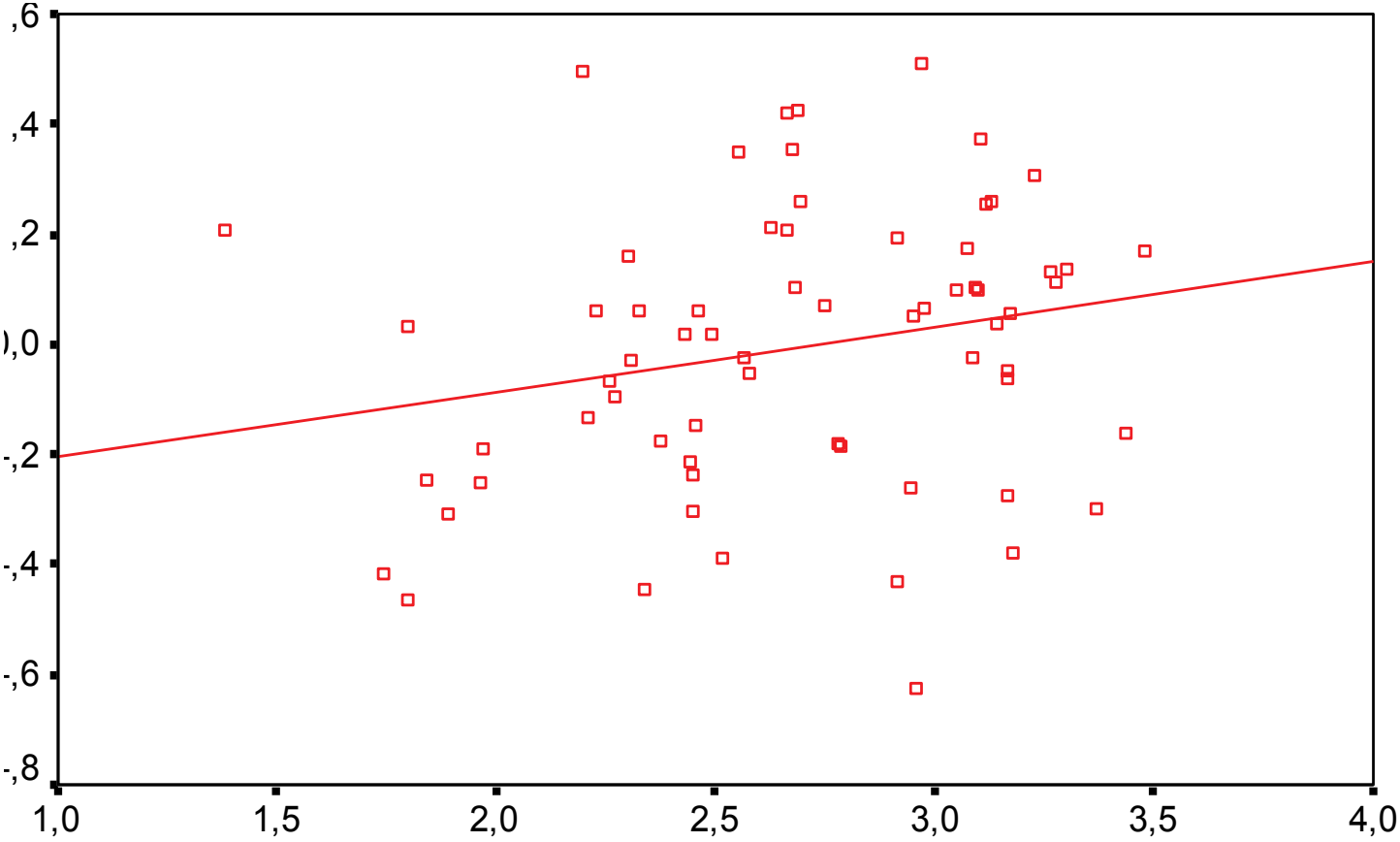
Supportive Climate predicts motivational development



Change in math interest over 1 year

Supportice Climate (one selected lesson)

Cognitive and motivational effects of teaching

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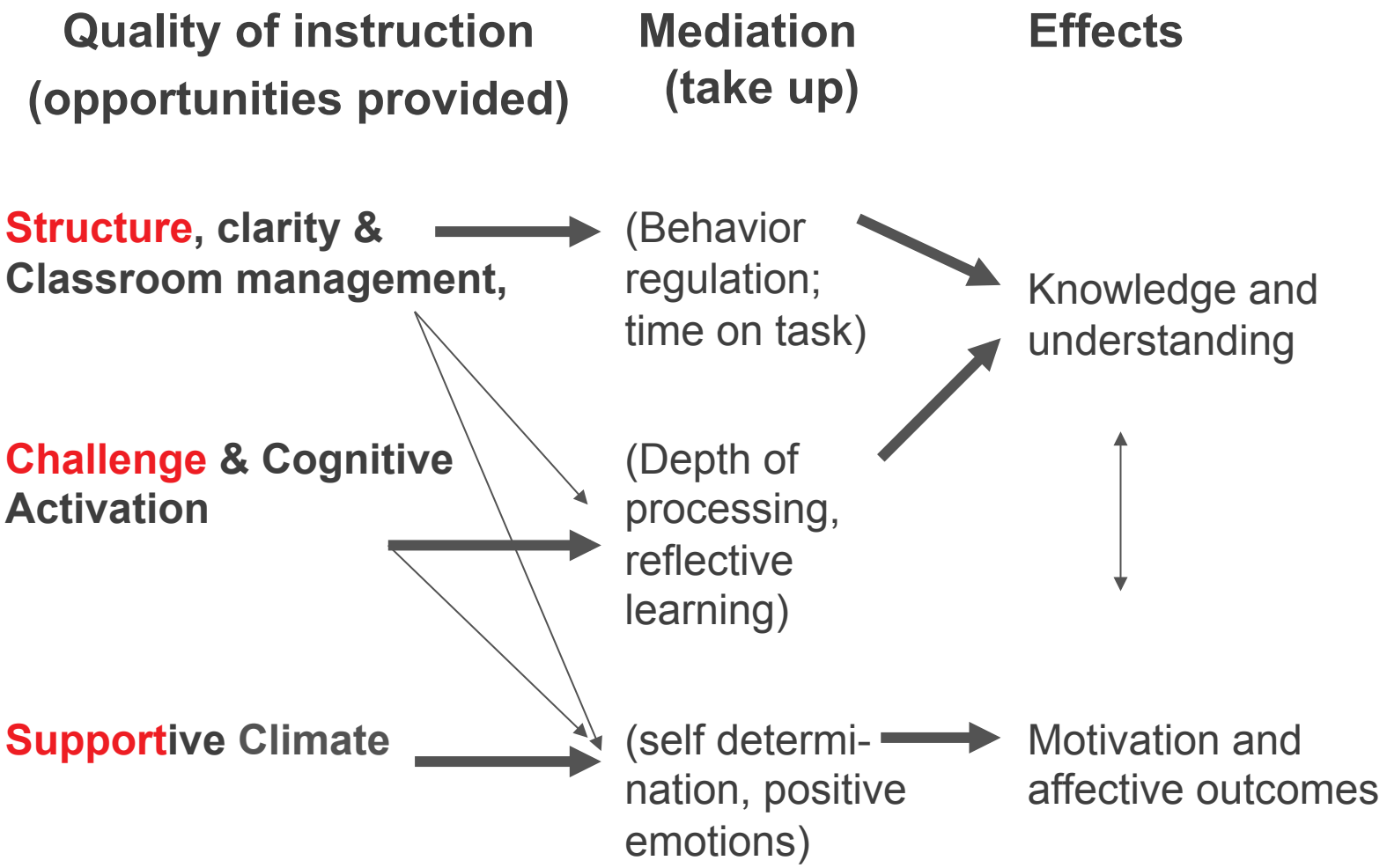

(Klieme, Pauli & Reusser, 2009; Klieme, Schümer & Knoll, 2001)

„Pythagoras“ study. Lipowsky et al. (2009): cognitive effects

Predicting mathematics performance at posttest

Predictors	Model 1 β	Model 1 SE	Model 2 β	Model 2 SE	Model 3 β	Model 3 SE	Model 4 β	Model 4 SE
Class-level variables								
Performance at pretest	.33**	.06	.32**	.06	.35**	.06	.33**	.06
Time spent on Pythagorean-Theorem content	.12**	.04	.12**	.04	.11*	.04	.12**	.05
Classroom management			.09*	.04				
Cognitive activation					.10*	.04		
Supportive climate							.08 ns	.05
Individual-level variables								
Performance at pretest	.15**	.03	.15**	.03	.15**	.03	.15**	.03
Prior mathematics-related interest	.07*	.03	.07*	.03	.07*	.03	.07*	.03
Basic cognitive ability	.22**	.03	.21**	.03	.21**	.03	.22**	.03
Perceived cognitive activity	.09**	.03	.09**	.03	.09**	.03	.09**	.03

Lipowsky, F., Rakoczy, K., Pauli, C., Drollinger-Vetter, B., Klieme, E. & Reusser, K. (2009). Quality of geometry instruction and its short-term impact on students' understanding of the Pythagorean Theorem. *Learning and Instruction.*

„Pythagoras“ study.
Rakoczy et al. (2007): motivational effects

Dependent variable:	
Class level:	
Cultural background[a]	-.09
Mean interest	.09*
Mean prior knowledge	-
Structured organisation of the LE	.09*
Individual level:	
Gender[b]	-.12
Interest	.33*
Prior knowledge	-

a: 0=Germany, 1=Switzerland; b: 0=Girls, 1=Boys
* $p<.05$; - Variable not in model

DESI Study
(German National language Survey)

Klieme, Steinert & Hochweber (2010)
Hochweber, Steinert & Klieme (in press)

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Standardized effects (controlling for individual and school-level context)
In ninth grade (440 classrooms, 11.000 students)

	German		**English**	
	Achievement	Interest	Achievement	Interest
Cognitive Activation	.242	.073	.150	.001
Structure	-,147	.188	-.069	.113
Support	.050	.239	.030	.303

For German, effects remain significant if intake is controlled for.

IGEL Study - Classroom intervention:

adaptive science education in primary schools

(Fauth et al., in prep.)

Predictor	Achivement			Interest		
Individual-level						
Intakte	.20 (.03)*	.20 (.03)*	.20 (.03)*	.11 (.05)*	.11 (.04)*	.13 (.04)*
Science competence	.27 (.03)*	.27 (.03)*	.27 (.03)*			
Cognitive abilities	.23 (.03)*	.23 (.03)*	.23 (.03)*			
Teacher popularity	.04 (.03)	.03 (.03)	.04 (.03)	.14 (.04)*	.12 (.04)*	.19 (.04)*
Cognitive activation	-.02 (.03)	-	-	.18 (.04)*	-	-
Supportive climate	-	.03 (.03)	-	-	.20 (.05)*	-
Classroom management	-	-	-.01 (.04)	-	-	.11 (.04)
Classroom-level						
Intake	.09 (.15)	.12 (.14)	.08 (.13)	.10 (.15)	.16 (.14)	.15 (.14)
Science competence	.22 (.13)	.25 (.12)*	.31 (.13)*			
Teacher popularity	.39 (.09)*	.43 (.12)*	.15 (13)	.41 (.13)*	.33 (.14)*	.51 (.13)*
Cognitive activation	-.18 (.15)	-	-	.41 (.11)*	-	-
Supportive climate	-	-.16 (.17)	-	-	.39 (.13)*	-
Classroom Management	-	-	.38 (.13)*	-	-	.16 (.15)

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PISA 2012 Field Trial: Predicting Math Achievement and Interest

	Achievement	Interest
Individual Level (L1)		
Cognitive Activation	.074**	.250***
Teacher Support	.030	.141***
School level (L2)		
Cognitive Activation	.648***	.321***
Teacher Support	-.331***	.186***
System level (L3)		
Cognitive Activation	-1.468*	.407
Teacher Support	-0,933 **	.694***

OECD Teaching and Learning Survey (TALIS)

- **“Structuring practices”**
  e.g. “I explicitly state learning goals.”
  other items: summary of earlier lessons, homework review, checking the exercise book, checking student understanding during classroom talk by questioning students

- **“Student oriented practices”**
  e.g. “Students work in small groups to come up with a joint solution to a problem or task.”
  Other items: ability grouping, student self-evaluation, student participation in classroom planning

- **“Enhanced activities”**
  e.g. “Students work on projects that require at least one week to complete”.
  Other items: making a product, writing an essay, debating arguments.

TALIS: Latent profiles within countries (Vieluf, Kaplan, Klieme & Bayer, 2012)

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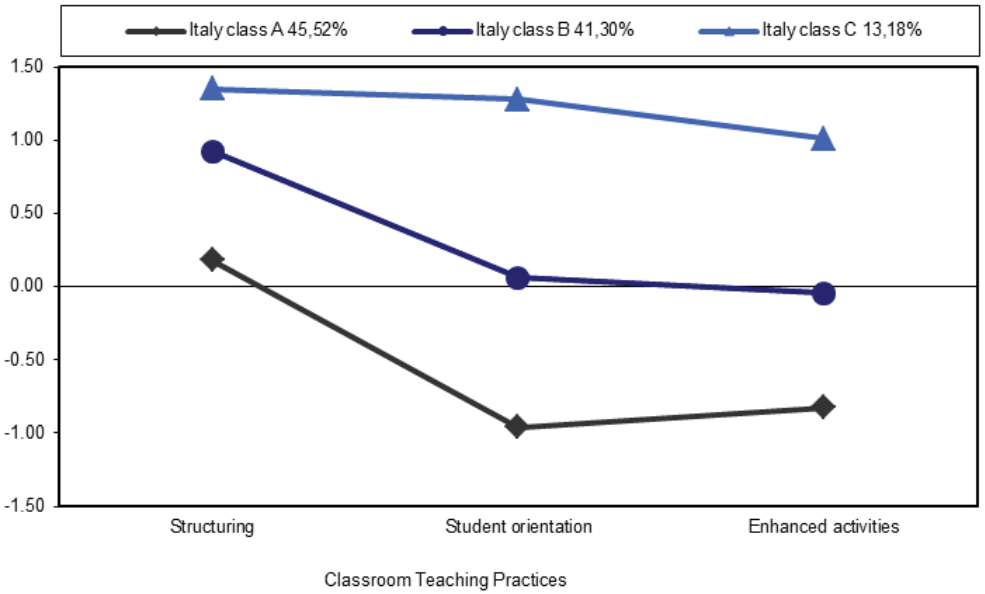
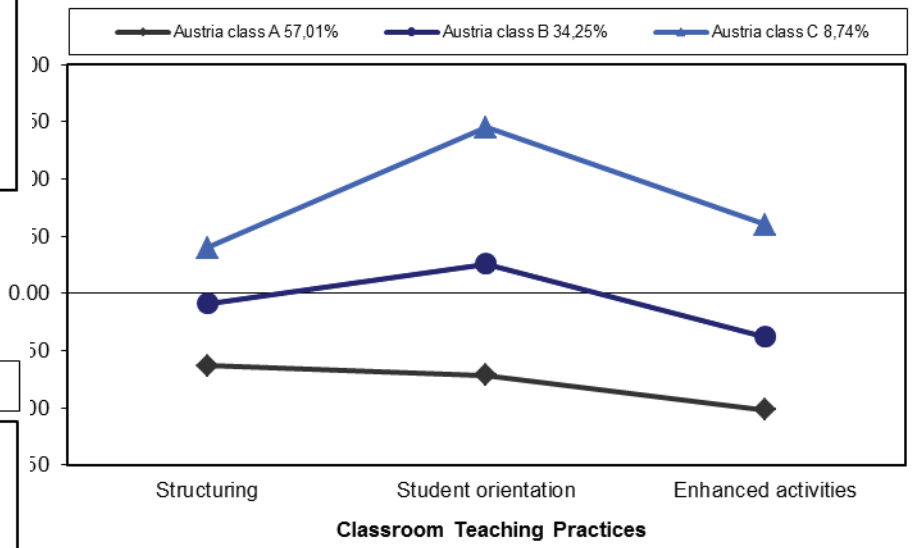
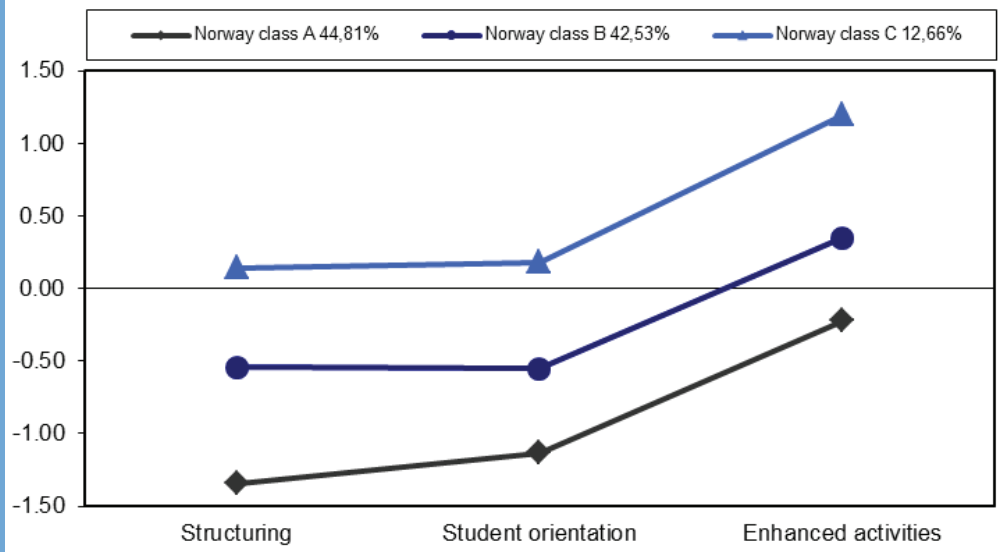
Italy



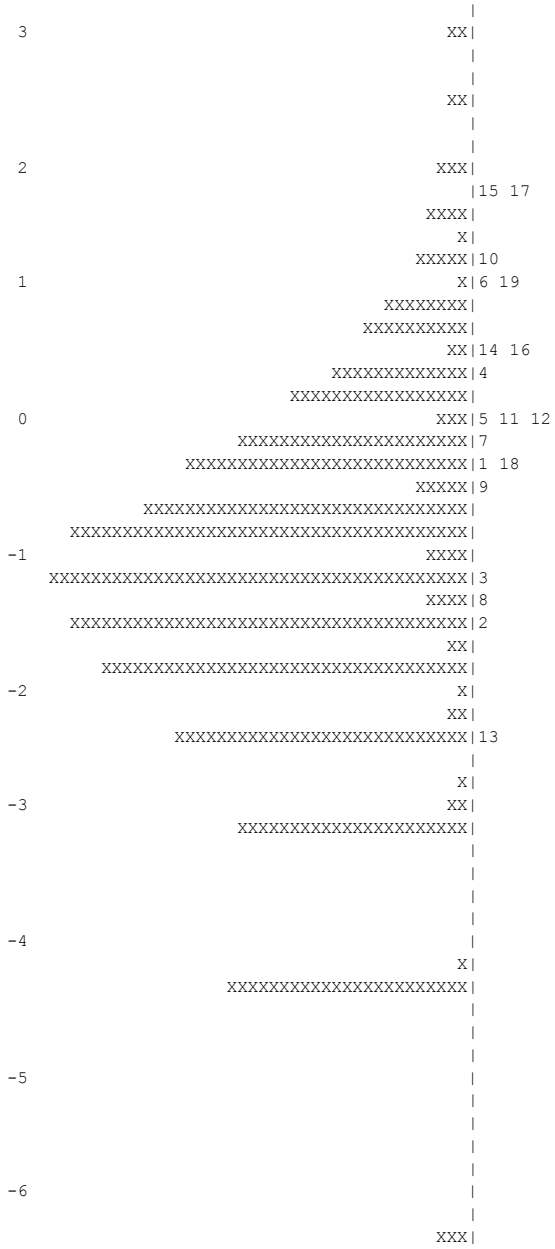
Austria



Norway

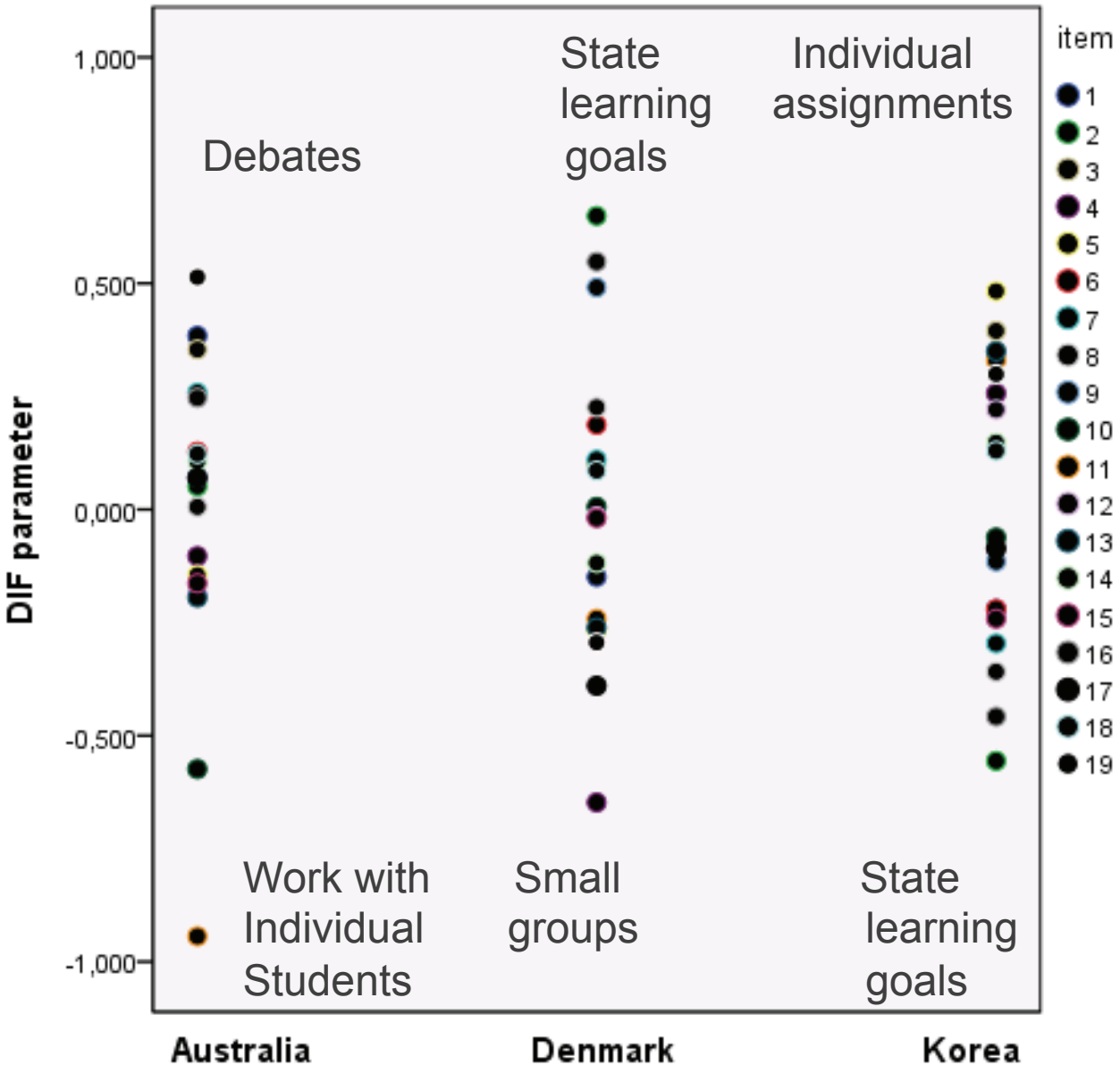


TALIS: Hierarchy across countries (Klieme, Vieluf et al., in prep.)



Enhanced activities >0,8	S (debate), F (participation in planning), J (projects), Q (essay), O (product)
Student-oriented practices <0,8	L (students evaluate own work) ,E (differential assignments), K (work with individual students) D (small groups), P (tests and quizzes), N (homogeneous groups)
Structured practices <-0,1	M (check by questioning), B (state goals), H (present summary), C (review homework) , A(lecturing), R (individual practice), I (check exercise books), G (ask to remember),

TALIS: Country DIF
(Klieme, Vieluf et al., in prep.)



Final Conclusions

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- The Three basic dimensions of Teaching Quality can be identified in different samples, subjects, and countries with different instruments.
  → The structure seems to have some universal validity.
- The quality dimensions tend to have specific effects on cognitive vs. non-cognitive outcomes:
  support → motivation, interest (on all levels)
  cognitive actication → achievement (mainly classroom/school level; at least in secondary education)
  Structure/classroom management → mostly achievement, but heterogeneous findings → needs specification
- Cross-sectional data have to be treated with caution:
  (a) support is oftentimes negatively related to achievement. → Reserve causality ?
  (b) student perceptions are subject to response bias

Alternative Structure: Distinguishing between interaction-related and content-related aspects

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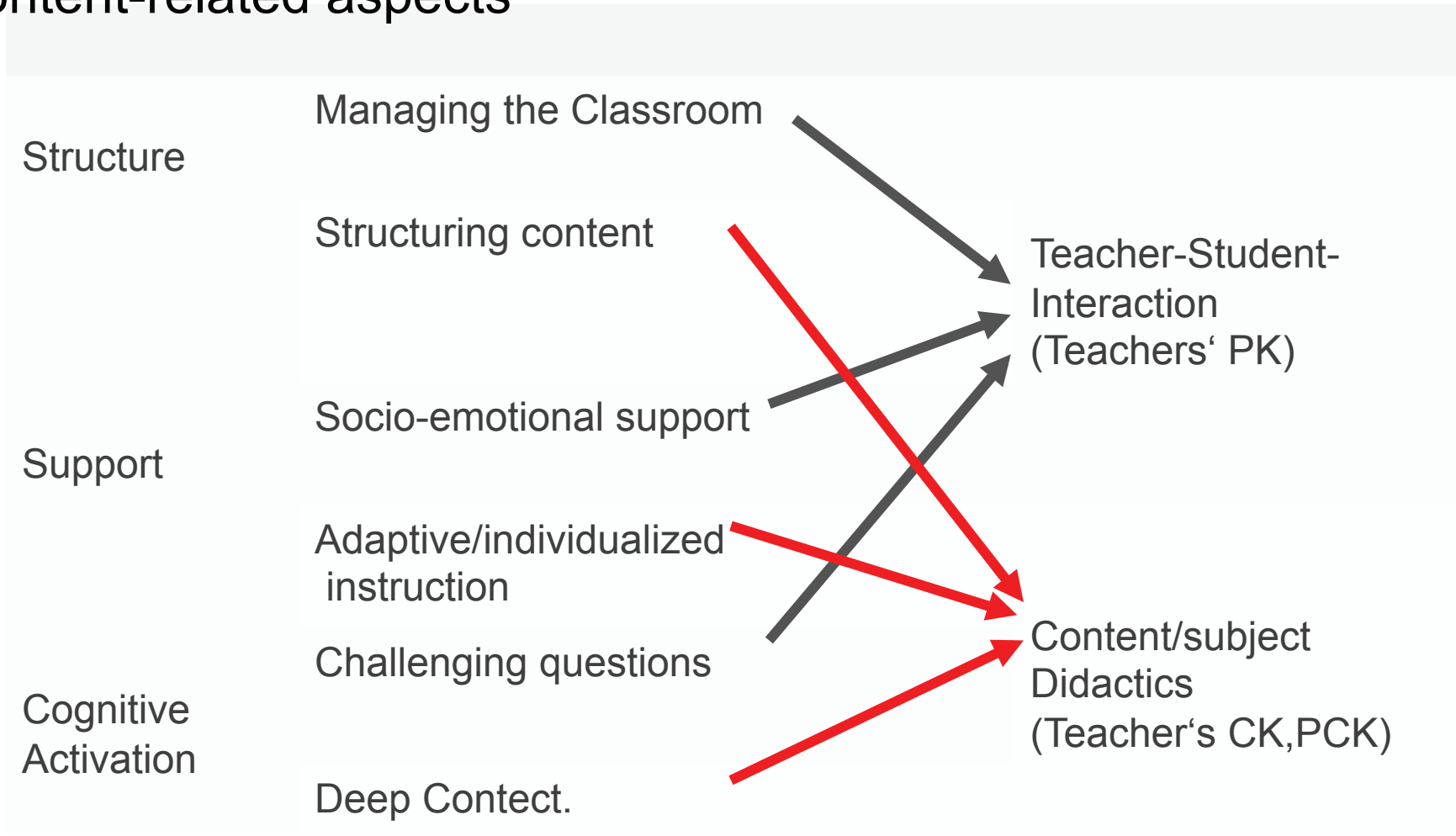

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- The model should be tested by targeted intervention studies (cp. Shechtman/Abu Yaman, AERJ 2012, on „affective teaching“)
- In addition to the „latent“ structure of structure, support, and cognitive activation, teaching can be described by Opportunity to learn (e.g., content coverage)
  and classroom practices.
  Practices show a culture-general structure, with some specific deviations (DIF for frequency of practices).
- The relationsship between latent dimensions and observable practices needs further research.
  In PISA, both contribute to the prediction of achievement and student interest.
- All in all, teaching effectiveness research is moving towards a better, and more sophisticated understanding of both qualities and effects – beyond simple „quality talk“.

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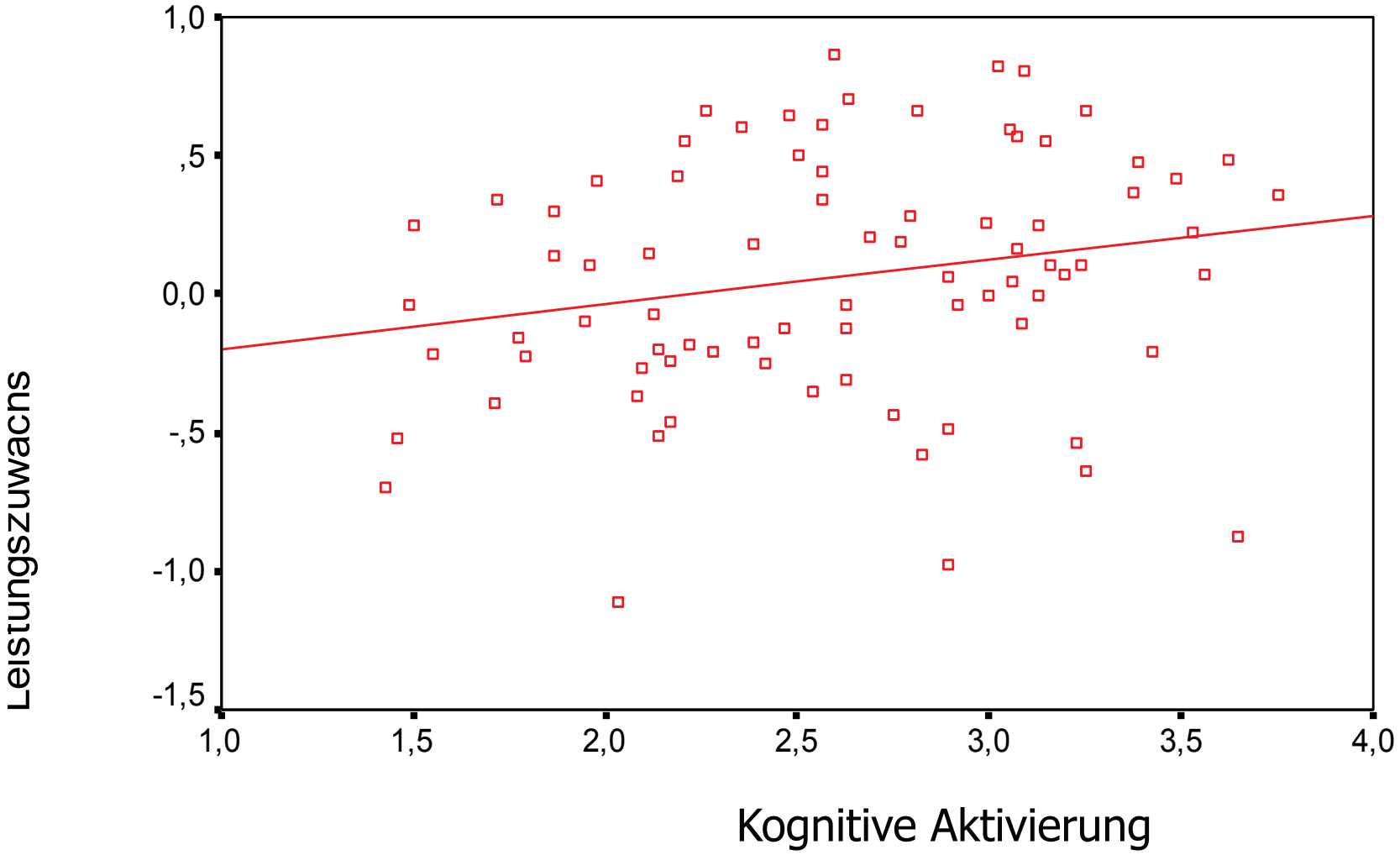
und Bildungsinformation

Thank you !

klieme@dipf.de

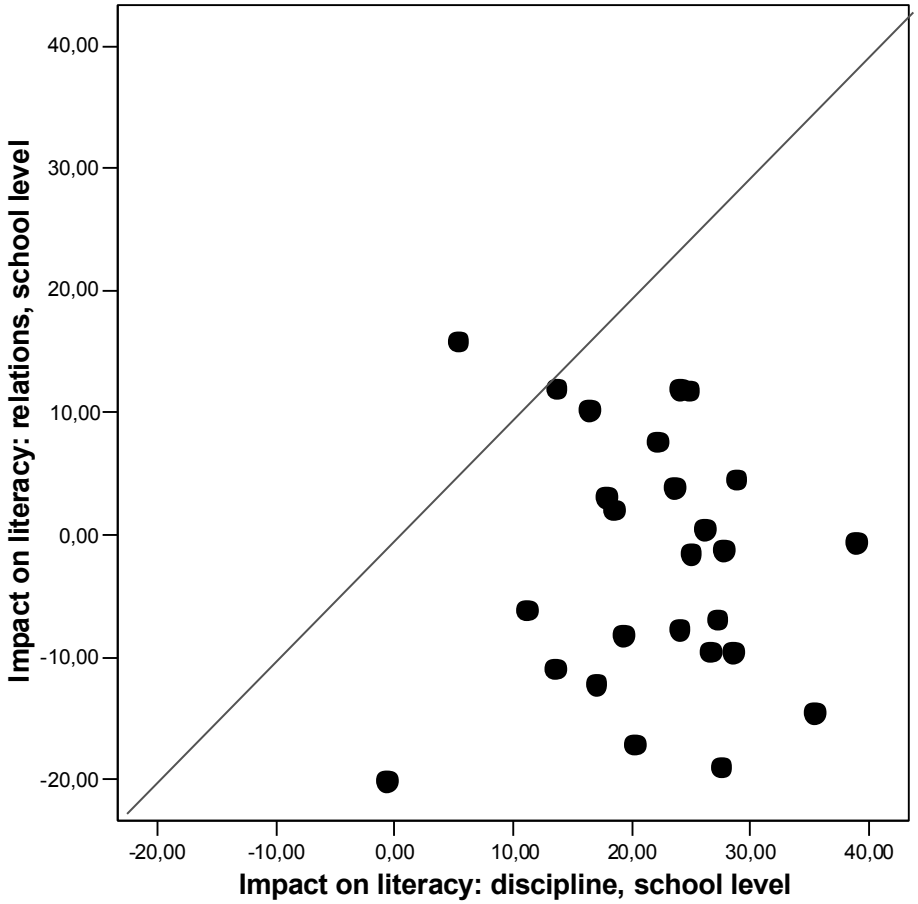
TIMSS-Video-Studie

Unterrichtsqualität und Leistungsentwicklung

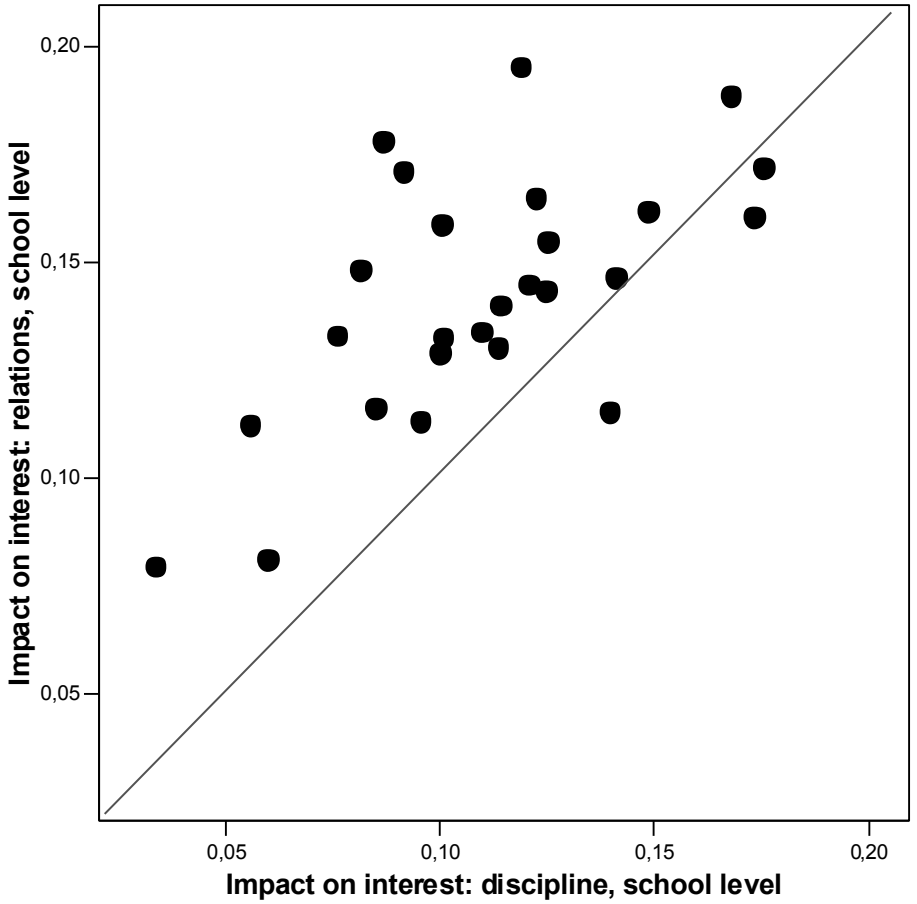


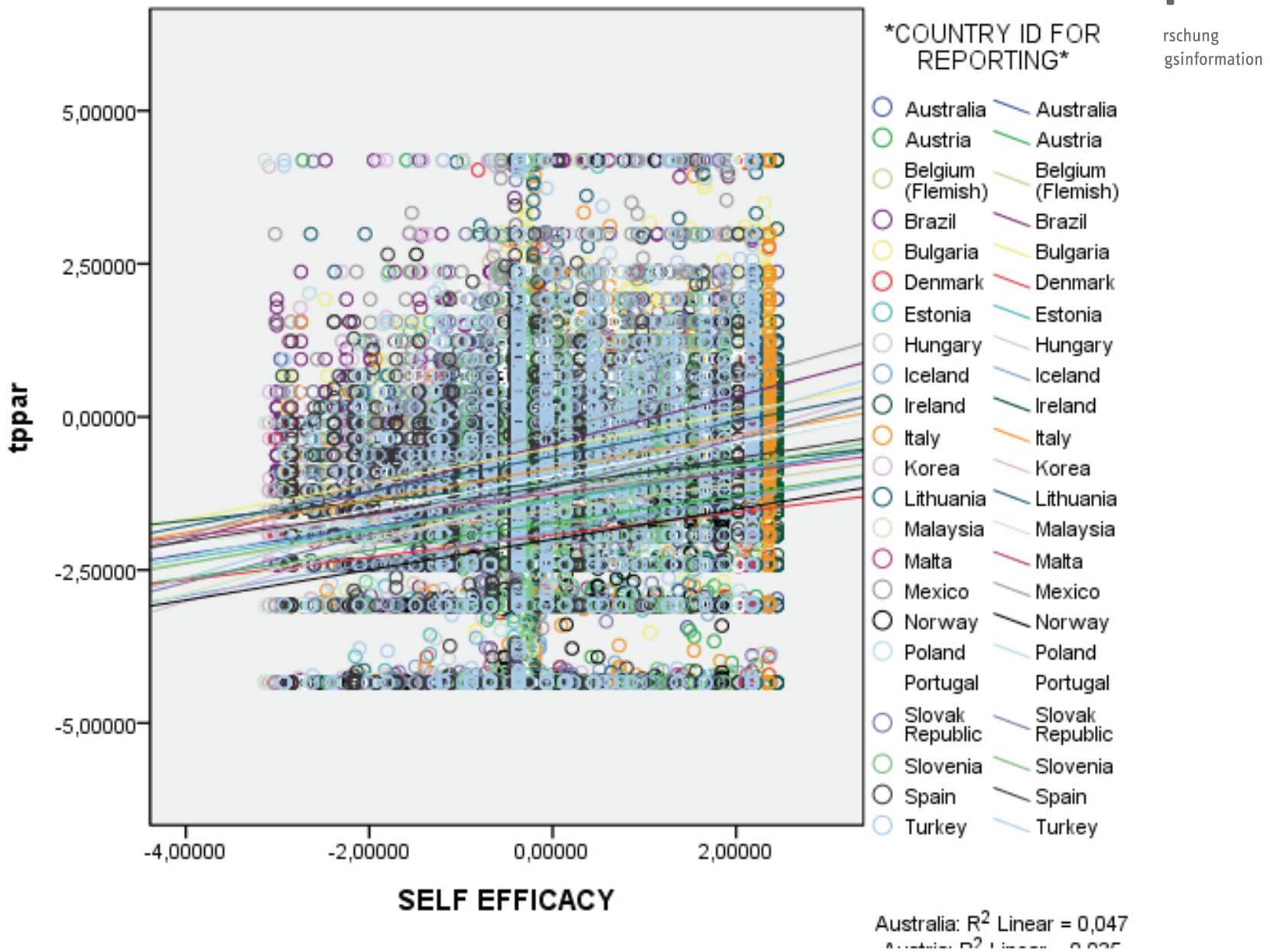
PISA 2000: School-level effects by country

… on Reading **Literacy:** Discipline > Relations



… on **Interest** in Reading: Relations > Discipline

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SELF EFFICACY
COUNTRY ID FOR REPORTING
Australia
Austria
Belgium (Flemish)
Brazil
Bulgaria
Denmark
Estonia
Hungary
Iceland
Ireland
Italy
Korea
Lithuania
Malaysia
Malta
Mexico
Norway
Poland
Portugal
Slovak Republic
Slovenia
Spain
Turkey
Australia: R2 Linear = 0,047

PISA 2012 Field Trial: Predicting Math Achievement

	School level	Country level
Student SES (ISEI)	.180***	.034***
OTL: Concept Familiarity	1.057***	.279*
Concepts: Overclaiming	-.500***	-.614***
OTL: Math Tasks	.111***	.379*
Cognitive Activation: Challenging Problems	177***	.714
Disciplinary climate	.122***	1.082***
Teacher Support	-,081**	-.106
Instructional Practices: teacher-directed	-.004	-1.242**
Instructional Practices: student oriented	-.162***	-1.032***
Instructional Practices: formative	-,063	.842**

PISA 2012 Field Trial: Predicting Math Interest

	School level	Country level
Student SES (ISEI)	.001	-.003
OTL: Concept Familiarity	.019	-.030
Concepts: Overclaiming	.025	.091
OTL: Math Tasks	**.057****	**-.131***
Cognitive Activation: Challenging Problems	**315*****	**.521****
Disciplinary climate	.036	**.195***
Teacher Support	**.158*****	**.495*****
Instructional Practices: teacher-directed	-.008	-.027
Instructional Practices: student oriented	**.053***	**.373*****
Instructional Practices: formative	.055	**-.290***