

Teacher Professional Development: Lessons Learnt from a Large-scale German PD Program

Olaf Köller
Leibniz Institute für Science and Mathematics Education (Kiel)

- Look back in anger: Results of German students in TIMSS 1996 and PISA 2000
- Consequences of TIMSS and PISA
- Teacher professional development to enhance students' learning
- SINUS: A TPD program to improve the effectiveness of science and math education
- Evaluation of SINUS
- Take-home messages

Look back in anger: TIMSS 1996



- Prior to 1995:
 - Focus on Input: Curricula, lesson tables, financial issues, structure of the school system
 - More historical and philosophical orientation in educational research (not empirically oriented)
 - High degree of confidence in the effectiveness of the German educational system
- Findings of TIMSS
 - Disappointing results of German students, particularly compared to most European neighbors
 - Particularly problems in applying math and science knowledge to real-world-problems

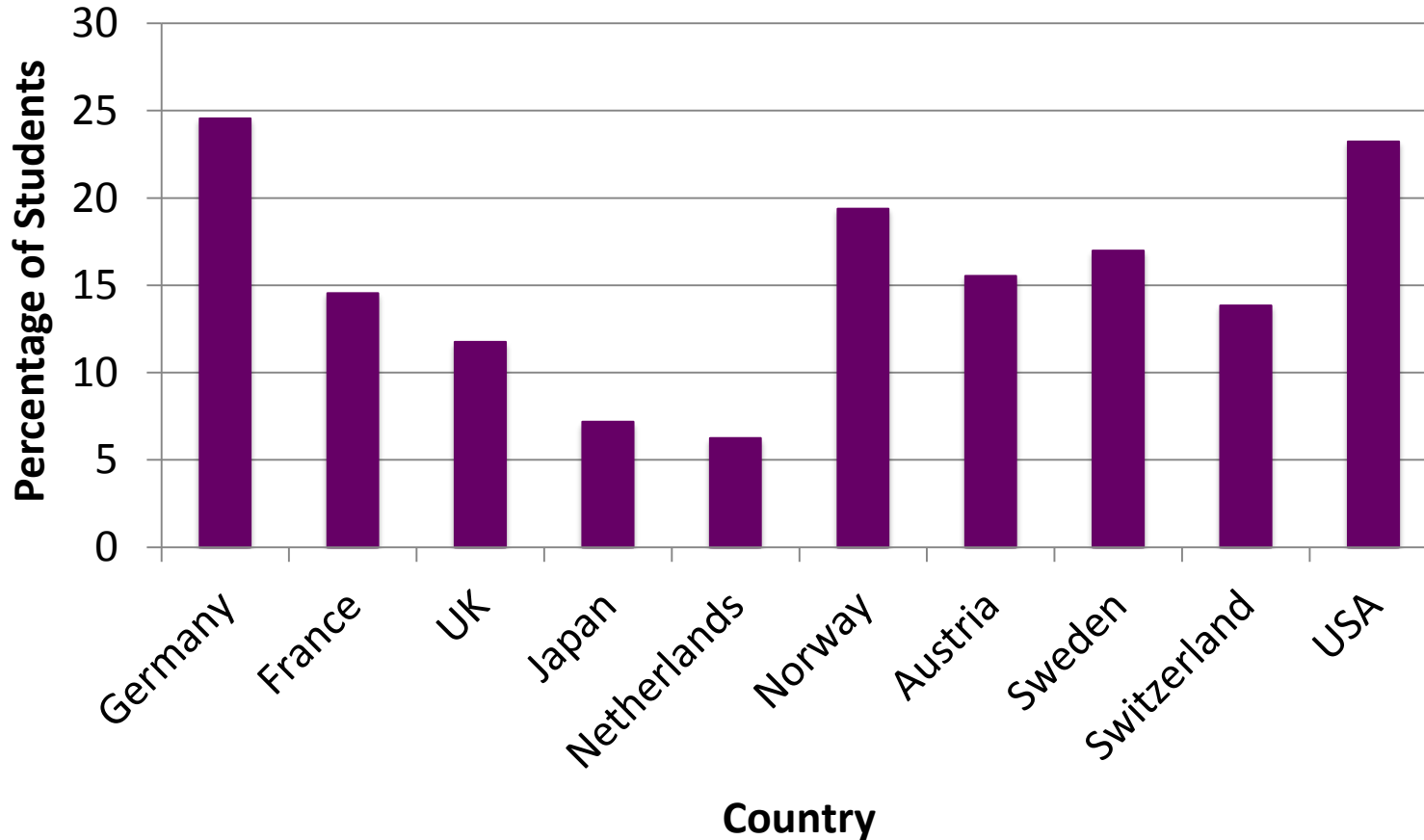


Bad News from PISA 2000



15year old students failing in math*

(Findings from PISA 2000)



*Proficiency level I or below

Educational reforms after TIMSS and PISA 2000

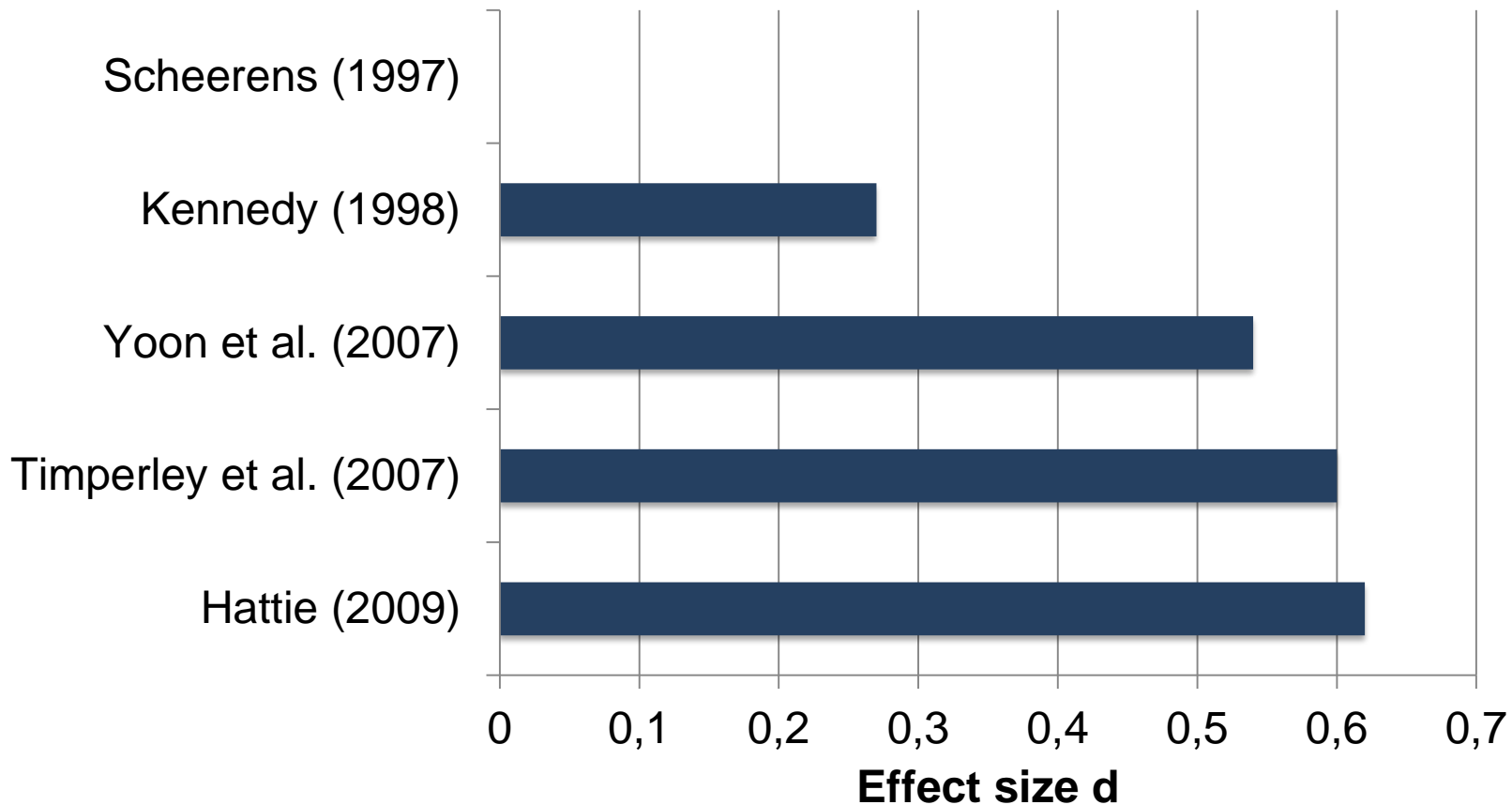
- Increasing the number of schools with full-day service
- Decreasing the number of grade repetitions
- Introduction of additional pre-school programs (center-based and home-based) particularly to improve language skills of children with migration background
- Large-scale programs on teachers professional development in math and science (so-called SINUS-program)
- Reform of the lower secondary system (grades 5 to 10). Only two different school types (vocational vs. academic track) instead of 3 to 5 different types
- Introduction of central final examinations

- School inspections
- Development of educational standards for core subjects (mother tongue, math, foreign language, science)
- Foundation of a National Institute for Educational Progress
- National assessment of educational progress every three years in secondary schools and every five years in primary schools
- Participation in PISA, TIMSS, and PIRLS
- State-wide assessments in grades 3 and 8 (not high stakes)

Was there any evidence for these reforms? Some findings from Hattie (2009)

- Negative effect of grade retention ($d = -.16$)
- No substantial effects of ability grouping ($d = .12$)
- Much evidence for the effect of preschool programs ($d = .45$)
- Evidences for positive effects of testing ($d = .34$)
- Effectiveness of reading programs ($d = .67$)
- **Substantial effects of programs on teacher professional development ($d = .62$)**

Effectiveness of TPD: Findings from Meta-Analyses



What makes TPD successful?

Teachers learn more ...*

- when there is collective participation and effective staff communication;
- When they are in teacher networks and study groups;
- in professional development programs that are longer, sustained and intensive, since traditional episodic, fragmented approaches do not allow rigorous, cumulative learning;
- when TPD is part of a coherent, integrated professional development program of the school – that is, school curriculum, assessment, standards and TPD should be linked.

*Caena, F. (2011). Literature review quality in teachers' continuing professional development. Brussels: European Commission

What makes TPD successful? (Caena, 2011)

- A considerable duration;
- A clear theoretical rationale grounded in research, and a strong knowledge base;
- Should be based on collaborative, active learning and teaching (not on a one-shot lecture or a 'drive-by' workshop), as well as on feedback;
- Should be delivered to a team of teachers (same age group, subject, school...)
- Should be focused on specific content knowledge / strategies (not general), helping teachers develop the pedagogical skills to teach specific content, with strong positive effects on practice;
- Should be coherent, practical, focused on students' learning of content and on the examination of students' work, in relation to standards for what students should know and be able to do.

SINUS



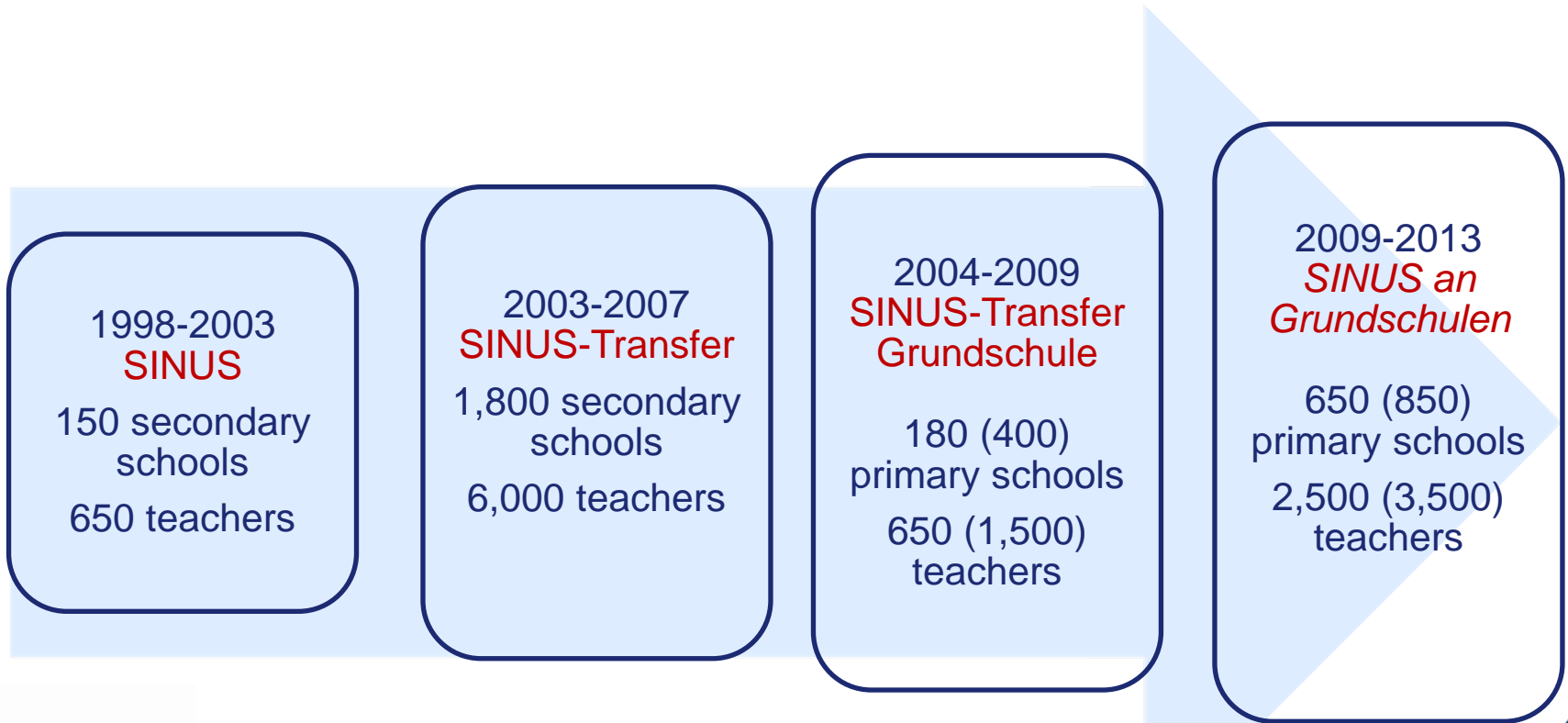
an Grundschulen

Steigerung der Effizienz des
mathematisch-naturwissenschaftlichen
Unterrichts

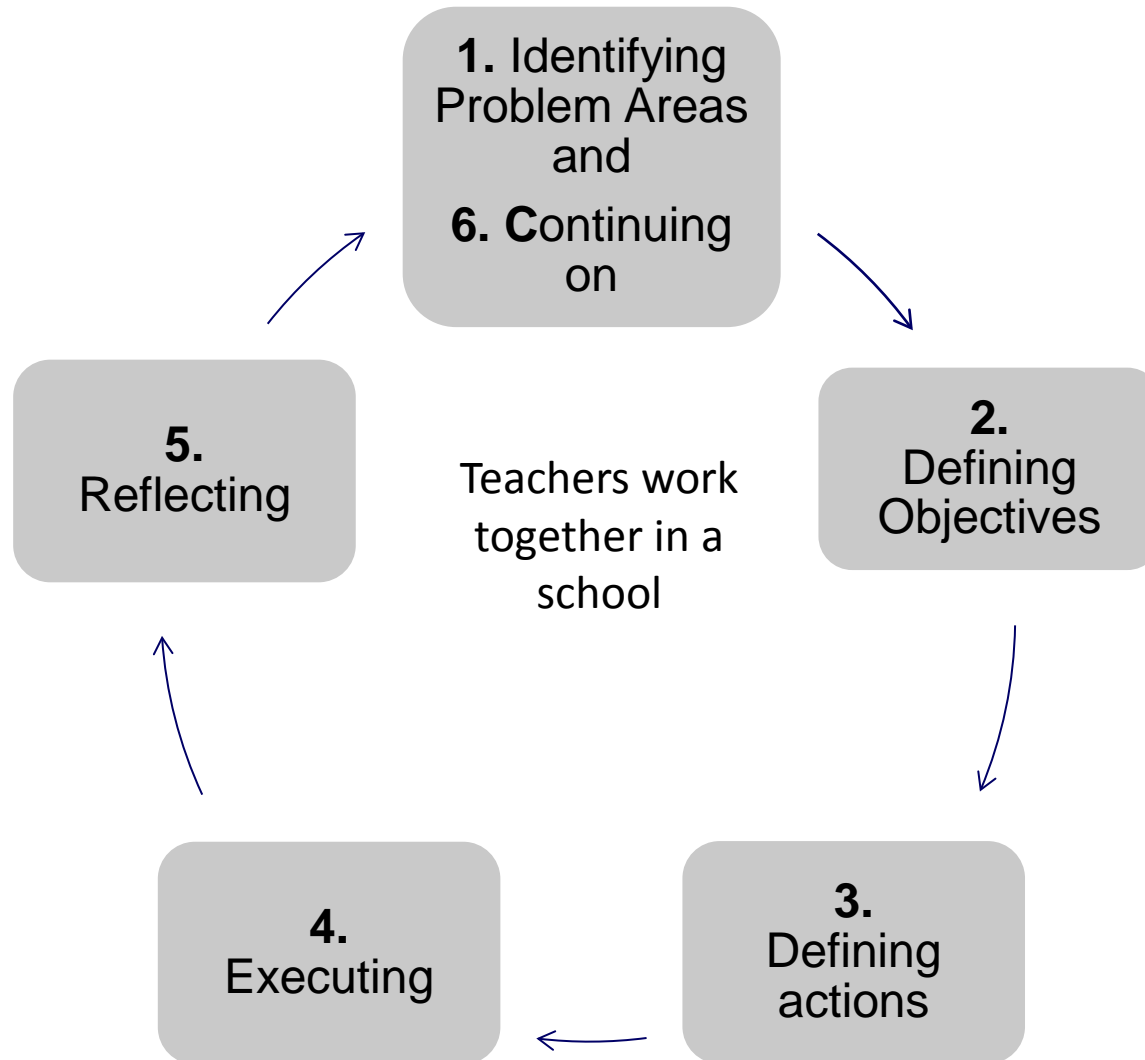
SINUS: Improving math and science teaching

- **Long-term professional development initiative**
- **perspective: situated learning**
- **implementation on a large scale**
- **focus on science and mathematics**
- **initially addressing high schools (grades 5 – 10)**
- **later: adaption for primary schools (grades 1 – 4)**

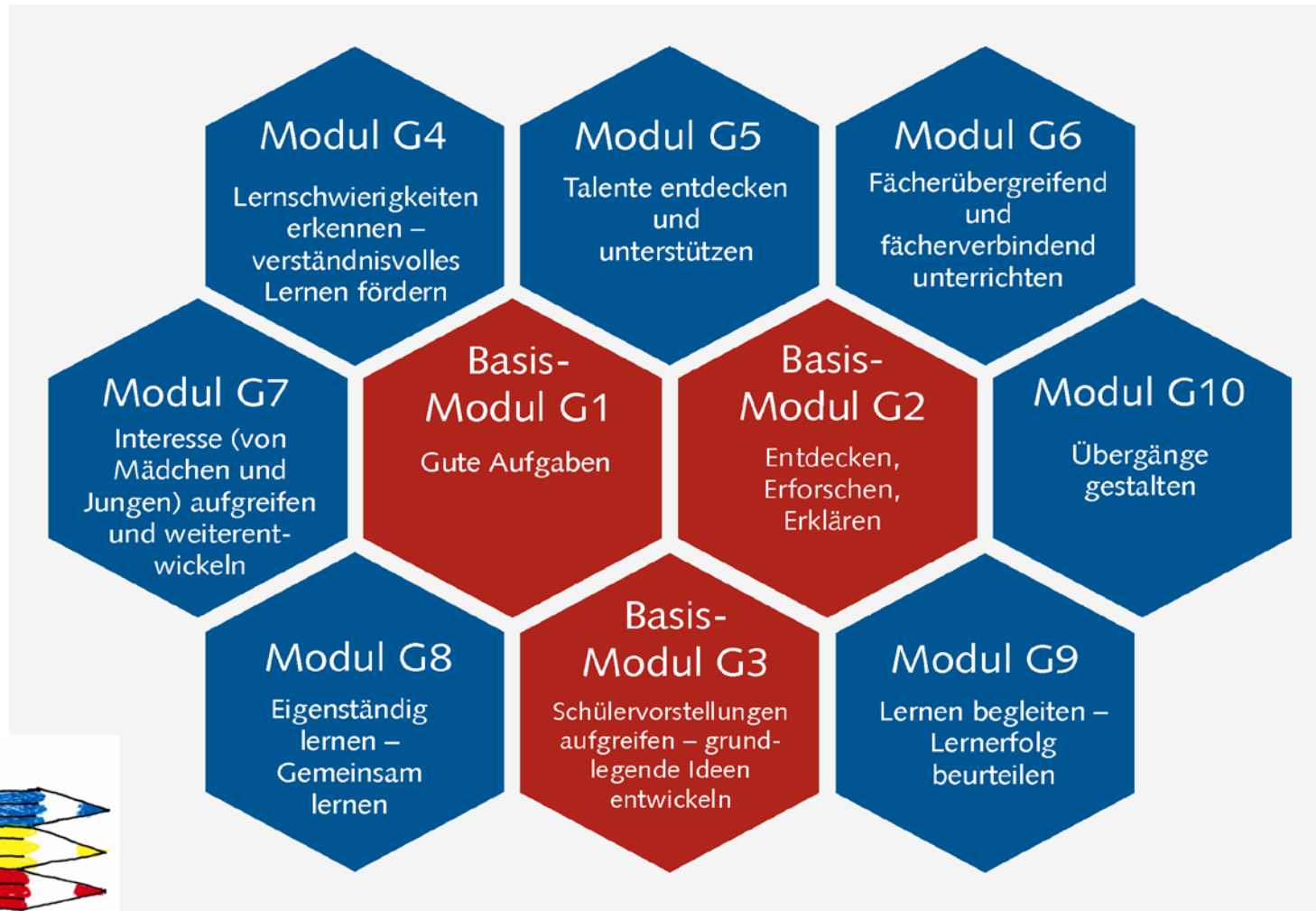




A model of teacher cooperation



Areas of PD in SINUS



Evaluation of SINUS in primary schools: 4 levels of effectiveness*

- (1) **Reaction:** taking part in the program for several years, understanding its objectives, feeling comfortable with the procedures
- (2) **Learning:** extent, to which teachers change attitudes and improve knowledge and skills as a result of taking part in the training
- (3) **Behavior:** change in visible procedures that a teacher applies in his or her classroom routines
- (4) **Results:** Student outcomes

*Kirkpatrick & Kirkpatrick (2012)

Survey

2010: 332 principals & 1,662 teachers
2013: 850 principals & 4,500 teachers

Documentations

2010:
48 schools
2012:
45 schools

Case Studies

2010:
19 schools
2012:
15 schools

**Nationwide Test in
Mathematics,
TIMSS 2011:**
80 schools
(previous participants)

**How do teachers select
and analyze tasks in
mathematics?**

2012: 80 teachers
(volunteers)

Video-Study
12 teachers
(volunteers)

4 annual
reports
from all
participating
federal
states
(2010,
2011,
2012,
2013)

**6 Bachelor-
& Master-
theses**

analyzing
(didactical)
aspects in
Math or
Science
Teaching

- **Quantitative and qualitative methods**
- **Survey:** online-questionnaire (2 different tools for teachers and principals)
- **Documentation:** structured online form
- **Case studies:** various documents
- **Nationwide assessment:** standardized paper-pencil tests
- **Video study:** video recordings, student questionnaires
- **Study about math tasks:** paper-pencil form
- **Reports:** online-questionnaire

Reaction:

- Program was well accepted
- Teachers felt supported

Learning:

- Teachers reported gains in several areas
- Professional cooperation became increasingly more common
- Teachers mostly followed a cyclical professional development process (well defined aims, actions and reflections)

Behavior:

- Teachers' documents showed more orientation towards students' learning
- Videotaped lessons gave insights in teachers' classroom management and showed instructional changes

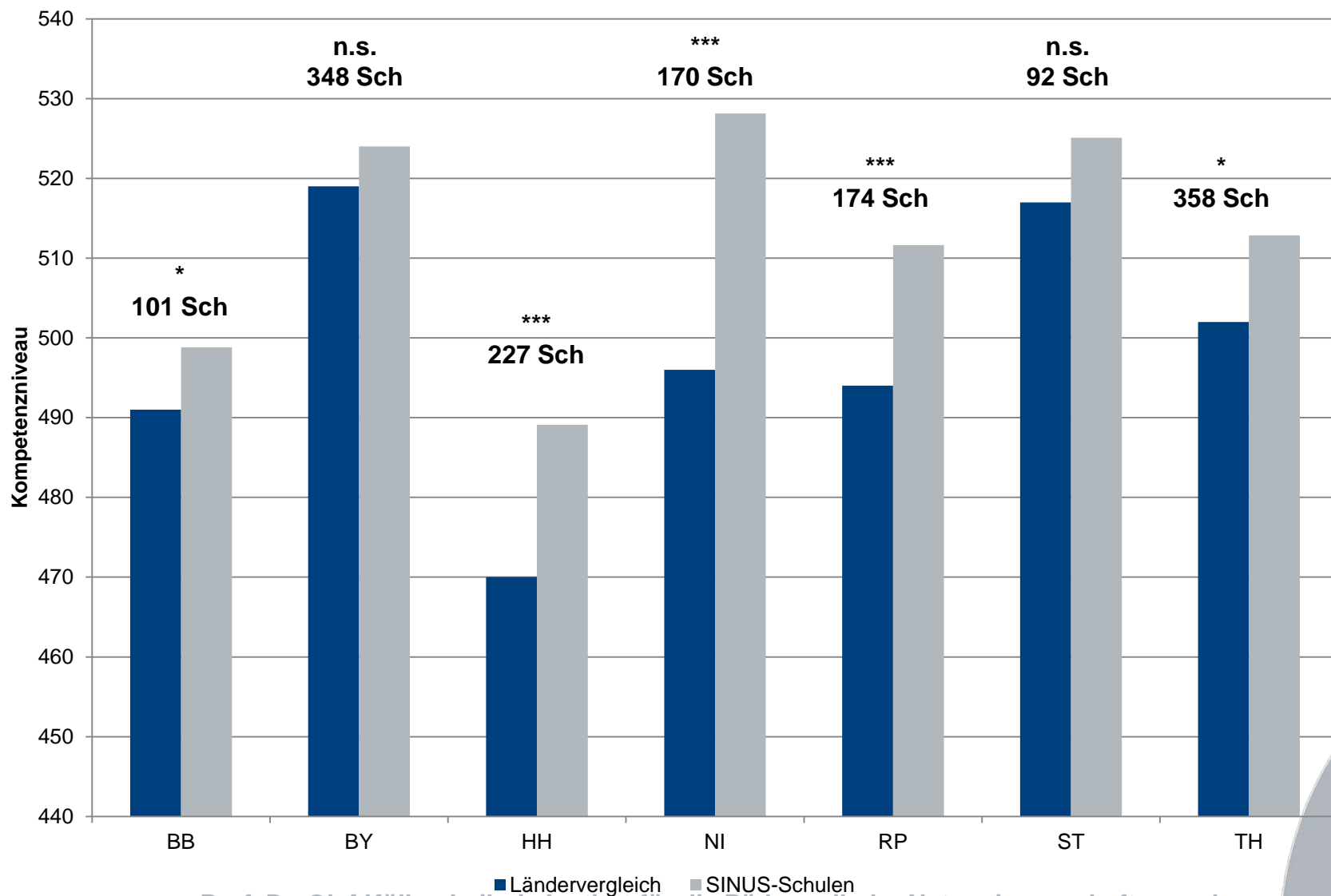
Results:

- Students' competencies in SINUS-classes were higher compared to competencies of students not learning in SINUS-classes

Level 4: Student outcomes

- Extension of the National Assessment of Educational Progress in 2011
- 80 SINUS primary schools formed an additional testing group which could be compared with students from all 16 federal states (N = 27.000 from 1.349 schools)
- Schools started in 2004 in SINUS
- Students worked at the end of grade 4 on standard-based tests
- Test scores were available on a national scale with $M = 500$ and $SD = 100$

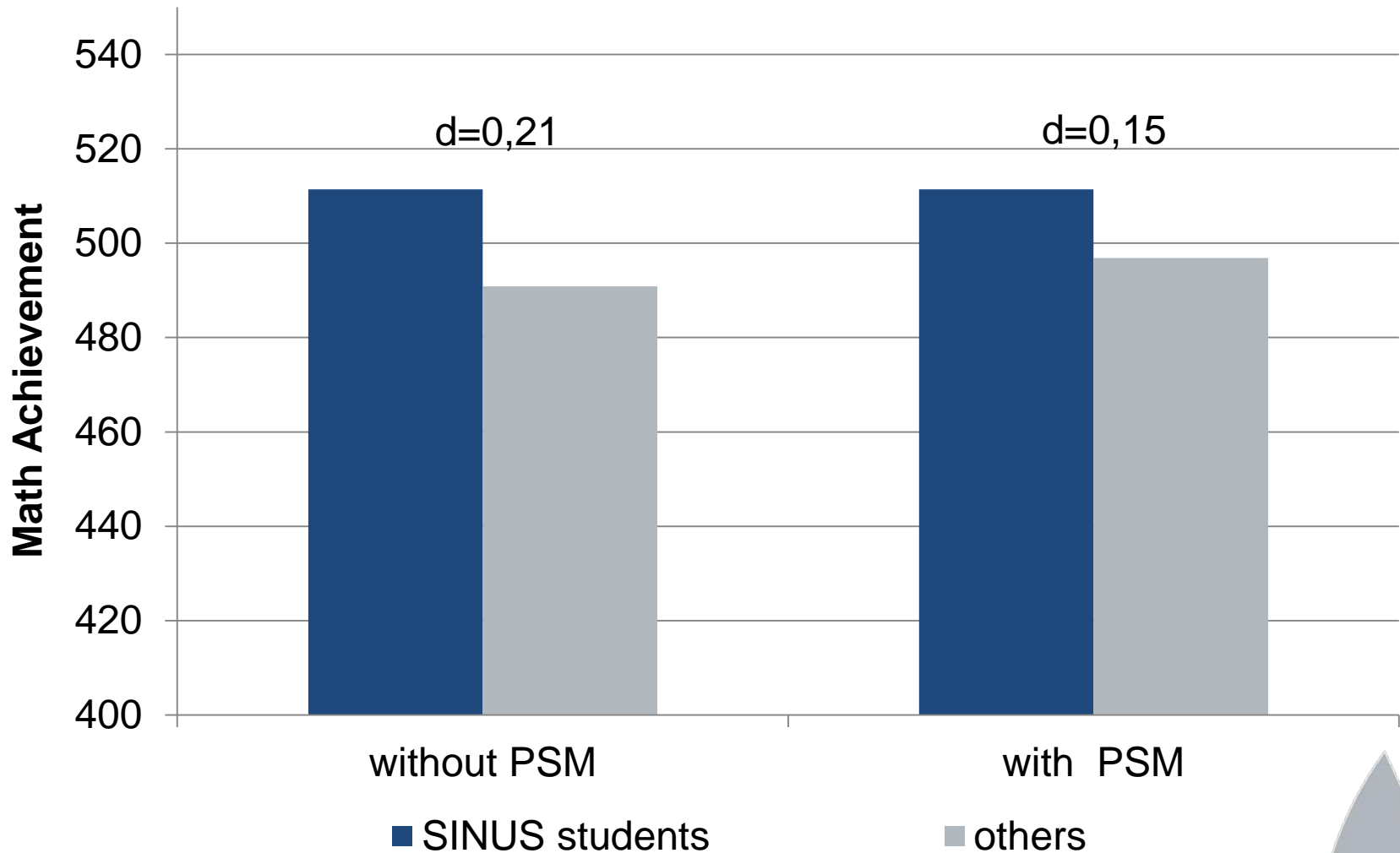
Findings



Limitations

- Students from SINUS schools could differ in many entry characteristics so that differences are not the consequence of SINUS but of these characteristics
- Solution: Propensity Score Matching: Comparing students from SINUS schools only with those students who came from similar schools and had similar entry characteristics as well as similar school characteristics

Findings after propensity score matching



Lessons learnt from SINUS: Implementing change in schools works, if ...



- Teachers are accepted as experts in their professional field
- TPD contents refer to subject-specific learning
- Teachers can combine their experiences with new elements of the innovation
- Teachers have time to improve their work
- Teachers work in cooperative structures
- Teachers get support from their principals

Lessons learnt: SINUS experience ...

can be used for ...

- the conception of innovative TPD programs concerning the *content*, *the organizational*, and *the resource level* (e.g., teaching other subjects [mother tongue, foreign language] in an innovative way)
- the implementation and dissemination of innovation *in individual schools* and *in whole regions*
- *improving students' competencies* after teachers have been trained

However, please don't expect large effects of TPD programs in ecologically valid contexts



There are no limits, only horizons!

Thank you very much for your attention!
Contact: koeller@ipn.uni-kiel.de