

## Research Questions and Theoretical Background

In experiments at school [...] you want to prove a law and you measure the results that fit the strongest.  
 [...] In scientific experiments [...] the physician wants to discover a new law and has to be objective [...].



Students' quote by Meyling (1990, p. 92)

### Research Questions

- 1) How can epistemological beliefs (EBs) concerning classroom science be reliably assessed?
- 2) Do EBs related to classroom science and EBs related to professional science of 8<sup>th</sup> grade students differ?
- 3) What influences account for students' differing EBs related to classroom and professional science?

### Theoretical Background

• *Epistemological beliefs* (EBs) are the set of individual subjective theories one holds about the nature of knowledge and (the process of) knowing. (Anschütz, 2012; Hofer & Pintrich, 1997)

### EBs in Science Class

- EBs as *achievement goal* (Kampa et al., 2016): EBs are part of scientific literacy
- EBs as *precondition for learning science*: EBs have multiple influences on students' learning (e. g., use of learning strategies, perceiving and processing information) (Bromme et al., 2010; Edmondson & Novak, 1993; Hofer, 2001)
- Development of EBs is *affected by instruction* (Hofer, 2001): EBs are context dependent and develop with experience (Bromme et al., 2010; Muis et al., 2006)
- Students probably hold *differing EBs* related to the context of either classroom or professional science (Clough, 2006; Hogan, 2000; Sandoval, 2005)

### Research Gap

Until now there has been no empirical investigation of the difference between students' EBs concerning classroom and professional science.

## 4 Dimensions of EBs

Nature of knowing	<b>Source</b> Knowledge is not a privilege of few authorities	According to Conley et al. (2004)
	<b>Justification</b> Experiments as possible means to create knowledge	
Nature of knowledge	<b>Certainty</b> There's not always an absolute answer. Knowledge can be revised	
	<b>Development</b> Science is constantly evolving	

**Exemplary item** (certainty, by Conley et al., 2004)

Scientists always agree about what is true in science. (-)

**Exemplary item** (certainty, equivalent school-specific version)

You always agree about what is true in science class. (-)

## Assessing School-Specific EBs

### Adapted Questionnaire for School Context

- Based on the questionnaire by Conley et al. (2004)
- Addresses all four dimensions of EBs
- Iterative development of analogous phrases for school context (cf. Tab. 1)
- Systematic exchange of profession related phrases (cf. Exemplary items)

**Table 1: Analogous phrases for professional and classroom science for adapting the questionnaire**

Profession related phrase	Classroom related phrase
Scientists	Teachers/general phrase including all participants of lessons in school
Science books	Textbooks
Science lecture	Science class
(In) science	(In) science class
Scientific knowledge	Knowledge in science class
Science experiments	Experiments in science class
Science questions	Subject-specific questions

## Structure of the Research Project

**Study 1** Winter 2017/18  
**Testing the adapted questionnaire**

### Research question 1

#### Sample

N=102 (♀= 60, ♂= 42) 8<sup>th</sup> graders; 3 academic-track schools

#### Instrument

Adapted questionnaire with 26 items (*source*: 5 items,  $\alpha=0.84$ ; *justification*: 9 items,  $\alpha=0.42$  ( $\alpha=0.59$ , if item 25 is omitted); *certainty*: 6 items,  $\alpha=0.72$ ; *development*: 6 items,  $\alpha=0.54$ ); 10 likert-scale, 3 open-ended items concerning the verbal intelligibility and general feedback

#### Results

- Students' EBs related to classroom science and professional science differ
- Items referring to justification and development should be revised (low inter-item correlation, negative feedback)
- Students perceive difficulties with stating an opinion while understanding the items seems to be rather easy

**Table 2: Interpersonal comparison of students' EBs related to classroom and professional science.** Data for professional science from Urhahne & Hopf (2004); N=167 9<sup>th</sup> graders

	Classroom science	Professional science
Source	3.05 (1.22)	3,94 (.58)
Justification	4.11 (.91)	3.96 (.50)
Certainty	3.38 (1.13)	3.69 (.50)
Development	3.74 (.98)	3.22 (.67)

**Study 2** Summer/Autumn 2018  
**Comparing EBs related to classroom and professional science**

### Research questions 2 and 3

#### Expected sample

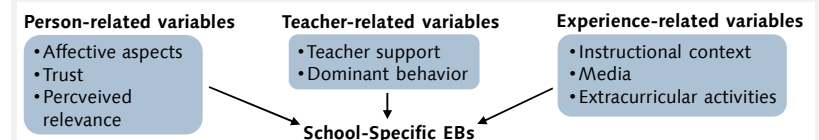
N=450 8<sup>th</sup> graders

#### Instrument

Adapted questionnaire; Questionnaire by Conley et al. (2004); Items measuring potential influences to students' EBs (cf. Fig. 1)

#### Influences on EBs related to professional science

(Urhahne & Hopf, 2004)  
 Self-concept, motivation, interest in science, learning strategies



**Fig. 1: Exemplary potential influences on EBs related to classroom science.**

**Study 3** Autumn 2018  
**Assessing causes for differing EBs**

### Research question 3

#### Expected sample

N=20 8<sup>th</sup> graders (out of sample of Study 2)

#### Instrument

Combined semi-structured interviews and retrospective think-aloud protocols to elucidate causes for differing EBs

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## Contact Information

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