

Science for citizenship?

Reproduction of inequalities in science education

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Abstract

In many countries, to be good at Science is a qualification needed to reach prestigious higher education and societal positions. Since the pass rate in the science subjects is lower than in other school subjects, it can be assumed that Science is a key factor in the reproduction of an unequal society. The way Science is taught in schools may thereby contribute to a society where children from minority cultures or disadvantaged socioeconomic backgrounds have less chance to succeed. It may even be assumed that these practices can contribute to the increasing stratification and polarisation of Swedish society. The overall aim in this study is to understand how school Science reproduces structures in society. Based on theories of reproduction, I will try to understand how school Science (Physics, Chemistry and Biology) can be a key factor in the reproduction of an unequal and unjust society. Data are collected at Swedish compulsory schools with ethnographic methods. Results will be discussed and analysed using concepts derived from Bourdieu (Bourdieu & Passeron, 1977; Mills, 2008a, 2008b; Reay, 2004), as well as from a science education point of view. In particular, the study will be informed by research regarding impacts of gender, ethnicity and/or socioeconomic background in science education (Aikenhead, 1996, 2001, 2007; Costa, 1995; Lee, 2003).

Background and outline of the study

Many students do not reach the goals for Science set by their national curricula. The situation is particularly alarming in Physics, Chemistry and Biology. But all students do not have equal chances of failing Science. More of the students who perform poorly have parents of foreign origin or come from disadvantaged socioeconomic groups. And the consequences are not limited to school alone. A number of Swedish and international reports suggest that to fail in Science at school has serious implications for the individual student, as well for society at large. Linder et al. (2007) argue: "Instead of equipping students to participate thoughtfully with fellow citizens building a democratic, open and just society, school science will be a key factor in the reproduction of an unequal and unjust society" (p. 8), while Tobin et al. (1999) argue that "there is a risk that school science simply maintains the status quo and pushes minorities even further toward the margins" (p. 172).

This study aims to contribute to our understanding of how such mechanisms of exclusion and social discrimination operate in the classroom, through the processes of choice of content, of assessment, or by the creation of a particular classroom climate. The study

takes its starting point in questions regarding citizenship and equality, discussing issues of gender, ethnicity and socioeconomic background.

The study draws on a number of theoretical and empirical assumptions concerning reproduction at school in general, and in school science in particular. The study is based on implications from the following research:

- Success in school Science (Physics, Chemistry and Biology) has been shown to act as a gatekeeper to higher education, thus broadening life chances of those who succeed, while limiting the future opportunities of those who fail (Broady & Börjesson, 2008; Harker, 1990; Linder et al., 2007).
- Failure in mastering Science at school is correlated to low social class. Failure in Science has by Swedish and international researchers been demonstrated to be more strongly correlated to social class than any other school subject. Foreign background correlates both to school failure and to social class, which makes the situation particularly complex (The Swedish National Agency for Education, 2009a, 2009b; Egelund & Eidesgaard, 2009; Gonzales et al., 2008; Gorard & See, 2009; Goyette & Mullen, 2006; OECD, 2007; Turmo, 2004).
- Both success and failure at school play an important part in reproducing social and economic structures (Bourdieu & Passeron, 1977).

My specific research interest concerns in what ways the reproduction of social inequalities is shaped in the classroom. By studying goals, content, and assessment, as well as classroom interactions and relations, it is hoped that light can be shed on some of the concrete mechanisms that shape the selection and which define the relative positions of the students. The focus will, thus, be on the manifest processes and activities of the Science classroom, as well as how these are experienced by the actors, foremost the students. Issues concerning gender, ethnicity, but above all, socioeconomic background, will also be focused in the analysis.

The analysis will make use of concepts derived from two different research areas:

- 1) Research on sociology of education, relating to the concepts of ‘habitus’ and ‘cultural capital’ (Blackledge & Hunt, 1993; Bourdieu, 1992; Bourdieu & Passeron, 1977; Harker, 1990; Mills, 2008a, 2008b; Reay, 1995, 2004).
- 2) Research on science education, concerned with the issues of gender, ethnicity and/or socioeconomic background (Aikenhead, 1996; Carter, 2004; Cobern & Aikenhead, 1998; Costa, 1995; Kelly, 2007; Lee, 2003; Lee & Fradd, 1996; Mortimer & Scott, 2003; Roth & Tobin, 2000; Tobin et al., 1999; Wickman, 2005).

Research questions

In order to answer the general questions concerning which features and mechanisms characterise the reproduction of inequalities in science education, the following research questions are applied:

- How is the reproduction of inequalities shaped in the science classroom, regarding aims and purposes, goals, content, and assessment practices and criteria?
- How is the reproduction of inequalities shaped in the science classroom, regarding classroom interactions and relations?
- How do students' positions regarding gender, ethnicity and socioeconomic background correlate and interact?

Methods and methodology

The research is conducted at Swedish compulsory schools. Most students live in the vicinity of the school. A first pilot study was carried out in spring 2006, at a compulsory school set in a multi-ethnic urban area. The data were collected during Science lessons with students aged 13 and 14 (year 7). The students were followed during 2 ½ months including units of Biology and Chemistry. A second round of data collection has recently begun at another compulsory school, set in a middle class area in a small town (population 10 000) with students with foremost Swedish background. The students are in year 8, aged 14 and 15. The students are followed during a 5 week unit on Physics. Neither of the studied schools has tuition in ability groups. Both investigations are part of my doctoral studies, which are scheduled to continue until spring 2012, probably including an additional round of data collection.

Data are collected according to an ethnographic research design (Atkinson et al., 2001; Hammersley, 1986; Reay, 1995; Willis, 1977). The data sources are derived from observations, interviews and recordings. The collected data also include field notes and examples of student work, such as written class work, tests, and homework. Besides, student questionnaires similar to the PISA 2003 Student questionnaire are collected. This questionnaire gathers information about students and their families, their experience of school Science and their plans for the future. This opens up for a wide range of possibilities when processing the data, such as text analysis, thick descriptions, and categorisations. The questionnaire enables a statistical analysis and a comparison with a larger student population.

As stated above, the research design is inspired by an ethnographic point of view. In this study this entails that the analysis is not a distinct stage of the research process, but rather an ongoing process that will continue throughout the study. Reflexivity will therefore be a key issue throughout the study (Hammersley & Atkinson, 1983; O'Reilly, 2005). Crucial considerations for criteria and aspects that will be focused during the process of analysis are based in the theoretical framework of the study, informed by (1) Research on sociology of education, relating to the concepts of 'habitus' and 'cultural capital' and (2) Research on science education, concerned with the issues of gender, ethnicity and/or socioeconomic background.

The first results will be published autumn 2010 and the study in whole aims to be presented spring 2012.

Discussion/Questions to be raised at NARST

The first analysis will be finished late in spring 2010, which means that there are no results at present. Nevertheless, there are other questions to be discussed.

- What issues and problems could be raised regarding how to use macro perspective in a classroom setting? In what way can the concept 'habitus' contribute to the understanding of reproduction in school science subjects? (See for example (Reay, 1995, 2004; Roth & Tobin, 2000; Zevenbergen, 2005).
- How can research in between sociology of education and science education be carried out? What are the methodological and theoretical challenges in working between these areas?
- What implications might the results of the study have for science education? How can this research contribute to the discussion and shaping of policy in science education?
- In what way may science education serve as a key factor in reproducing unequal economic and social structure?
- How can science education contribute to the ongoing discussion about citizenship in education?

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