

## **Who fits into the science classroom? Critical perspectives on pedagogical models in science education.**

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This mini-symposium aims to stress issues about how pedagogical models like e.g. SSI, science for girls and ESD construct who fits in or not in the science classroom. These models are developed from a good intention of including "all" students, opening up possibilities for them who often are seen as outsiders in science culture. But we claim that these seemingly democratic pedagogical models fabricate desirable and undesirable subjects. Often, the norms for fitting in can be understood in terms of images of gender, ethnicity and social class.

A movement in science education research highlights the importance of making science knowledge "useful" for "everyone" in "everyday life". The aim with these efforts is to let students develop scientific literacy, which often is talked about as "necessary" for citizenship. Different practices carry strong ideas of designing the future, and emphasize the need of competences that are inscribed in the concept of "future citizen". These competencies are often described in terms of problem-solving, critical thinking and making rational decisions to contribute to a sustainable world. In relation to this image, those children that don't want to make decisions, solve problems become constructed as failures. In a wider perspective, they can be seen as threatening the intentions of science contribution to a sustainable world.

In this symposium we would like to raise critical issues about what norms that are constructing individuals, from different social categories, as desirable or non-desirable in science classroom. These issues will be discussed in relation to six examples from empirical studies which are problematizing the construction of the desirable science student. These examples are: 1) PISA construction of the science student; 2) Social class in science class; 3) Narratives of females and science; 4) Gender, sexuality and normality; 5) Who is the democratic citizen?; 6) Who is the sustainable citizen?

Keywords: citizenship, gender, social class, PISA, Education for sustainable development, critical thinking

## **Introduction**

Who is the desirable student in school science practices? What kinds of competencies and characters do we have in mind when trying to engage students in science? How do we imagine the wanted student in terms of e.g. gender and social class – but also in terms of learning strategies and acting in classroom? When we talk about preparing students for the future, whose future do we have in mind and what kinds of subjects do we include in the imagined future?

In this mini-symposium we would like to stress issues about how pedagogical models like e.g. socioscientific issues (SSI), science for girls and education for sustainable development (ESD) constructs preferred subjects. All these models are developed from a good intention of including "all" students, opening up possibilities for them who often are constructed as outsiders/ unprivileged in the science culture. But we claim that even these seemingly democratic pedagogical models fabricate desirable and undesirable subjects. Through defining norms in the classroom, one inevitably defines who is outside the norm and become constructed as "the child left behind", ill-fitting in the democratic practice – and a problem to be solved. These ill-fitting students can be seen as threatening the purpose of school science – if they are not willing to engage in and learn science.

Another movement in science education research and teaching has been to make science knowledge “useful” for "everyone" in "everyday life". The aim with these efforts is to let students develop scientific literacy which often is talked about as “necessary” for citizenship in a complex society. Different practices, sometimes entitled as Vision II science education, carry strong ideas of designing the future, and emphasize the need of competences that are inscribed in the concept of “future citizen”. These competencies are often described in terms of problem-solving, critical thinking and making rational decisions to contribute to a sustainable world. In relation to this image of the desired subject, those children that don't want to make decisions, solve problems become constructed as failures. In a wider perspective, they can be seen as threatening, perhaps, the intentions of a future sustainable world or healthy society. Thomas Popkewitz (2004) means that all pedagogical models fabricate desirable and undesirable subjects. This means that students who are not willing to take the desired position become excluded from school culture. Above that, Popkewitz talk about a double exclusion, since these children often come from social classes, not representing the norm of the white, middle-class masculinity – a norm which is imprinting the school science as well as other societal areas.

In this symposium we would like to raise critical issues about what norms that are constructing individuals, from different social categories, as desirable or non-desirable in science classroom. In a roundtable discussion we want to discuss who becomes constructed as a “success” or as a “failure”, non-fitting into the norm and therefore also get difficulties with identifying with the culture of school science. How are hidden norms influencing students' participation in different school practices? These issues will be discussed in relation to six different examples from empirical studies which are problematizing the construction of the desirable science student. These examples are: 1) PISA construction of the science student; 2) Social class in science class; 3) Narratives of females and science; 4) Gender, sexuality and normality; 5) Who is the democratic citizen?; 6) Who is the sustainable citizen? The presentations of the studies will be short, and the purpose is to raise issues for a joint discussion. In the following these examples will be presented.

### **PISA construction of the science student**

One example of how the discourse of school science is constituted is in the questions in the PISA test. Margareta Serder will in the symposium discuss how the desirable science student is constructed through PISA questions. The assumption is that the test reflects what those empowered to decide the rationales for testing and what items to be used deem as valuable knowledge, but also how to “be” as a good student. Through a study of 15-year-old Swedish students collaboratively engaging in the problem-solving of three units of science test-items from PISA 2006, Serder has studied the interaction between the students and the test items, and in what ways the students are (not) able to identify themselves with fictional students that occur in the test. In the analysis of the students’ meaning making of the test items clear structures of the desirable science student emerge. The backstory texts and items of the PISA science test implicitly give a picture of different fictional students through whom scientific knowledge and practice is enacted. Actions and utterances from the fictional students are taken up in the real student’ discussions and emerges such as an embodied scientific culture to be negotiated. In their dialogues, the “real” students are questioning the fictional students’ scientific discourse, in which communication comes about through strict, academic and impersonal language and where the “normal” way of posing questions about problems in everyday life is through conducting scientific experiments. They take positions in resistance to the fictional science students through talking about them as “besserwissers” and distance themselves from the science culture which occurs as elite, superior, and with little interest in things in life outside the scientific box.

### **Whose knowledge is valued?**

Another expression for the school science discourse is activities in the everyday science classroom. Anna Jobér discusses how common – and taken for granted – activities and practices in the science classroom has impact on how students from different social backgrounds feel like “a fish in the water” or not (Bourdieu, 2010). Jobér has – from an ethnographic perspective – studied how social class is manifested in the science classroom. This approach is important since many studies have shown that there is a relation between social class and success in science education. Many students do not reach the goals for science set by their national curricula and failure in science has been shown to be more strongly related to social class than any other school subject (Calabrese Barton, 1998). But there is a lack of empirical studies that analyse how social class is manifested in the school science practices. Jobér understands the relation between social class and good results in science in terms of what is constructed as the “right way” to talk and act in the school science discourse, which behavior that is favored by the teacher and the school mates. Further, Jobér discusses how this hegemonic discourse constructs insiders and outsiders in the science classroom. What knowledge and whose knowledge are valued? Which subject position is available to whom? This part of the symposium aims to draw attentions to the understanding of how societal structure influences everyday life in the classroom and thus have implication on all levels, rather than focusing on blaming individual students.

### **Narratives of females and science**

The next example raises issues about images of gender in science education, and how these structures ideas of how to include females in science. Marianne Løken analyses narratives about females’ educational choices, and how a discourse on gender and science is constituted in individual stories about choosing science. She discusses how broad generalizations based on sex differences stands the risk of losing important nuances that again might lead to cementation of gender stereotypes in the classroom. Science education research often corresponds with what Løken refers to as the metanarrative about females and science. This metanarrative, as a synthesis of dominant discourses, includes claims that girls are

alienated by science, since the discipline is masculine and impersonal, that females have a more theoretical approach to science and that females are more collaborative than males, less competitive etcetera. These stories have been important in terms of creating gender awareness in science classrooms etc., and often illustrate that “inequity is a social problem that can be fixed” (Brickhouse et al, 2000). Løken argues that the metanarrative gives a homogenous, stereotyped and oversimplified picture of *females in general*, of *females and science*, as of *females in science*, which makes it hard to understand the diversity among females, inside and outside the classroom. The intention is to raise issues about how to challenge stereotypical notions of gender in and outside the school as an institution. To focus less on gender differences, and more on diversity among and within females, may be a step towards a more conscious perspective of diversity – “beyond gender” – where new subject positions become available for females in science.

### **Gender, sexuality and normality**

Another example of how stereotypical images of gender are making specific subject-positions available and non-available in school science is provided by Auli Arvola-Orlander. Her study illuminates the significance of images of femininity and masculinity in everyday school practice, focusing on empirical examples of role plays documented through an ethnography undertaken in a Swedish secondary school. The purpose of the role play was, according to the teacher, “to help you [the students] on the path to becoming a man and a woman”. Arvola-Orlander analyses what kind of reiterated possibilities of acting these students had in their current educational situation. How did images of femininity and masculinity vary between the plays performed? What kinds of images of femininity and masculinity were rehearsed in science classroom practice? By posing these questions, Arvola-Orlander wants to discuss what possibilities for agency that are opened up through the students’ acting, and what kind of opportunities for reimagining femininity and masculinity that exist as a result. The results showed that the portrayal of girls, homosexuals and others who do not fit the masculine norm were presented as fragmentary in comparison with the characterizations of heterosexual boys. Norms for gender and sexuality strongly organized the “path to becoming a man and a woman”, and one can ask how role plays can make new subject positions available rather than contribute to closing them?

### **Who is the democratic citizen?**

In the next contribution Maria Andrée and Iann Lundegård scrutinizes how the national curriculum for science education for the Swedish compulsory school express ideas of educating the democratic citizen. The Swedish curriculum emphasizes the democratic mission as imparting respect for human rights, fundamental democratic values and preparing all students for responsible participation in societal life. This is in line with a strong discourse on scientific literacy. In this contribution, Andrée and Lundegård focus particularly on how the terms argumentation and critique are expressed and used in the Swedish national science curriculum documents. They find that the curriculum particularly emphasize the importance of the good and equal conversation where all arguments are scrutinized on the basis of a shared scientific norm. These writings contribute to fabricating a scientific norm where ill-fitting opinions may be dismissed as irrational or simple deviations that need to be overcome through teaching, thus excluding students that do not adjust to the criteria of rationality (cf. Todd, 2009). Andrée and Lundegård wish to discuss possibilities for including a critical deliberation in science class, in which students are allowed to participate directly in conflict-rich public issues with emphasis on criticism and argument. Their study points to the importance of recognizing how activities concerning argumentation and critique are related and may be exercised simultaneously. They argue that deliberation requires

recognition of dissensus, conflict and alteration, and also, that critical action requires interpersonal encounters.

### **Who is the sustainable citizen?**

The aim with the last study presented is to problematize who and what is included and excluded in the field of ESD. In this contribution Per Hillbur, Malin Ideland and Claes Malmberg discuss which sustainability problems that are presented as important to solve, who should solve them, using what activities and with which declared intentions. By analysing in what ways teaching material fabricate stereotyped images of the “good student”, they also will describe what subject positions that are described as “undesirable” or simply are not pronounced inside the practice of ESD. Who is able to identify him/herself within this practice? The aim is to problematize in what ways constructions of “the important problems” and the “good citizen” inside a hegemonic ESD-discourse is reproducing norms for a “white, Swedish, academic middle-class”. Hillbur, Ideland and Malmberg claim that the dominant discourse of how to live sustainable is upheld by the middle-class, and expressed through calls for buying organic food, driving environmental cars and recycling. On the other hand, lifestyles which means other ways to save nature resources, e.g. by not consuming (even organic products), are not inside the ESD discourse (Bradley, 2009). In the discussion, Hillbur, Ideland and Malmberg intend to raise issues about consequences of this normative practice, which often is taken for granted as “good” and “democratic” and – not at least – “necessary”. Which other discourses around ESD are possible to construct?

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