29. CONTEMPORARY SCIENCE IN THE LOWER SECONDARY PHYSICS CLASSROOM

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Abstract
Can contemporary science have a role in the classroom? While many students find contemporary science exciting, they often view school science as boring and uninteresting. Most of the physics taught in school was developed over a century ago and can be seen as well-established consensus science. Including discussions on contemporary research is one way to increase interest and motivation, and is also a way to provide students with possibilities to learn what research today could look like. It is also one way to teach general nature of science (NOS) perspectives, which have been argued to be important for many different reasons. In this presentation we will describe how a group of science teachers developed and implemented teaching sequences focusing on contemporary physics during in-service training. Each teacher chose a research area, interviewed a researcher, and wrote a popular science article aimed at secondary students (13-15 years old). Finally they designed, implemented and evaluated a teaching unit built around the popular science article. During the presentation we will describe the teachers' experiences, the resources developed by them, and the kind of NOS perspectives included by the teachers.

1. Introduction and theoretical framework
There is much evidence from science education research that science classes around the world are focused on established, consensus science. Often, the concepts and models presented evolved some hundred years ago. However, it has been argued that also contemporary science should have a place in the teaching of science (e.g. Tytler, 2007). It has also been shown that although many students view school science as boring and uninteresting, the same does not necessarily hold for contemporary science, which students instead often find exciting and interesting (Jidesjö, 2012). Including discussions on contemporary research is one way to give students possibilities to learn what research today could look like. It is also a way to teach general nature of science perspectives (NOS), which has been argued to be important for a number of reasons (e.g. Lederman, 2007). Getting the possibility to get to know about contemporary research and contemporary researchers could challenge images of science as being no more than a large body of established facts. Furthermore, it could open up possibilities to challenge stereotypical images of scientists (see e.g. Rodari, 2007; Sjøberg, 2010; VA, 2007) through adding human elements of science (such as creative and socio-cultural aspects of science).

Students could meet with contemporary scientists in real life as suggested by Woods-Townsend et al. (2016) or through e.g. films or texts. Meeting possible role-models could improve the possibilities for different student groups (e.g. girls) to identify themselves with science. However it is, as argued by Tytler (2007) necessary to "remember that teachers' professional identities are forged through their experiences of school and university science, with very few having practiced science in a research or professional sense. If we are serious about having school and university science reflect the nature of science as it is practiced in contemporary society, then we need to interrogate directly the nature of contemporary science and how it might differ from schooling versions" (p. 23). One way for pre- or in-service teachers to start examine contemporary science practice is to interview practicing scientists. Such an approach has been described in Tala and Vesterinen (2015).

In summary there are many different possibilities of including not only consensus "Ready-made science", but also contemporary "Science in-the-making" in science teaching. Such teaching could

provide students with possibilities to understand research of today; challenge common stereotypical views about the nature of science; and give students more possibilities of finding role models to identify with. Broadening the images of scientists could be important to help students to participate and identify with science (see e.g. Henriksen et al., 2015). In the Swedish curriculum it is also stated that "Current research areas in physics, such as elementary particle physics and nanotechnology" (Skolverket, 2011) should be included in the physics core content knowledge for school year 7-9. However, this is something that is often overlooked in the physics teaching. Since there are most often no traditions to teach about contemporary science, there is a need to develop resources to support teachers.

This presentation describes a case study where science teachers, during in-service training, developed and implemented teaching sequences focusing on contemporary physics. An important part of the development of the teaching sequence was that the teachers met with a researcher, performed an interview, and with the starting point in this interview wrote a text that was used by their students during the teaching sequence. The aim of the presentation is to shed light on the NOS that was included in the texts directed towards the students, as well as to describe the in-service teachers' experiences from the project.

1. Research methods and analysis

The teachers were, as mentioned above, taking an in-service teaching course, spanning three semesters. NOS perspectives had been taught earlier during the course, and the teachers had also tried NOS activities in their own classrooms. Thus, these teachers had a great deal of NOS-teaching experience, compared to most science teachers in Sweden.

Each teacher identified an area of current research. We, as teachers of the course, supported them by contacting the researchers and scheduling interviews, as well as short presentations by the researchers to the whole group. Each teacher interviewed "their" researcher, wrote a popular science article aimed at secondary students (13-15 years old), designed, implemented and evaluated a teaching unit built around the article, and finally wrote a short report on their experiences from implementing the teaching sequences in their classrooms.

This presentation builds mainly on the analysis of the texts written by the teachers. The popular science articles were examined for different NOS aspects. This analysis used a previously developed framework (Leden et al., 2015) inspired by the Lederman tenets (e.g. Lederman, 2007) as well as the family resemblance perspectives on NOS (Erduran & Dagher, 2014). The final reports were analyzed for challenges and opportunities connected to the inclusion of contemporary physics in physics class.

2. Results

The preliminary results show that the popular science texts include presentations of the specific researchers engaged in the chosen research areas. In the description of the research area and the work and interests of the researcher a number of different NOS perspectives were raised. These include descriptions of scientific processes in different areas including Big Science, research funding, the relation between empirical and theoretical work, research collaborations as well as the peer review system, the relationship between applied and fundamental research, the historical development of research areas, and interdisciplinary research. Some of the texts covered many different NOS issues, while others focused more closely on a few specific aspects. Most often explicit NOS related questions were asked by the teachers in the interviews and the researchers' perspectives are described in the texts.

The teachers' experiences from the project were generally very positive. Of course they encountered challenges, such as finding it hard to answer all the questions raised by the students related to the contemporary science topic. They also found it time consuming to prepare this kind of teaching. On the other hand, they found students' interest and engagement very inspiring. The relevance of physics

increases – physics becomes something that happens now and in which people of flesh and blood are engaged, and not something relevant only in the school setting.

4. Discussion and conclusion

At the outset of the project, most of the teachers found it hard to see how it would be possible to include contemporary science in school year 7-9. However, by the end of the project they felt more confident working in line with the intentions of the curriculum. We believe that the teachers' meetings with the science researchers had a great impact on them – researchers became real people. This is something that could serve as inspiration for other pre- and in-service teacher training programs. Another important issue is the necessity for teachers to get the possibility to develop teaching sequences, with support of colleagues and teacher educators, and also implement and reflect on them. In the presentation, we show how it is possible to begin to bridge the gap between research and policy documents on the one hand, and the actual teaching practice on the other, in areas such as teaching contemporary science and NOS to compulsory school students.

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