

Supporting Information

Pharmacy students' conceptions of theory-practice relation in the analytical chemistry laboratory – a phenomenographic study

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Supporting Information

Questionnaire handout to students in a lecture, originally in Danish printed here in translation:

Short questionnaire about laboratory teaching

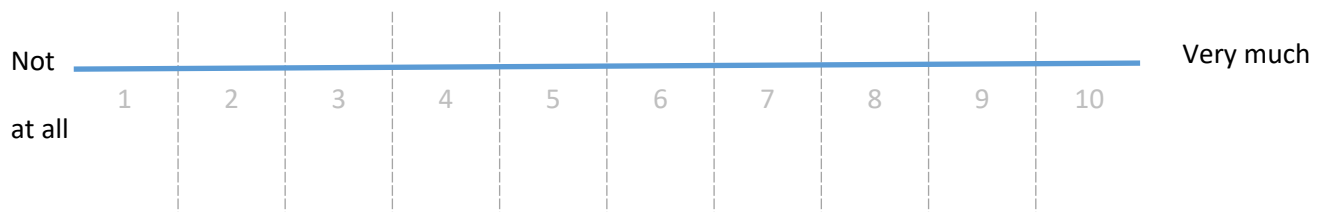
Secondary education (tick box):

STX HTX HF other

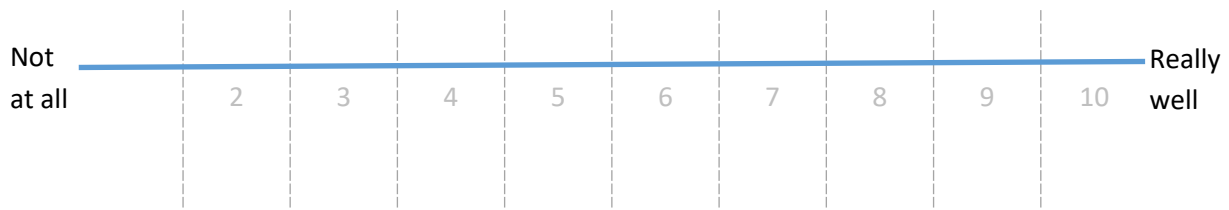
Have you passed all courses (tick box):

Yes No, lacks one No, lacks two or more

I like to work in the laboratory (add an x on the line):



I work well in the laboratory (add an x on the line):



We would like to know if you are interested in participating in this research project about improving laboratory learning.

The research project involves possible video observations and audio recordings of teaching situations and interviews. Only researchers affiliated with the research project will have access to the material. All excerpts from interviews and possible videorecordings will be transcribed and depersonified in case of publication.

I'm interested in participating in the research about laboratory teaching.

If you would like to participate please fill out below:

Name: _____

Team nr.: _____

How do we contact you? (add at least one)

Mail: _____

Supporting Information

phone: _____

Laura will return to you shortly for further arrangements if, you have shown interest in participating in the project.

Thank you for your participation!

Bente Gammelgaard and Laura Finne

Supporting Information

Interview protocol – This protocol is translated from Danish.

¹ The students' background and prior experiences with the lab and general interests are important because they shape their ideas about the world based on their experiences. That is why I start with this – also to start the talk.

Supporting Information

Interview 2

Overall theme	Under theme	Questions
assesment and feedback		- How was the feedback from the labreports?
	Preparing for the exam	- How do you (or plan to) prepare for the exam? <ul style="list-style-type: none"> ○ Why do you do it like this?
teaching learning activities (aims....)		- Why do you think you have laboratory courses (doing chemistry, practical skills, concepts, scientific skills, general skills)? <ul style="list-style-type: none"> ○ What do you gain from this kind of work that you cannot have in any other way? <p>How is the way you learn in the lab different from other ways of learning (Lectures, klasses timer)??</p>
	Specific learning outcomes from the course	- (choose some intended learning outcomes) How have you obtained this/to what extend – Can you describe how you have learned this?
learning support		- What did you do, if you got stuck in the lab? Can you describe a situation? - What have had the biggest impact on your learning in this course? (Access to teacher, well-chosen exercises, lab reports, lectures, teaching materiel (video, quizzes, books))?
Conceptual understanding (udformes sammen med Bente)	Figure of something - to explain. - Not assessed.	- Can you, in your own words, explain to me what you see on this drawing (eg. HPLC)?

Supporting Information

Examples of a Codebook

The lab help to remember

When students describe what they do in the lab helps them remember.

Examples: They get pictures that they can recall, they see things, and they do things

The lab is a place to verify understanding

When students say that the lab work corrects or verifies their previous understanding of the theory.

Examples: students get confirmed in their prediction based on the theory they have read, students can predict the outcome of the lab, and students can explain why the experiment was wrong

The lab is a place to verify knowledge

When students explain that the lab is where you see for yourself what you already know.

Examples: Students explain that the lab is where you see it for yourself, it is real, and they try things and see how they are acting out.

The experience of differences

When students explain what they get from the lab, they can't from theory and vice versa.

Examples: causal connections, what happens when they change the setting at the instrument, and small things that are important in the lab that they cannot read.

At a later iteration of the codes these were used:

Representation – to see (early category A)

When students describe the importance of “seeing” in the lab:

Examples: It is important to see what happens with their own eyes. They don't know that it is real without seeing it for themselves. The lab gives them a picture in their mind to remember the theory better.

Representation – more modalities (early category B)

The lab is giving opportunities for the students to use many modalities to express their knowledge and understanding.

Examples: They discuss with teachers and other students, they perform experiments and manipulate the instruments, and they hear and see things that help them understand.

Lab and theory are complementary (early category C)

When students explain that the laboratory helps them focus on the differences between theory and practice.

Examples: Students acknowledge that the laboratory is not an ideal situation compared to theory. Mistakes happen in the lab that helps them understand the theory better.