From the Colloquial to the Scientific Story: the use of Classroom Dialogue in the Development of Conceptual Understanding of Physics

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Abstract. The importance of drawing upon the daily-life views of students during colloquial classroom dialogue in physics education is widely recognised. Switching to the scientific jargon is important, but when and how to make this transition is not clear. Equally unclear is how many transitions are effective. Many transitions may allow students to 'ease' into using newly acquired scientific jargon, but may take long. Conversely, only few transitions may constitute unsurmountable steps for the students. A better understanding of what constitutes effective implementation of these transitions during classroom dialogue is achieved by means of collaborative designing lesson materials and implementing these in the classroom. This talk will present the outline for my study which will take place in the next four years.

Problem statement

Common wisdom dictates that a new topic is best taught when a link is made with daily-life phenomena, using colloquial language. In time, the transition from colloquial language ("make a lightbulb light") to scientific language ("establish an electric current through the light bulb") needs to be made. These transitions are called turning points [1,2] and are fundamental in learning abstract concepts. When, how, and how many transitions are considered to be effective, is unclear.

Research that explicitly focuses on dialogues and the learning effects are very limited [e.g. 3,4]. Although the need and influence of turning points are recognized, occurrences of turning points mostly rely on teachers' intuition. But learning is too valuable to be governed by gut feelings. There is thus a pressing need to better understand how turning points are to be utilized during classroom dialogues.

Research into turning points

Under the scope of a PhD grant – which allows me to both work as a secondary school teacher as well as to conduct a PhD research - I will study the use of turning points in physics education. Guided by the overarching research question:

How does planning for turning points during classroom dialogue contribute to the development of conceptual understanding of physics in secondary schools?

The study is divided into four separate studies, each addressing one of the following sub-questions:

1. What are characteristics of turning points in classroom dialogues when teachers are teaching physics?
2. What are characteristics of effective turning points in classroom dialogue and how to support teachers in implementing effective turning points in classroom dialogue?
3. How can teachers collaboratively develop lessons that implement turning points in classroom dialogue?

4. To which extent does planning of turning points in classroom dialogue influence the development of conceptual understanding of students when teaching physics?

In studying and enhancing classroom dialogue with a focus on turning points, we identify four aspects that are relevant and achievable:

1. the baseline characteristics of classroom dialogues and the presence (or absence) of turning points in current classroom practices;
2. availability of prototype scenarios for effective physics classroom dialogue;
3. collaborative development of lesson materials that support teachers in implementing classroom dialogues with explicit attention to turning points;
4. the effect of classroom dialogue on the conceptual understanding of physics of the students.

This research will address these aspects in four studies, each addressing one sub-question and each providing a basis for the subsequent study.

The foci for GIREP 2022 – Study 3

The focus of the talk is on study 3, in which six physics teachers will participate. A Lesson Study (LS) approach consisting of two cycles will be used. Like in [5], each cycle will consist of two planning sessions, one research lesson (including interviews with case studies), and one evaluation sessions.

Drawing on the work of [5], we expect that the field notes, recordings of lesson observations, and minutes and design notes of the meetings can give further insights into how exactly the learning takes place among the teachers and as such will add to the literature on how in-service training of teachers could take place. At the end of study 3, I also expect to have two ecologically valid lessons scenarios. Finally, I expect that the participating teachers are (more) confident in having classroom dialogues in their own classrooms.

This approach is a unique example of how a Professional Learning Community (PLC) can be part of research into dialogue and conceptual learning. We will elaborate on this further in the presentation.

References

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