Freie Universität Berlin

PCK and Reflection in Computer Science Teacher Education

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DIDAKTIK DER INFORMATIK

Outline

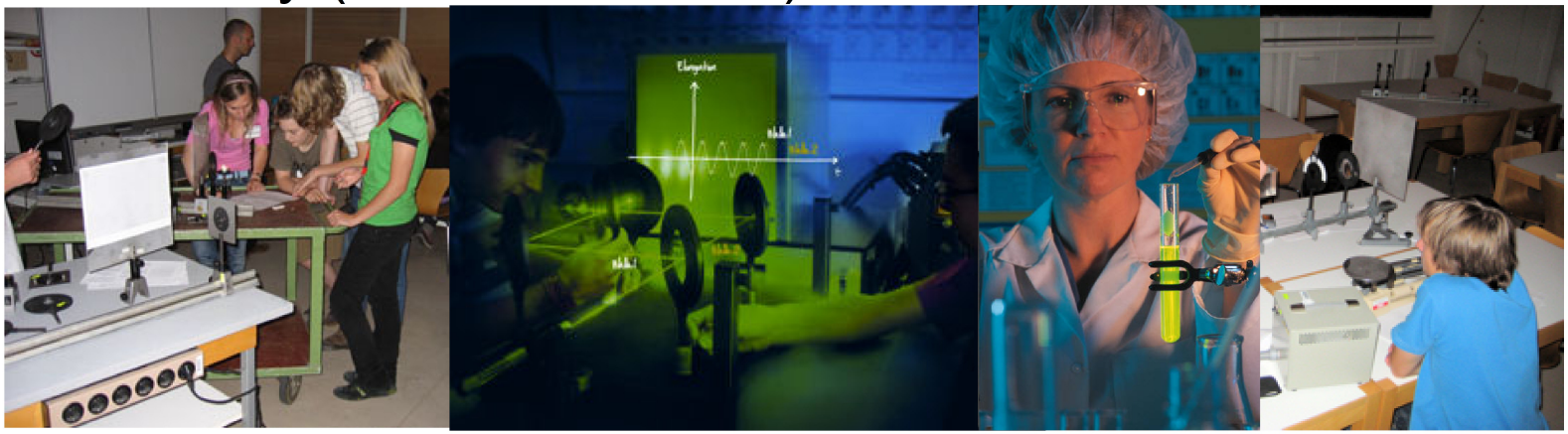
- **Background**
- Concept
- Implementation (Winter 2012/13)
- Evaluation
- Conclusion

Project Background I

- July 2009: Telekom Stiftung University Competetition
  - FU Berlin
  - HU Berlin
  - TU Dortmund
  - TU München
- FU Berlin
  - Integrate Labs into Teacher Education
- November 2013: Telekom Stiftung will Announce Partners for Follow-Up
  - FU Berlin / HU Berlin: Labs Into Teacher Education (plus n Partners)

Project Background

Science laboratories for school students in Germany (“Schülerlabore”)



Aiming at:

a. supporting schools in teaching modern science topics and concepts,

b. increasing students’ interests in science, and

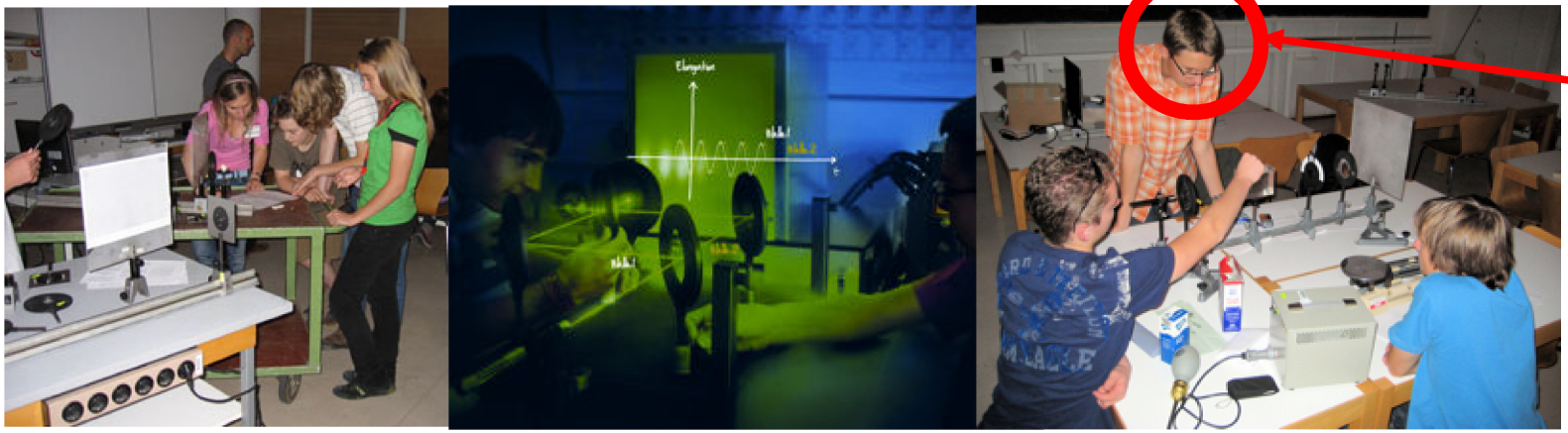
c. Attracting future university students in science and engineering domains

Pictures: PhysLAb @ FU-Berlin

Text: Uhlmann, S., & **Priemer, B.** (2011). Experiments in Schools and Science Labs An Explicit “Nature of Science”-Aspect in a Project for a Science Lab for School Students, Proceedings of GIREP Conference 2010 , Reims

Project Background

Science laboratories for **CS Teacher students**



a. Pupils Lab

b. Internship Lab: Protected environment for pre service teacher students, reduced complexity

c. Teaching/Learning Lab: Engages teacher students inquiring the learning environment like a researcher, cyclic refinement, group work, and reflection

- Reserch Lab maybe better term(?)

Project Background

Deutsche Telekom Stiftung

FU.MINT MINT-Lehrerbildung neu denken

FU laboratory for **CS Teacher students**

Van Driel: developing PCK:
(a) focus on teachers' knowledge, beliefs and concerns;
(b) opportunities to **experiment in their own practice**;
(c) collegial **cooperation** or exchange
(d) **sufficient time for changes** to occur.
Reflection, individually and collectively

OECD-Report: Teachers Matter:

„Develop skills for **reflective practice** and research on-the-job"

Need for „**rethinking the role of field experiences**"
and „**development of teachers' learning communities**"

Teachers need to become researchers:
CS Teachers@Research

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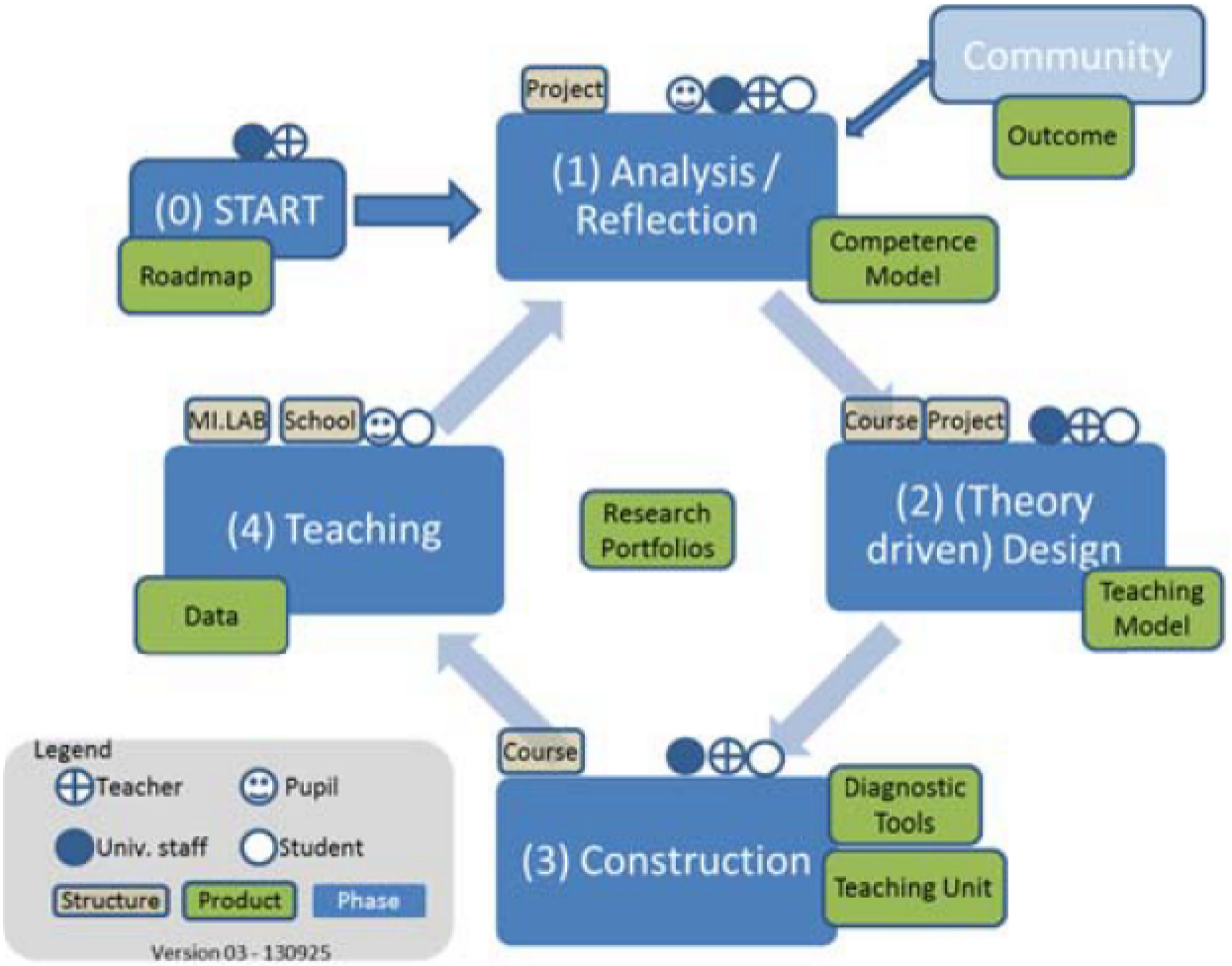

Koli 12: ProspectiveTeachers@Research - CS Teacher Education revised

Table 1: Comparison of design research processes

Design Based Research [16]	Action Research [2]	Participatory Action Research [22]	Theory oriented development of teaching units [21]	Educational Reconstruction [12]	Derived Model
Preparation (goals, starting point, learning trajectory, context)	Entrance	Reflection on action	Analyze learning prerequisites	Analysis (of Subject matter and educational significance)	Roadmap
Design and Analysis	Data Collection	Question	Set objectives	Research on teaching & learning (learner perspectives)	Analysis and Reflection
Collect data and apply interpretive frameworks	Interpretation	Fieldwork	Select a learning theory as framework	Development of instruction	(Theory driven) design
Test	Consequences ('practical theory')	Analysis	Connect aspects to a coherent approach	Teaching	Construction
Retrospective analysis (establish trust, ensure generalizability)	Action	Action	Design teaching units and materials	Evaluation of instruction	Teaching
			Test and evaluation		
Iterative (steps 2-4)	**Iterative**	**Iterative**	-	**Iterative**	**Iterative (steps 2-5)**

Koli 12: ProspectiveTeachers@Research - CS Teacher Education revised

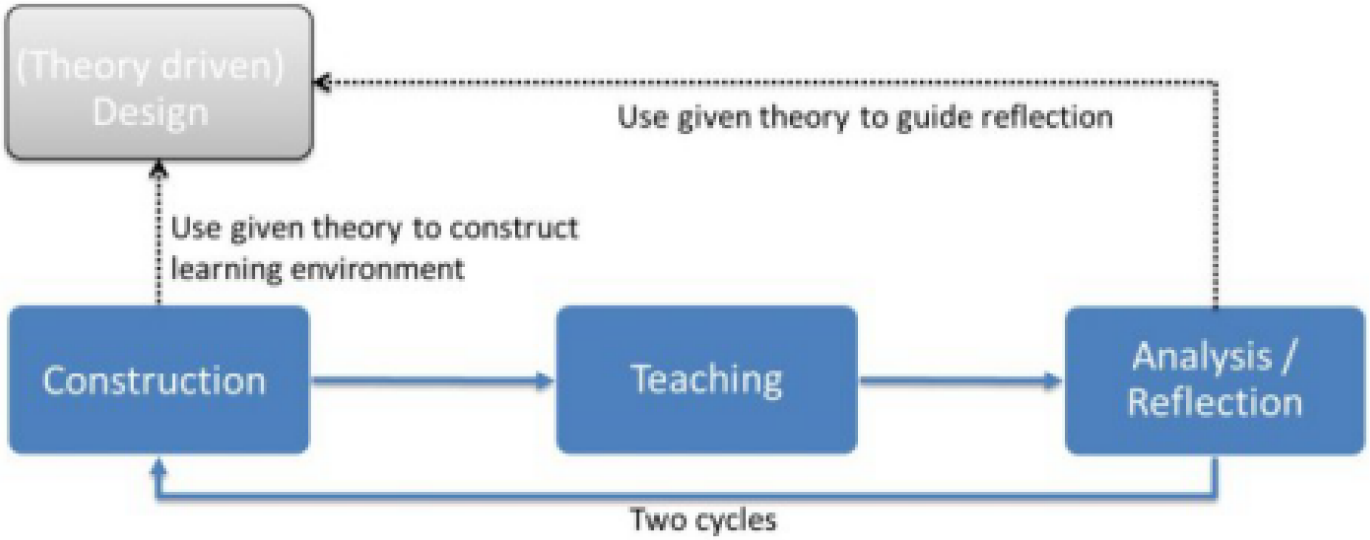

Figure 4: Ba-Module within the concept

Integrate Research in Computing Education and CS Teacher Education

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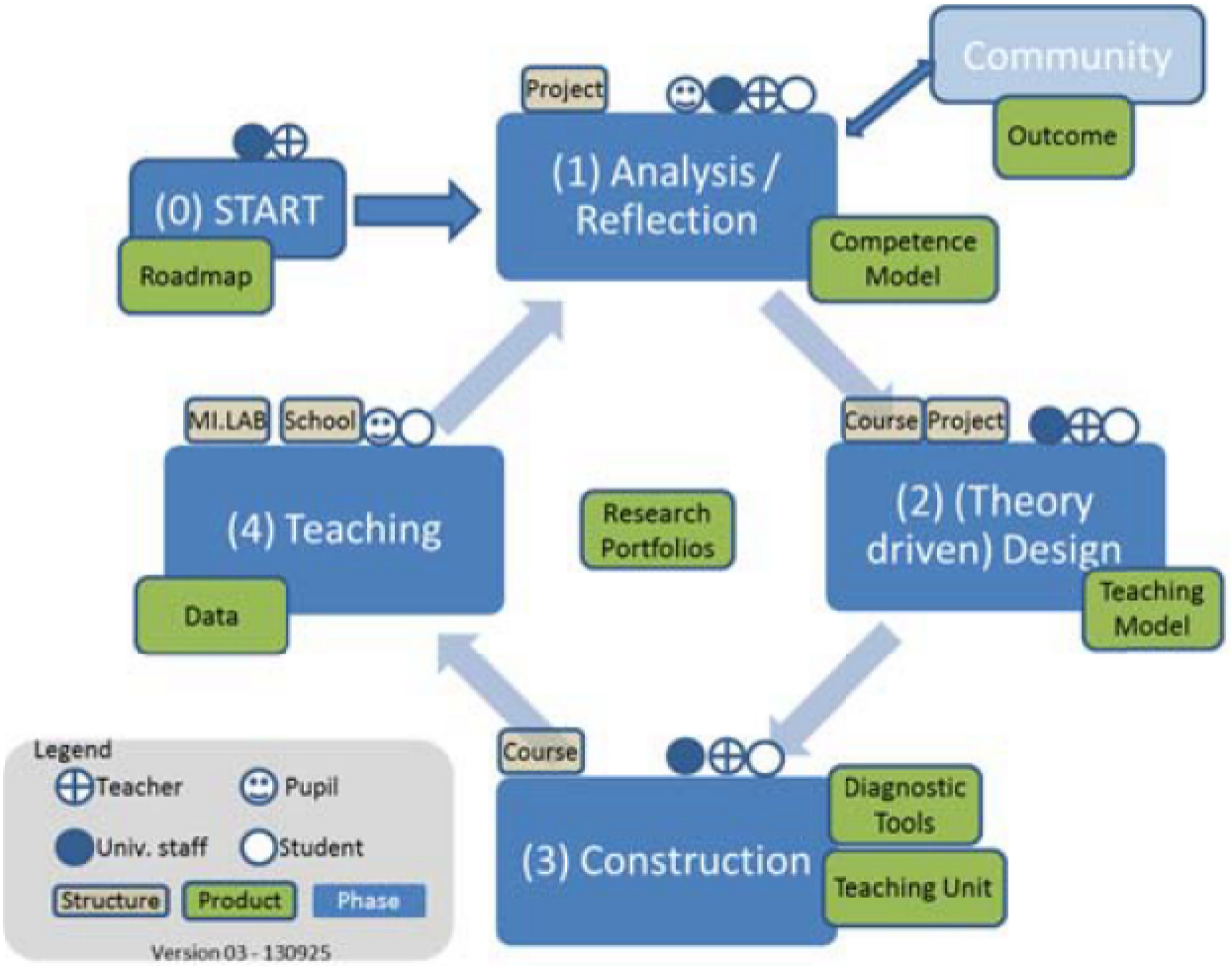
Repetition: Background (Numbers)



Outline of Seminar

0 1 2

- Seminar Preparation
- Choice of Topic, based on Community Interest
- Group of external helpers ('Godparents')
- Designing Outline for Pupils Module
    - SmartGrid: Electricity Grid plus new IT-Infrastructure for Control

SmartGrid

- White: Electricity Grid
- Orange: Future IT Grid

Old:

- Capacity controlled by current demand
- Producer → Consumer

New:

- Prosumer
- Capacity: Optimization between Demand & Production

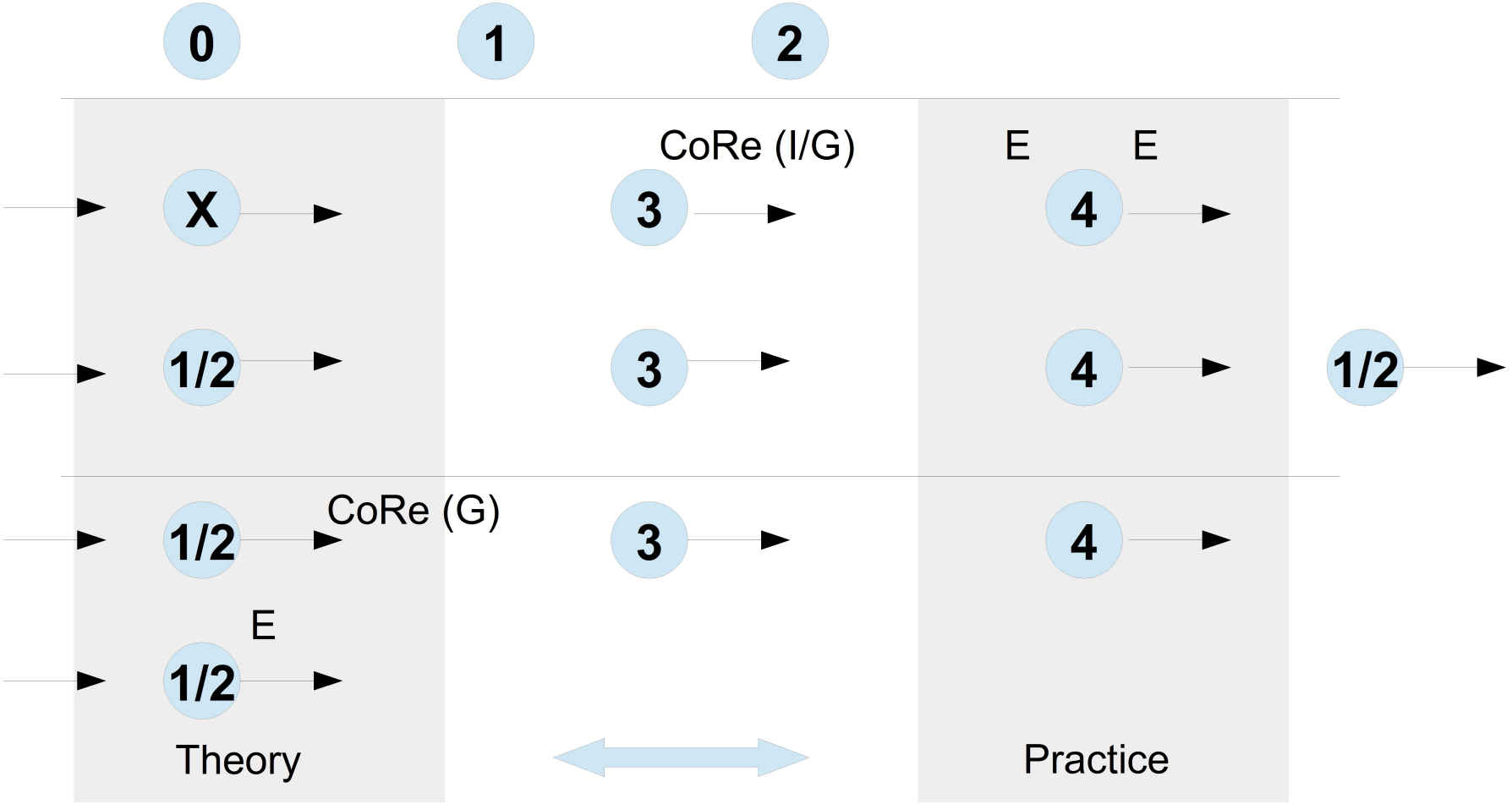
Outline of Seminar

0 1 2

- Seminar Preparation
- Choice of Topic, based on Community Interest
- Group of external helpers ('Godparents')
- Designing Outline for Pupils Module
  - SmartGrid: Electricity Grid plus new IT-Infrastructure for Control
  - Three Parts: Introduction Modelling & Simulation Reflection

    MindStorms AGG Debate

Outline of Seminar



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Procedure: CORE Questionnaires

1. What do you intend the students to learn about this Big Idea?
2. Why is it important for the students to know this Big Idea?
3. What else do you know about this Big Idea (and you don't intend students to know yet)?
4. What are the difficulties/ limitations connected with the teaching of this Big Idea?
5. Which knowledge about students' thinking influences your teaching of this Big Idea?
6. Which factors influence your teaching of this Big Idea?
7. What are your teaching methods (any particular reasons for using these to engage with this Big Idea)?
8. What are your specific ways of assessing students' understanding or confusion around this Big Idea?

Results

Level	Teaching nexus			Learning nexus			Other	
	Q1 (what)	Q2 (why)	Q3 (SMK, reduc.)	Q4 (difficulties)	Q5 (prior knowledge)	Q8 (assessment)	Q6 (forces)	Q7 (methods)
1	topic is named	goals is named, but not justified	(nearly) no knowledge about the topic	teacher centric: tries to cope with the topic herself	mentions parts of the content	teacher just knows (observes)	focus on organizational issues and teaching material; vague impression that pupils perspective is important	few methods
2	topic and CS connected	NOT CLEAR [not: names more than one goal!]]	deeper content knowledge, but no justification what to leave out	teacher centric: how to reduce / reconstruct	NOT CLEAR	teacher inquires	NOT CLEAR	more methods, and justification for Content
3	connected to everyday life	goal is justified; connection between CS and real world is made	focus on specific parts of the deep content knowledge, no justification what to leave out	learner centered: knows specific, content related learning obstacles	NOT CLEAR	teacher has methods/aspects to inquiring;	NOT CLEAR	broad knowledge of methods; use of methods is partially justified

Figure 3: Results of analysis, presented as preliminary competence model

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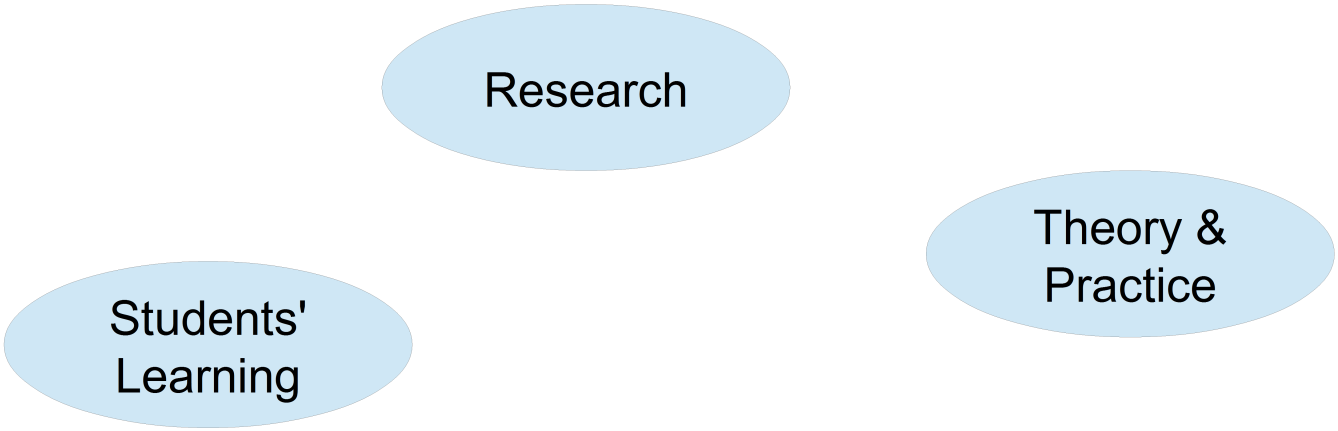
Conclusion

- Teacher Education!



Thanks!