Science Education in the Greenlandic Public School

- a multiple case study of nature, teaching and language

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ABSTRACT

Introduction and background

The current Public School Act of Greenland is from 2012[1]. The Act is a revised version of the Decree[2] of the 8th of May 2002 on the Public School, which was passed as a result of a reform of the public school dubbed *Atuarfiatsialak* – the good school. Following the reform, the school was divided into three steps, the languages Greenlandic and Danish were formally given equal status as teaching languages and all subjects excluding *personal development* became subjects in which the pupil is tested. All subjects furthermore became obligatory from the 1st to the 10th grade and learning objectives (læringsmål) were defined for all subjects.
In a science education perspective the reform introduced a new subject. The former subjects biology and geography from grade four to grade nine and physics/chemistry from grade eight to grade 11 were redefined as the subject *nature* or *the subject of nature* [naturfag] – which comprises basic science elements from biology, physical geography, physics/chemistry and astronomy from grade one to grade seven. From grade eight to grade ten the subject is divided into three separate subjects: biology, physical geography and physics/chemistry (including astronomy).

Results from the final oral examinations of these three science subjects show a great diversity in the pupils' knowledge of science. Some of the qualitative feedback from external examiners indicates that the practical and experimental dimension has its challenges. Apart from this, the knowledge available about the state of science education and the pupils' knowledge of science are primarily based on a test score. In other words, not much is known about the characteristics of day to day teaching, what makes sense for the pupils and how to teachers perceive/experience the framework for teaching science defined by the local school.

State of the Art

In an international perspective on science education research points to general issues and themes such as *low pupil motivation* (Sjøberg & Schreiner, 2010), *gender* (Holmegaard, 2014; Tsai, Yang, & Chang, 2014), and a focus on new teaching strategies to increase pupil motivation, i.e. Inquiry Based Science Education [IBSE] (Crawford, 2000; Harlan, 2011; Østergaard, et al., 2010), and generally more time allocated to hands-on experiments (Osborne & Dillon, 2008; Raved & Assaraf, 2011; Rocard, et al., 2007). An Arctic (Canadian) research perspective on science education is often focused on a cultural

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[1] Inatsisartut Act No. 15 of the 3rd of December 2012 on the Public School (Folkeskoleloven)

[2] Landstingsforordning

conflict between Western science and an indigenous culture (Aikenhead & Elliott, 2010; Aikenhead, 1997; Castagno & Brayboy, 2008; Egede & Aikenhead, 1999; Higgins, 2011). In this perspective a multiplicity of teaching approaches should be applied in order to increase pupil motivation and learning (Bourque, Bouchamma, & Larose, 2010). Similarly more time should be invested in active fieldwork (Friesen & Friesen, 2002).

Across the literature from the Arctic as well as in a broader international perspective, a number of common features relate to the pupils' learning in science and perceptions of how science should be taught.

Science education in the Greenlandic Public School is the main focus for this ph.d. project.

Research question

The project is based on the following main research question:
How does Greenlandic pupils' perception of nature influence science education?

The main research question is divided into the following four sub-questions:

- How do pupils understand nature and science education?
- How is pupils' perception of nature integrated in the teaching of science?
- How is science taught?
- Which organizational and structural conditions are important to teachers' planning and implementation of science education

In the project I seek a theoretical clarification of nature (Bonnett, 2004; Ellen, 1996; Kruse, 2002), what science and science education is, and a situational perspective on science education (Dewey, 1996; Driver, et al., 1994; Lave & Wenger, 1991; Paulsen, 2006).

Fieldwork

The Ph.D. project is founded in a qualitative approach in three case studies (Creswell, 2013; Flyvbjerg, 2010; Stake, 2006). A school in Nuuk, a town school in north Greenland, and a settlement school, also in north Greenland. The fieldwork was initially centered on science education in grade seven, and biology, physical geography and physics/chemistry in grade eight. In two of the three cases, fieldwork was primarily set around a single well defined science project. In the school in Nuuk a grade seven was involved in project on ecosystems, and in the settlement school in the north of Greenland the pupils were involved in a project on the halibut. The teachers at both the school in Nuuk and the settlement school had actively planned the fieldwork to include the surrounding nature. In Nuuk the pupils carried out their fieldwork by a lake close to the school. At the settlement school the pupils carried out their fieldwork on the sea-ice. At the town school in the north of Greenland I observed teaching in science [naturfag] in a grade seven, biology and physics in a grade eight, and physical geography in a grade nine.

Aside from observation of teaching, the empirical material rests on interviews with teachers, pupils and school leaders, as well as questionnaires for pupils with open questions about their perceptions of nature and science education.

Analytical findings

My analyses have been carried out in a cross case approach (Stake, 2006; Yin, 2014). With a theoretical approach from hermeneutical phenomenology (Laverty, 2003; Zahavi, 2003) the analytical goals have been my informants perspectives on nature and science, e.g. to analyze their perceptions on what takes place in a science lesson. What is good science teaching – from a student perspective. The cross-case analyses defines the four analytical chapters: *Students on nature*, *Science education in practice*, *teaching staff and time* and *the language of science.*

The cross-cases analyses have led to the identification of several discoveries.

Analyses within each theme have led to an identification of several significant subthemes and findings.

1: Students on nature

The analyses point towards that nature as a space for teaching is geographically dependent, dependent on teachers at the school and allocated time for teaching. Pupils' perception of nature varies between the three schools. Between the settlement school in the north and the city school in Nuuk, there is also a significant difference in how pupils' personal perception of nature finds its way into teaching. However, independently from pupils' different perceptions of nature, they express science education ideals.

2: Science education in practice

Teaching in science seems to be influenced by two primary teaching approaches; a book guided teaching and an inquiry inspired teaching. Among other things the analyses points to a significant difference between pupils' science lesson experiences and how they believe science should be taught. According to pupils, most science is taught through books and only rarely do they experience an inquiry approach or that it takes place outside.

3: Teaching staff and time

Teachers explain that too little time for teaching is one of the major obstacles for not doing [enough] inquiry teaching. According to teachers there is a lack of coherence between curriculum goals and time for teaching. Teachers' experiences of too little time for inquiry teaching seems to be a result of lacking pedagogical reflection in the reform process leading up to the present school act, and the subsequent implementation at municipality level. Furthermore, an analysis of how schools prioritize teachers' subject skills, reveal that many schools seemingly have a low priority of teachers' subject skills in science.

4: The language of science

Teachers use different strategies for teaching science concepts. Different perceptions of learning are visible. Teachers' approaches to a linguistic dimension in science points to a receptive concept

understanding. A similar approach is found at the teachers' training college. The goal of a scientific linguistic understanding is closely connected to a Greenlandic/Danish discourse, which is linked to pupils' further educational opportunities.

Concluding remarks

From the analysis, the following may be concluded in relation to my research questions: Pupils perception of nature is highly influenced by their subsistence life. There are geographical variations between north and south, or between town and settlement. This perception does not seem to influence their perception of science education. Notwithstanding pupils' perception of science, pupils call for the same way of learning science. Integration of pupils' perceptions of nature are not included in the teaching of science, unless teacher's have actively chosen to do so, planning their teaching based on pupils' knowledge of nature. Teaching in science education is often dominated by books. The 'how' of teaching science henceforth does not live up to the curriculum goals, partly because the curriculum goals are not implemented as intended. How the school places educated science teachers influences how science is taught. The school does not use teachers' content knowledge. The significance of time allocated to science education depends on how the time is spent. More time do not necessarily equate better teaching or more inquiry-based teaching.

Discussion and perspectives

Based on the fieldwork and the subsequent analysis the ph.d.-project has provided an understanding of what signifies science education in Greenland. There are a number of fundamental didactic conditions for science education which influence the teaching of science. A discussion of how to improve these conditions also opens further perspectives. It is necessary to discuss how pupils' perceptions of nature may be integrated into the teaching of science which goes beyond the sharp division between an epistemology described as a Western based epistemology and an inuit perspective, which is what the empirical findings and existing litterature from arctic Canada point towards. Because the pupils' - regardless of their perceptions of nature - all agree on one thing. Good science teaching is first of all inquiring and experiment-based, and it takes place in nature. Where their perceptions of nature play an important part is in teachers' planning of science education. In order to make appreciation of their perceptions of nature a didactic condition, and pupils' get to experience the meaningful, inquiring and experiment-based learning of science that they ask for, it is necessary to discuss the future of science education in Greenland and how we get there. Closely related to this it is necessary to discuss how we achieve a productive science language across greenlandic and danish, which is not hindered by a narrow view of concepts. Finally a discussion of the above also necessarily has to include a perspective of how to best use the teachers at hand. This points to letting teachers with a science education background teach their main subjects instead of other subjects for scheduling purposes.

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