JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

INSTITUT FÜR DIDAKTIK DER PHYSIK

Teachers' Beliefs About Learning and Teaching Science Content and Scientific Inquiry

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Focus of the Study

Engaging students in inquiry activities is often assumed to contribute to their learning of **science content (SC)** and **scientific inquiry (SI)** (e.g., NRC, 2012).

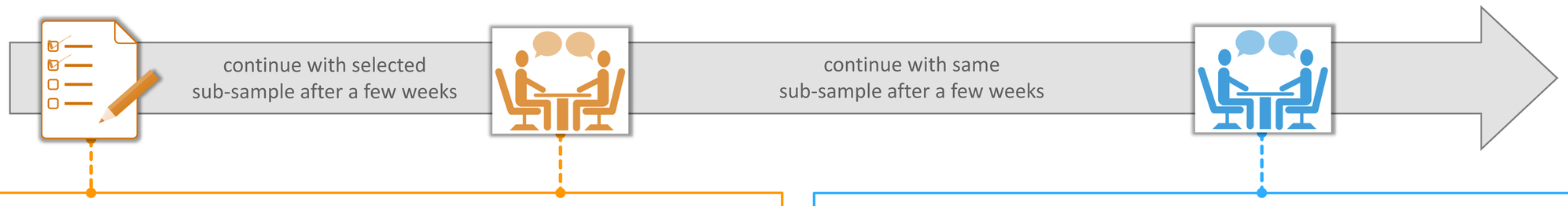
While students are frequently engaged in inquiry activities during instruction (inquiry as teaching strategy; e.g., Börlin & Labudde, 2014), inquiry strategies are rarely discussed (inquiry as goal; e.g., Capps & Crawford, 2013).

Assumption: The relatively **small focus on SI as goal** in teachers' classroom **practice** could be **related** with teachers' **beliefs about learning and teaching SC and SI** (i.e., beliefs are psychologically-held understandings, premises or propositions about the world and one's own self that are *felt to be true;* based on Richardson, 1996).

Research Question 1:
How do teachers' **beliefs** about learning and teaching **differ** regarding **SC and SI**?

Research Question 2:
How do teachers **discuss/reflect** about teaching practice on SC/SI and to what extent does this **correspond** with their **beliefs**?

Research Design and Methods



Online-Questionnaire

Using Likert-items and open questions to assess teachers' **beliefs** about ...

- the helpfulness of selected strategies to teach SC/SI
- their own abilities to teach SC/SI
- ...

Statistical analysis of differences between beliefs about SC and SI

Guided Interview

Detailed analyses of teachers' **beliefs** by investigating ...

- the reasons behind their choices (e.g., why do they believe a specific strategy is helpful?)
- what aspects (e.g., strategies) teachers mention by themselves

Category-based analysis of beliefs about SC and SI (see open questions)

Tasks and follow-up Interview

Capturing how teachers **plan** lessons and how they **analyse** lesson vignettes on SC and SI (considerations)

Capturing what aspects teachers **"think"** about regarding planning and analysing lessons on SC and SI (considerations and reasoning)

→ Investigate the relationship between assessed teachers' **beliefs** and their **considerations/reasoning**

→ Identify other aspects (e.g., experiences, additional beliefs) that potentially impact how teachers plan and analyse lessons on SC/SI

Beliefs About Teaching Strategies

For good teaching of physics content / scientific inquiry, it is *not helpful / ... / indispensable* that ...	*Not helpful*	*Rather not helpful*	*Rather helpful*	*Helpful*	*Very helpful*	*indispensable*
SA ... the students carry out investigations by themselves. *[student activity]*	☐	☐	☐	☐	☐	☐
TA ... the teacher carries out investigations. *[teacher activity]*	☐	☐	☐	☐	☐	☐
SO ... the students' prior experiences on physics content / scientific inquiry are taken into account. *[student orientation]*	☐	☐	☐	☐	☐	☐
EX ... physical concepts (e.g., Ohm's law) / rules for conducting inquiry (e.g., control-of-variables strategy) are elicited and explained to the students. *[explicit instruction]*	☐	☐	☐	☐	☐	☐
... [subject orientation, guided instruction, open instruction]						

Interviewer: From your point of view, what is **important for teaching** if you want to foster your students' understanding of **science content**?

Interviewee: ...

Interviewer: From your point of view, what is **important for teaching** if you want to foster your students' **scientific inquiry** abilities?

Interviewee: ...

Considerations ("what?") and Reasoning ("why?")

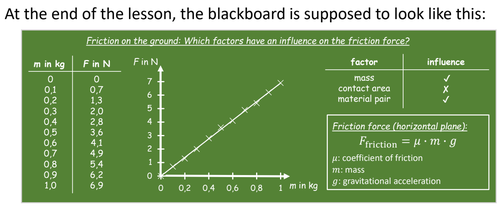
Vignette Excerpt:

Mr Meyer plans a 90-minutes lesson on experimenting for his 8th grade. His plan is to let his students work in groups on the tasks listed below.

Tasks [for students]:

a) Establish assumptions on the following question:
Which factors have an influence on the friction force?
b) Plan a suitable experiment to test one of your assumptions.
...

At the end of the lesson, the blackboard is supposed to look like this:



Analysis task [for teachers]:
What feedback would you give Mr Meyer on this lesson plan?

Interviewer: **What** do you think was Mr Meyer's goal in this lesson and **why do you think so**?

Interviewee: ...

Interviewer: Mr Meyer tells you that he wants to foster students' SI abilities. Would you change something in this lesson and, if so, **what and why**?

Interviewee: ...

Preliminary Results

Findings from piloting of the questionnaire with *N* = 70 *pre-service* teachers

Pre-service teachers seem to believe that ...

... several teaching strategies are more helpful for teaching SC than SI.
(student orientation: $M_{SC} = 5.03$, $SE_{SC} = 0.06$, $M_{SI} = 4.79$, $SE_{SI} = 0.08$, $t(68) = 4.2$, $p < .001$, $r = .45$;
explicit instruction: $M_{SC} = 5.07$, $SE_{SC} = 0.08$, $M_{SI} = 4.84$, $SE_{SI} = 0.08$, $t(68) = 3.6$, $p < .001$, $r = .40$)

... their teaching abilities are better for SC than for SI.
($M_{SC} = 4.88$, $SE_{SC} = 0.06$, $M_{SI} = 4.65$, $SE_{SI} = 0.08$, $t(69) = 4.4$, $p < .001$, $r = .47$)

→ Findings strengthen the assumption that the observed difference in teachers' classroom practice could be related with varying beliefs about (learning and) teaching of SC/SI.

Current State and Open Questions

Development of ...			
... instruments for **data collection**	✓	✓	in progress
... methods for **data analysis**	in progress	**?**	**?**

? Additional approach(es) to reconstruct beliefs from the interview data that complement the category-based analysis?

? What should be considered when a) developing the instruments (e.g., vignettes) and b) analysing the data (e.g., interviews for reconstruction of beliefs) to allow a comparative analysis of the different types of data?

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DOWNLOAD

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