Sami Culture and Values – A Study of the National Mathematics Exam for the Compulsory School in Norway

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Abstract

Norway ratified the ILO convention 169 concerning indigenous and tribal people in independent countries in 1990. In accordance with the convention the education programs for the Sami shall address their value systems and their cultural aspirations. Our aim is to investigate the implementation of this convention. The focus is on how Sami values are reflected in the national mathematics exam for the compulsory school. In Sami traditional knowledge the term "knowledge" means knowledge as a process, not just the final outcome of a process. The tasks are analyzed with respect to four different Sami values. We present an overview of the complete exam and more profound analyses of three selected tasks. The analyses reveal that the tasks more or less reflect some Sami values. A stronger focus on modeling problems in school mathematics may open up for forms of teaching that focus on Sami values to a larger extent than today.

Key words:

Indigenous, Sami, value, culture, examination

1 Introduction

The Sami are an indigenous people of the Arctic, living in Norway, Finland, Sweden and the Kola Peninsula of Russia. According to the ILO convention 169 concerning indigenous and tribal people in independent countries (ILO 1989) the education programs for the Sami shall address their value systems and their cultural aspirations. Norway ratified this convention in 1990, and the first Sami curriculum in Norway, L97S (KUF 1997) asserts that

> *The Sami School covers the knowledge, traditions and values, which are bridging characteristics in a Sami community ... the education as a whole is intended to promote Sami identity. The education includes the local Sami culture ... " (ibid., pp. 59–60, authors' translation)*

The Sami curriculum of 2006, LK06-S, (KD 2007a), also subscribes to this view, and states that the Sami school should promote an understanding of Sami values, language and culture (KD 2007b). Values and language are elements of the culture. This paper explains Sami values according to Lindholm (1997); values are *what are worth aiming for or preserving*. The focus of this paper is to shed light on Norway's implementation of the ILO (1989) convention 169, and in order to accomplish this we have chosen to study how Sami values are reflected in the mathematics teaching in the compulsory school.

Bishop (1988) claims that teachers need to know about the cultural values inherent in the subject they are responsible for, and they need to reflect on their relationships with those values. But values do not seem to mean much to the mathematics teachers (Bishop 2012). Namukasa (2004) asks what the standard examination measures if it is not culturally biased. What is assessed determines what is taught, so this paper analyses one particular compulsory school mathematics exam with respect to Sami values. The research question is

> *How do the tasks from the national mathematics exam for the compulsory school reflect the LK06-S visions, which claim that the Sami School shall promote Sami values?*

Even though many Samis live in the capital Oslo, more than 3/4 of the pupils who have Sami as their first language[1] live in the north, in the rural municipalities in Finnmark county (Todal 2012) that are covered by the Sami Language Act (Lovdata 1990). Hence, we have chosen to focus on Sami culture and values related to these northern Sami municipalities.

According to Cai (2005) U.S. and Chinese teachers have different cultural values concerning mathematical representation, and they draw on their cultural beliefs as a normative framework of values to guide their teaching. Schukajlow, Leissigen, Pekrun, Blum, Müller and Messner (2012) point out that pupil-oriented, "operative-strategic" forms of teaching tend to have stronger effects on pupils' values and interests than teacher-oriented "directive" teaching.

Cai and Garber (2012) discuss *values* as general educational qualities that teachers, schools and the society at large aim to nurture in pupils. These values are not necessarily specific to the nature of mathematics. This paper takes Cai and Garber's (ibid.) perspective, and discusses values as qualities that some Sami societies

[1] The Sami pupils in Norway can choose between three versions of Sami language education: Sami as the first language, Sami as the second language or Sami as a foreign language.

aim to nurture in its youths. The paper's focus is not on values as an aspect of the learner's attitude. Pupils from the administrative district for the Sami languages in Finnmark county appeared to score lower than the average among Norwegian pupils on the lower secondary mathematics national tests for 2011 (Udir 2011), so we found it worthwhile to research whether Sami values are reflected in the national mathematics exam. According to Darnell and Hoëm (1996) interests may be regarded as precursors to values, so in addition to analyzing tasks in mathematics with respect to Sami values, this paper will discuss the notion of "interests".

We approach the research question by analyzing the tasks in the national compulsory school mathematics exam from 2009. Since Norway has a ten-year compulsory education this is the grade 10 mathematics exam. The Norwegian directorate for education and training, Udir, evaluated the 2009 exam, but they did not ask any explicit questions related to Sami pupils or Sami culture. Our study of the 2009 exam provides a different perspective, and is expected to broaden existing knowledge about this exam.

First, we clarify what we mean by "Sami values" and present our perspective on mathematics. The examination tasks are analyzed with respect to whether they provide opportunities to reflect Sami values.

2 Sami culture and values

The concept of culture can be understood in different ways. Høgmo (1989) defines "culture" as the common opinion a people in a group ascribe to themselves and their surroundings: "Culture can be understood as a group of people's common ideas of values, thinking and ways of solving life tasks. In other words, the term refers to a system of interpersonal understanding mechanisms (intersubjectivity)" (ibid., p.69, authors' translation). Klausen (1992) emphasizes the cognitive community, "the ideas, values, rules, norms and symbols that a person takes over from the previous generation, and further tries to pass on – usually a bit changed – to the next generation" (ibid., p. 27, author's translation). Eriksen (1997, p. 32) introduces a definition that focuses entirely on the present and the possibilities for mutual understanding: "culture is what makes communication possible." He points out that culture is learned, and that it more or less is transmitted while it is changing. Darnell and Hoëm (1996) see culture as the complex knowledge that a nation or a people has in stock. Culture shapes the basis for understanding and coping for the individual, the society and the nation.

According to Høgmo's perspective (1989), Sami culture is described as Sami shared values, mindsets and ways of solving life tasks. Based on Klausen's (1992) concept of culture, Sami culture focuses on the ideas, values, rules, norms and symbols that the Sami youths will take over from their parents' generation. According to Eriksen's perspective (1997), Sami culture includes everything that makes the Sami able to communicate

with each other and with the rest of the world. According to Darnell and Hoëm's perspective (1996), Sami language and Sami values are considered as elements of the Sami culture. Based on their perspective Sami culture is the Sami basis for understanding and mastery.

2.1 Values and interests

Values are key elements of people's cultural repertoire (Lindholm 1997). A value may be the price of a commodity that is sold or exchanged. Value theory was a special discipline in the German political economic theory in the 1800s, but today "value" means not only economic value, it simply means *what should be* (ibid.). Conversely, negative values are what should be avoided, prevented or eliminated. Sometimes there is an implicit reference to specific ethical concerns, to moral and political questions of right and wrong, of good and evil, just and fair, decent and indecent.

According to Darnell and Hoëm (1996), social values are the most fundamental forces that govern how people interact. Shared values make cooperation possible, while a lack of shared values makes cooperation difficult. In the absence of common values, common interests may be a useful substitute. In that way common interests may enable collaboration that would otherwise be difficult. The upper-left corner of **Fig. 1** represents an ideal situation, where values and interests are shared. The opposite situation is represented in the lower right corner. Here none of the participants believe in what they do, and they resist cooperation. Such a situation is not unusual in a nationally or centrally planned school located in a remote native village. "Without a means to accommodate local values and interests, the work of the school will conflict with the needs or wishes of the community. In this situation the school must assert strong pressure and discipline if its position is to prevail" (ibid., p. 278).

The most frequently occurring situations in the North are those where interests and values are both common and conflicting (ibid.); these situations are shown in the upper right and lower left boxes in **Fig. 1**. If the values are shared while the interests are conflicting, a teaching program will be difficult to initiate. In situations with conflicting values and common interests, however, an education program will be relatively easy to initiate, but there will be a constant need to stimulate the interest for the subject being taught. Such teaching is unstable and not as longlasting as when the values are shared and the interests are conflicting (ibid.). If a pupil believes that mathematics is an OK subject to hold on to while their parents say they have no use for mathematics, the situation may be that the pupil's values are in conflict with the School's, while the interests are shared. According to Darnell and Hoëm (ibid.) mathematics instruction for such pupils is expected to succeed. If the interests are conflicting, however, the teaching has poor prognoses.

Both the curriculum and the exam set the premises for what is taught. Darnell and Hoëm (ibid.) argue that conflicting interests result in poor conditions for successful teaching. The curriculum points out that the Sami School shall promote Sami values, and it pays no attention to the pupils' interests. This study keeps the connection between values and interests in mind even though the research focus is on values.

2.2 Sami values

To be attached to one community is a traditional Sami value. This value is changing, since many Sami leave their traditional livelihood and move to more urban areas. This value is thus too unstable to be considered in the analyses. According to Lindholm (1997), what is worth preserving is a *value*. We interpret this to mean that the traditional Sami culture that has survived into the 21st century constitutes a Sami value.

2.2.1 Sami traditional knowledge

The concept of Traditional Knowledge is used in different contexts, and there are various definitions. Berkes (1999/2008) uses the term "traditional ecological knowledge", TEK, which means

> *"a cumulative body of knowledge, practices and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment." (ibid, p. 7)*

"Knowledge" is used here in the sense of knowledge as a process, as opposed to knowledge as content. The focus is rather on how the knowledge is acquired than on the knowledge itself.

Darnell and Hoëm (1996) points out that the modern tradition is a mix of both historical traditions and recent traditions, based on innovation and changing environments. Berkes (1999/2008) describes "tradition" as intelligent reflection tested through generations' need to survive. The term "ecological knowledge" is defined broadly, as a broad understanding of the knowledge of an ecosystem. Berkes' (ibid.) use of "Traditional Ecological Knowledge" includes a component of local and empirical knowledge about the species and other environmental phenomena. There is also a component of practice in relation to the way people conduct agriculture, hunting, fishing and other activities. Furthermore, there is a component of attitude, people's faith in their role in the ecosystem and how they interact with natural processes there. We have chosen to use the term "Sami Traditional Knowledge", STK, because this expression indicates a part of Sami cultural knowledge that is not indicated by TEK.

We concentrate on the transmission of Sami traditional knowledge. From a young age, children start accompanying learned and experienced members of the community in order to observe and learn how they deal

with practical problems and performed tasks. This has been going on for generations, and so the Sami's basis for mastering is formed. It is important to include the children in the process as early as possible (Gaup Eira and Nystad, 2005). One of Nystad's (2003) informants describes how the process starts: "The initial training must commence during childhood, already at the *árran* (the fireplace in a Sami traditional tent called *lávvu*). Even if the child cannot make itself useful yet, the child is at the stage where it learns the most" (ibid, p. 108).

2.2.2 Reasonableness and relations to nature

Aikio (2010) explains the fundamental Sami value "govttolašvuohta" (reasonableness) as a "wellbeing" that constitutes the basis for a harmonious and fruitful relationship with others as well as for a strong Sami identity and way of life: "Reasonableness as an element in a good life is part of the Sami's mastery, and constitutes the basis for human survival in the Sami living areas" (ibid., p. 143, author's translation). In order to survive and live a good life under hard climatic conditions you do not spend time performing useless activities. Bishop (2012) introduces mathematical wellbeing as a proposed theoretical construct. The usefulness of this idea is to clarify and describe the important differences between the engaged and the disengaged pupils' behavior in their classes.

Cooperation with nature is another Sami value. According to Lehtola (2013) nature has always been the basis for the material as well as for the spiritual aspects of Sami culture. This is also what is special with the Sami culture compared to industrial cultures or the residents' agriculture. The Sami life is based on balance with nature, and people treated the nature with gentleness. To hurt nature has been treated as interference with what was created by God. Nutti (2007) refers to reindeer herders and Sami handicrafters who express a respect for the nature, so they adapt to the sun and the light, to the changing weather conditions and the reindeers' behavior. Nystad, Spein and Ingstad (forthcoming) support this perspective by claiming that nature is seen as an important part of community resilience. According to Lipka, Andrew-Ihrke and Yanez (2011) Yup'ik values concern using things with care, from the land, from the sea, from all of nature. If you are careful and not wasteful, then things of nature will help you.

3 The Sami curricula

The ILO convention 169 and the Norwegian constitution §110A, lay down the foundations for the first Sami curriculum (KUF 1997) that is equal with the national curriculum. Today's Sami curriculum LK06-S (KD 2007a) includes competence aims for all subjects. Competence aims are written in the same frame for all subjects, starting with "[t]he aims for the education are that students shall be able to ..." (ibid.). The competence

aims in the curriculum are based on the view of knowledge as content; the goals make no claims about the process pupils are undergoing. This corresponds poorly with TEK (Berkes, 1999/2008), where the process of knowledge transfer is the focus.

Regarding the evaluation of L97S, Sara claims (2003 p. 121) that "... Sami traditional knowledge is important for the creation of identity, just like all other Sami knowledge and sense of belonging to Sami culture." Although the LK06-S does not explicitly focus on Sami Traditional Knowledge, STK, we interpret the curriculum as being in accordance with Sara's (ibid.) statements. According to the LK06-S quality framework (KD, 2007b, p.1), the training shall "strengthen and develop the students' identity by protecting their linguistic and cultural backgrounds and needs, and promote their versatile development and their knowledge and skills."

4 Mathematics and mathematics assessment

Mathematics may be regarded as a doctrine, as an activity or as a science. We have chosen to use Freudenthal's (1991) perspective, and consider mathematics as an activity created by people; mathematics is "an activity in which discovery and organization takes place in an interplay between content and form" (ibid. 1991, p. 15). This view is compatible with TEK (Berkes (1999/2008), where knowledge is seen as a process rather than as pure content. This is also in line with Gaup Eira and Nystad (2005) who underline the importance of the learning process and not just the final product. Star (2005) claims that the pupils' procedural knowledge is often measured simply by what a pupil can or cannot do. He asks for research methods that focus on how pupils can or cannot do. In other words, tasks in mathematics that assess what a pupil can or cannot do, do not reflect whether the pupils' procedural knowledge is deep or superficial. A task that just requires superficial procedural knowledge is not interpreted as treating knowledge as a process.

According to a different but established opinion (Thompson & Martinsson 1997, p. 292, authors' translation) mathematics is the study of numbers and space, and the many generalizations of these concepts created by the human intellect. Bishop (1988) claims that mathematics was regarded as "culture independent" knowledge until the beginning of the 1980s. Mathematics is a cultural product, developed as a result of various activities (ibid.). According to this perspective, mathematics is a result of the activities and not the activity itself, opposed to Freudenthal's (1991) perspective. Lipka, Andrew-Ihrke and Yanez (2011) take Freudenthal's perspective a bit further by adding how the Yup'ik mathematics is integrated with cultural values. The purpose of constructing a square is to make the pattern on a Yup'ik fur parka or a Yup'ik ceremonial headdress, for

example. The construction process is explained by the need for balance and harmony between the wearer and the spirit world, and between the user and the task.

What is assessed by examination and in other situations is related to your vision of mathematics. If mathematics is regarded as the content of rules and doctrines, the exam may look different than if mathematics is seen as an activity with an emphasis on the process by which the pupil or mathematician constantly makes new discoveries. When a child sits beside a fireplace together with its family, it might wonder in how many different ways the family members can be organized around the fireplace. From our perspective mathematics is the process that the child undergoes on its way to formulate and solve this problem. It is not the formula or the solution itself.

4.1 Equality and assessment

The pupils in Norway take an exam at the end of lower secondary school. The exam is equal for all; the intention is that pupils from one school or one municipality shall not have an advantage over others. We want to contribute to the discussion concerning whether it is possible to construct an examination that is equal for all. According to Pais and Valero (2011) the terms "equality" and "quality" often live side by side in the mathematics education literature, and they are equally political. It seems clear that the problem of equality is an economic and political problem. If anyone should be successful, there must be someone who fails or are excluded from succeeding. If we accept that exclusion is inherent in our educational system, we must realize that in order to put an end to exclusion, we must also put an end to the school we have today. "The question is whether it is impossible or it is ideologically posited as impossible" (ibid. p. 45).

Mathematics, to a greater extent than other subjects, plays the role of a seemingly "objective" judge, one that decides whom among the society's members "may" and who "may not". In this way, the subject of mathematics is a gatekeeper that determines people's future participation in the decision-making processes of the society (Skovsmose 2005). From this perspective it is important that everyone in the community are given equal opportunities to succeed with the compulsory school mathematics.

4.2 Examinations

Examinations and other assessments have great political significance, and this provides great power to those who design the exam tasks and the criteria for task assessment. What is valued in the assessment constitutes the aims of the curriculum. The educators' challenge is that the assessment needs to reflect both the society's demands and the visions of the curriculum. If the learning outcomes we value are not included in the assessment,

there is great risk that the curriculum is an expression of our degenerated assessment (Clarke 1996). Society's demands may be considered as interests. Usually the community and the parents have the shared interests that the children succeed in mathematics at school.

The curriculum visions focus on Sami values, language and culture central to teaching, so we expect the exam to reflect some Sami values. The Sami curriculum LK06-S (KD 2007a) contains more visions than the National curriculum (KD 2007c), but the Sami pupils' exam in mathematics is just a translated version of the Norwegian exam. This study intends to clarify whether this is a problem or not, and why it may be a problem. It may be that Sami pupils would benefit from learning some mathematics that primarily reflects Sami values. However, this question is not the focus of this text.

One important reason for including the mathematics subject in school is to make the pupils able to apply mathematics in different contexts and situations beyond school. For that reason it is important that the teaching includes applications and modeling (Niss, Blum and Galbraith 2007). The examination ought to test whether the individual pupil is able to perform mathematical modeling.

One intention behind the exam is to allow pupils to show what they know and can. If all pupils are assessed by the same criteria then the exam is expected to treat everyone equally. However, the understanding of what it means to address and achieve equality in mathematics education diverges among researchers (Pais and Valero 2011).

4.3 Tasks

Tasks in mathematics can be categorized in several different ways based on context. Niss, Blum and Galbraith (2007) as well as Schukajlow et al. (2012) uses the three categories *modeling problems*, *dressed-up word problems* and *intra-mathematical problems*, where the first two categories include so-called word problems, while intra-mathematical problems include the so-called pure mathematics tasks.

Solving the modeling problems is characterized by a seven-step sequence of activities (Schukajlow et al., 2012): 1) Understanding the problem and constructing an individual situation model, 2) simplifying and structuring the situation model and constructing a real model, 3) translating the real model into a mathematical model, 4) applying mathematical procedures to determine a result, 5) interpreting this mathematical result in relation to reality and attaining a real result, 6) validating this result with reference to the original situation, 7) exposing the whole solution process. According to Niss, Blum and Galbraith (2007, p. 11), "… word problems are nothing more than a 'dressing up' of a purely mathematical problem in words referring to a segment of the real world." Dressed-up word problems are much easier tasks than modeling problems, because in this case a

simplified model is presented from the start (Schukajlow et al. 2012). All data necessary to solve the dressed-up problems are given in advance, and the task does not contain any unnecessary data. The result is easier to control than the results of modeling problems. Intra-mathematical problems are not related to reality. The solution process is based on a mathematical situation, and the task is solved by finding and applying appropriate mathematical procedures (ibid.).

5 Methods and materials

The curriculum focuses on Sami values, culture and language. The aim of our study is to shed light on how Sami values are reflected in the mathematics education for Sami pupils in Norway. The research focus is the 2009 National mathematics examination for the Norwegian compulsory school.

5.1 The examination

The previous examination tests in Norway have not been made public. The Udir stores these tests, and researchers and others can get copies of them if they ask for them. In this manner Norwegian procedures differ from the procedures in countries such as Russia, where the examination tasks are publicly available (Zvorono 2011). This paper hence does not provide any reference to the 2009 examination. The examinations are written tests in two separate parts, and the pupils get five hours in total to solve the tasks. They get parts 1 and 2 at the start of the exam, but they have to hand in Part 1 before two hours have passed. As long as they work on Part 1 no facilities are allowed except for pencil, pen, rubber, compass, ruler and protractor. Part one contains 22 tasks. Some are multiple-choice tasks that ask for one single solution; some tasks just ask for a single answer, and some tasks ask the pupils to present how they reached the solution. The maximum score for Part 1 is 27 points.

Part 2 contains six tasks. In the information part at page 2 the pupils are told that if the text does not ask for something special, they are free to choose which procedure to use. The maximum score for Part 2 is 40 points.

5.2 Analytic tools

The tasks are first categorized by whether they are modeling problems, dressed-up word problems or intra-mathematical problems (Schukajlow et al. 2012), and subsequently the tasks are categorized with respect to context and with respect to whether they reflect Sami values. There is no precise definition of what constitutes Sami values. The traditional Sami values are the basis for the values of today, but a modern society includes a greater diversity of Sami values. Four categories of Sami values are appropriate for this study:

1. STK (Sami Traditional Knowledge) views knowledge as a process. We analyze the exam tasks with respect to whether they consider knowledge as a process (Berkes 1999/2008; Gaup Eira and Nystad 2005) or as a product. This is equivalent to analyzing the tasks with respect to whether they concern mathematics as an activity (Freudenthal 1991) or as the result of an activity.
2. The basic Sami value "govttolašvuohta" (reasonableness).
3. Cooperation with nature.
4. Preservation of the traditional culture. Here the tasks' contexts play an important role. A context that is close to traditional Sami culture is interpreted as preserving the culture. By contrast, a context that is strange to traditional Sami culture will be interpreted as not reflecting this value.

In addition to a survey of the complete exam, we chose to perform deeper analyses of three tasks. These three tasks were chosen because we expected their contexts to be strange for the pupils from the Sami language administrative district in Finnmark (FAK 2013).

The three tasks are categorized with respect to our criteria for Sami values. Udir (2012) has developed some criteria for goal achievement, but these are meant to be a tool for teachers in their daily work, and not a tool for analyzing examination tests. For that reason we chose not to include Udir's (2012) criteria in our study.

Our research focus is the context of the tasks; we neither researched the workload, difficulties, examination form, nor the mathematics content in the tasks, as Udir (2009) did in their evaluation of the same examination.

5.3 The three chosen tasks

The three tasks might reflect some Sami values even though their contexts are expected to be strange for the pupils. The three tasks were numbers 9, 10 and 22, respectively, in Part 1 of the examination. **Fig. 2** presents task 9. The Norwegian text above the illustration means (left) "you find windows like this in the Parliament building," and (right) "draw all the symmetry lines in the figure below."

The timetable task in **Fig. 3** says: The Airport Express train starts from Asker and goes to Oslo Airport Gardermoen. Determine whether the following assertions are true or false by checking one option for each claim. Then the time table follows, accompanied by four assertions: 1) The Airport Express has its first departure from Asker at. 4:38; 2) the Airport Express spends 49 minutes from Asker to Oslo Airport; 3) if a train starts in Asker at. 4:58, it is in Skøyen at 5:19; and 4) to reach Oslo Airport at 5:47, the latest train you can take leaves Lysaker at 5:11.

The speedboat task presented three colored pictures of large speedboats from www.new-motortrends.com. Each boat's maximum speed was noted beneath each picture, boat A: 65 knots, boat B: 100 km/h, and boat C: 30 m/s. Two lines of text were given above the pictures: The 3 speedboats have different maximum speeds. Which one is the fastest? Give reasons for your answer. 1 knot = 1.852 km/h and 1 m/s = 3.6 km/h.

6 Analyses

The maximum score for the complete test is 67 points and we found that the pupils might achieve a maximum of 19 points from intra-mathematical problems. This represents 28% of the maximum score. 70% of the examination consists of dressed-up word problems and only 2%, or one single task, may be categorized as a modeling problem. The very low use of modeling problems indicates that the test do not meet the Sami value of STK (Sami Traditional Knowledge), which treats knowledge as a process rather than as a product. Tasks that can be solved by superficial procedural knowledge (Star 2005), by just applying a formula without any mathematical reasoning, are interpreted as not treating knowledge as a process. Modeling tasks, on the other hand, treat knowledge as a process. Blomhøj (2006) describes mathematical modeling as a cyclic process constituted by several part processes.

6.1 An overview of the complete test

The intra-mathematical problems in Part 1 concerned change of units, functions, inequalities, equations, the four basic arithmetic operations, contraction of expressions, geometric constructions, fractions, volume, powers of ten and area. The other tasks in Part 1 concerned the following contexts: Architecture (two tasks), ancient Greek history, movies, shopping, soccer (two tasks), dice, social science, school trips, speed boats, and a train time table.

Most of the intra-mathematical problems are found in Part 1. The pupils have to solve these tasks without any supporting tools. The intra-mathematical problems are presented as decontextualized tasks. The western society places a high value on decontextualization (Namukasa 2004; Ascher 1991). Many others in our own culture, as well as in other cultures, do not. For example, in the Biblical story in which King Solomon is faced with a situation where he has to divide a child between two women both of whom claim to be its mother, Solomon viewed the division in context and so he gave the child to the woman who spoke out against the solution of giving half a child to each mother (Ascher 1991). Another example is the MCC, Mathematics in a Cultural Context (Lipka, Webster and Yanez 2005); a mathematics curriculum for the Yup'ik people in Alaska.

Here culture and context is interweaved with mathematics and pedagogy. Nutti (2013) points out that the goal of Indigenous education is that it should be based on Indigenous culture and language. Her study focused on Sami mathematics teachers who integrated culture-based activities in the teaching. The context constituted an important part of their teaching. Decontextualization is not a Sami value.

Only one task may be categorized as a modeling problem. This task is also from Part 1, and it provides a maximum score of 1 point. The text is as follows: In shops you can often get offers such as "buy 3, pay for 2"; that is, you get three items for the price of two. A clothing store had a similar offer on T-shirts. The cost of each T-shirt was 100 Norwegian kroner. "How many percent discount will you get by using the offer 'buy 3, pay for 2'? Specify the percentage with one decimal."

Several other tasks might look like modeling problems. Two of the three chosen tasks are among these. First, in the airport express train task in **Fig. 3** a timetable is given in advance. To succeed in solving this task, the pupil needs to have understood the given model beforehand. The task provides more information than is needed to find a solution, but the task is nonetheless categorized as a dressed-up word problem. The second task shows the pictures of three speedboats[2] and provides information about the maximum speed of each boat. The pictures of the boats provide no useful information to the pupils; the task asks them to calculate and explain their calculations. The pupils' solution to modeling problems related to reality includes examining the illustrations thoroughly in search for relevant information.

This examination has two recurring main themes, the Parliament and Archimedes. 19 test points are related to the context *Parliament,* 10 points are related to the context *architecture* (including nine points from the Parliament building), and eight points are related to *ancient Greek history*. The most frequently occurring contexts might be found in most Norwegian parents' values, whether they are Sami or not. But it might be the case that the *Parliament*, *architecture* and *ancient Greek history* are of less interest to many Norwegian pupils regardless of whether they have Sami background or not. Darnell and Hoëm (1996) warn against situations with conflicting interests and shared values. Although the school emphasizes the pupils' knowledge of the Parliament, and the parents find this valuable, it might be an obstacle to the pupils' mathematical understanding.

6.2 The three chosen tasks

The contexts of the three chosen tasks were a) the Parliament building in the capital, Oslo; b) the Oslo airport express train; and c) speedboats. None of these contexts concern Northern Norwegian contexts; the Parliament

[2] Udir got permission from new-motortrends.com to use these pictures for the examination, but not for further distribution (phone call with G. Brogstad). Hence, this task is not presented in the paper.

building and the airport express train are located in the south, and speed boating takes place in southern Norway. The pupils could gain 5 points in total from these three tasks, which represents 18.5% of the Part 1 points. None of the tasks reflected all the required values. The tasks reflected some Sami values, and to some extent. It is not possible to claim that a task definitely reflects a particular value; it would probably be more correct to claim that a task reflects parts of a value. Three of the values were found in the window task, two values were found in the express train task, and only one value was found in the speedboat task.

The first value, Sami Traditional Knowledge, is partly reflected in the airport train task, because the task asks the pupils to make some decisions concerning when you have to leave, whether this or that train will reach the destination in time, and so on. This is an activity and not just a final product. The pupils have to reason and find the solutions without applying any standard formula. Hence, even though the context is a typical centralized, Southern Norwegian context, the mathematical content of the task is reflecting some STK. The window task asks for some knowledge about symmetry lines. This task may reflect some reasoning. The speedboat task, however, can be solved by just applying formulas. To some extent the task reflects a process, because you have to choose formulas in correct order to get the required answer. One problem with the task is the illustrations, since they do not provide the pupil with any useful information. The illustrations were probably added for the purpose of decoration or motivation.

The second value, “govttolašvuohta”, is definitely not reflected in the speedboat task. The context cannot be interpreted as useful in any way; there is no excuse for driving speedboats. That activity will hardly provide the driver any useful skills. The window task includes knowledge about symmetry and architecture, while the train task asks for knowing how to read and understand a timetable and find your way. Both of these tasks ask for knowledge that might be useful in a human being’s life. So despite their contexts, these two tasks are interpreted as reflecting some “govttolašvuohta”.

None of the tasks reflect the third value, cooperation with nature. The window task does not reflect this value, but it does not reflect the opposite either. Both the speedboat task and the express train task are interpreted as tasks that definitely do not reflect cooperation with nature. The express train and the speedboats are both used in transporting people. The Sami traditional use of motorized boats is for the purpose of transportation; to a fishing place, to some island for seasonal gathering of berries, eggs and plants. Sami reindeer herders often use motorboats if their herds are moving between islands and the mainland. Because speedboats use a large amount of gasoline, they hurt nature through pollution. Express trains use more power than slower trains and hence lead to more pollution than slower trains.

Only one of the tasks seems to support Sami traditional culture. The Parliament building is made of bricks, which is a rather rarely used building material in the northern Sami municipalities. But the fact that Norway has ratified the ILO convention 169 (ILO 1989) indicates that the Parliament promotes Sami values. Neither the airport express train task nor the speedboat task can be interpreted as supporting Sami traditional culture. A focus on Sami traditional culture in tasks from the national mathematics exam may result in a promotion of Sami identity, as the first Sami curriculum (KUF 1997) aimed at doing.

7 Discussion

According to Kawagley (1996), the Alaskan natives have a set of basic values that are necessary for adaptation, harmony and survival in the cold and harsh environments. The four values are honor, respect, reciprocity and cooperation. Holistic thinking is emphasized among the natives of Alaska (ibid.), and also in the transfer of Sami traditional knowledge (Gaup Eira and Nystad 2005). It does not make sense to question whether the four Alaskan native values of honor, respect, reciprocity and cooperation can be found in in different tasks from the individual written mathematics exam. These values concern people's behavior toward each other, and may be reflected in the way pupils work in a group work exam where the pupils' oral work is also assessed. According to Bishop (1988) much mathematics teaching is merely mathematical training with no explicit attention paid to values. We believe that a focus on Sami values in the national mathematics exam will lead to a mathematics teaching that pays some attention to Sami values. This will, in turn, result in a focus on Sami values in the Sami mathematics teaching.

70% of the examination tasks in mathematics were categorized as dressed-up word problems (Schukajlow et al. 2012); one characteristic of such tasks is that the problem to be solved in varying degrees has been removed from the context where it belongs. Kawagley (1996) asks when the hunter needs to know the exact distance across a river by means of trigonometric functions. In a modeling task the hunter context will ask for approaches toward exploring this distance without any trigonometric functions. If a larger amount of the tasks are modeling problems, then the mathematics and the context in these tasks will be closely connected. This will in turn facilitate a focus on Sami culture and Sami values in the teaching.

Clarke (1996) claims that those who make the tasks have a great challenge in meeting the demands of the society and the curriculum visions. Based on this, we raise concerns regarding the geographical and ethnical background of the members of the Examination Secretariat. In the 1990s worries were raised among teachers with respect to whether the contexts of the compulsory school examinations were Oslo dominated, so it is

peculiar to find the situation unchanged. Our question about whether the tasks might disfavor pupils from the areas covered by the Sami Administrative District (which all are located north of Oslo) led to the question of whether the tasks favor certain groups of pupils from central areas in the south-eastern Norway. According to Winchester (2013) it is hard for us to see any particular merit in other intellectual traditions than ours, even though we acknowledge them. So is for the task designers also. Because several tasks have a Oslo context while no task has a Sami context, it would probably be appropriate to have at least one Sami person and one person from Finnmark within the Examination Secretariat. We find reasons to ask who is responsible for selecting the people who create the exam tasks, and also how the tasks are quality-assessed before they are approved. In addition, we raise a question concerning which criteria constitute the basis for a set of tasks.

A pupil's background consists of events that have taken place, while the foreground is constituted by events that might take place (Skovsmose 2011). A person's background can be seen as a determining factor for the foreground; to some extent the foreground is framed by the background. The foreground is an open situation; it is how the pupil might experience possibilities. How pupils construct meaning depends on how they connect their learning activities to their foreground and to their overall situation (ibid.). Our study focuses on how tasks in mathematics reflect Sami values. A follow up study that focuses on pupils work with the tasks will have to pay attention to the pupils' foregrounds as well as to how the tasks reflect Sami values.

8 Summary

Analyses of how Sami values are reflected in tasks in mathematics have to consider that Sami culture is not just characterized by what makes it different from other cultures. It is also important to take similarities into account. The two Sami values STK (Sami Traditional Knowledge) and "govttolašvuohta" (reasonableness), as we interpret them in this study, are in line with recent research within mathematics education. Mathematics modeling has just recently entered the Norwegian National curriculum (KD 2007c). This indicates that a stronger focus on these two Sami values in the exam tasks in mathematics will probably improve the exam also for the non-Sami pupils.

Bishop (1988 p. 187) claims that "[w]e certainly know that different symbolizations have been developed in different cultures and it is very likely that there are differences in values also ... " The close connections between interests and values lead to difficulties in researching how the national compulsory school exam reflects Sami values. Insofar as the Sami curriculum (KD 2007a) claims that the teaching should focus on Sami values, the examination needs to reflect some Sami values. Schukajlow et al. (2012) categorize tasks in

mathematics as modeling problems, dressed-up word problems and intra-mathematical problems. Among these, the modeling problems reflect Sami values the most, since the other two have more or less removed the mathematics from its natural context. Our study showed that only one of the tasks in the 2009 exam might be categorized as a modeling problem.

We chose to conduct a deeper study of three tasks that we believed did not reflect any relevant context for pupils from rural areas in the north of Norway. We assumed that these tasks did not reflect any Sami values. The analyses revealed that one of these tasks reflected parts of one Sami value, while one task to some extent reflected two of the four Sami values that we analyzed, and the third task to some extent reflected three of these values.

It might be the case that Sami pupils benefit from learning a mathematics that does not aim to reflect Sami values, but rather aims to prepare them for the international Norwegian society. It may, however, also be the case that a stronger focus on Sami values in the teaching makes the pupils better prepared for the international Norwegian community. According to the curriculum's Quality Framework (KD 2007b, p. 2, authors' translation) "[s]tudents with a confident identity related to their own culture, and knowledge of other cultures, have a good basis for developing tolerance and respect."

It is possible for the Sami School to reflect Sami values, but the national examination reflects Sami values to very little extent. Further analysis of the values reflected in the national exam tasks may lead to an improvement of this exam's design. The large amount of dressed-up word problems in the exam is an issue to discuss in the future. Dressed-up word problems may lead to a distance between mathematics and the pupil, like for Kawagley (1996), who asks when the hunter needs to know the exact distance across a river by means of trigonometric functions.

Namukasa (2004) points at a need for exploring ways in which classrooms, schools, regions and nations could benefit from locally relevant curricula. The analyses in this paper reveal that a larger amount of modeling tasks may be one aim for the exam, since that will lead to more open tasks where the pupils include their values and interests. An increased amount of modeling tasks in the examination will most likely lead to an increased focus on modeling problems in the teaching. Modeling problems might provide the pupils with opportunities to keep their mathematics in the contexts in which it belongs.

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Figure Captions

Fig. 1 Positive and negative working conditions in schools based on the relationship between values and interests (by Darnell & Hoëm 1996, p. 278)

Fig. 2 Task 9 in Part 1. The Parliament building window task. (Printed with permission from Udir)

Fig. 3 The Airport express train timetable. To Oslo Airport. Valid from January 6, 2008. First departure …, Minutes after every hour …, Last departure ...

* Departure every 10 minutes Monday to Friday, 06:15 a.m. to 10:35 p.m; Sundays 12:15 p.m. to 11:15 p.m. Saturdays and the period between July 6 and August 3: every 20 minutes; i.e. departures marked with a star are annulled. Subject to change during public holidays. Further information at www.flytoget.no or dial 815 00 777. (Printed with permission from Udir.)

Figures

VALUES / INTERESTS	Shared	Conflicting
Shared	+ +	- +
Conflicting	+ -	- -

Fig 1

I stortingsbygningen finner vi slike vinduer:

Kilde: Utdanningsdirektoratet

Tegn alle symmetrilinjene på figuren nedenfor.

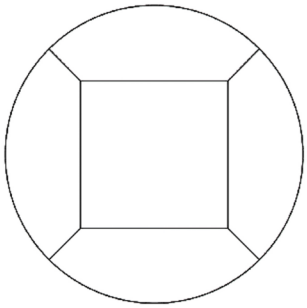
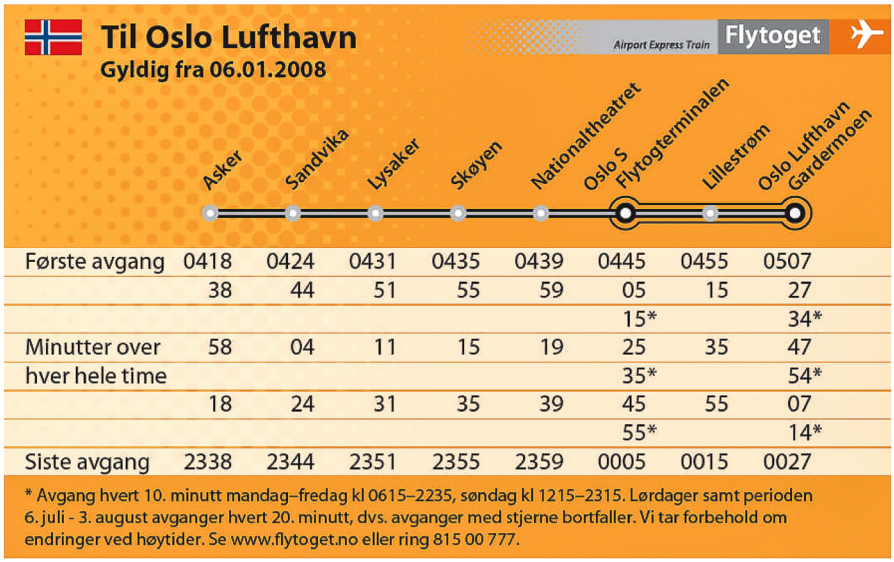


Fig 2

Flytoget starter fra Asker og går til Oslo Lufthavn Gardermoen.
Avgjør om påstandene er sanne eller usanne ved å sette ett kryss for hver påstand.



Første avgang	0418	0424	0431	0435	0439	0445	0455	0507
	38	44	51	55	59	05	15	27
						15*		34*
Minutter over	58	04	11	15	19	25	35	47
hver hele time						35*		54*
	18	24	31	35	39	45	55	07
						55*		14*
Siste avgang	2338	2344	2351	2355	2359	0005	0015	0027

* Avgang hvert 10. minutt mandag–fredag kl 0615–2235, søndag kl 1215–2315. Lørdager samt perioden 6. juli - 3. august avganger hvert 20. minutt, dvs. avganger med stjerne bortfaller. Vi tar forbehold om endringer ved høytider. Se www.flytoget.no eller ring 815 00 777.

Kilde: www.flytoget.no/nor/Reiseinfo/Rutetider (20.05.2008)
Brukt etter tillatelse.

Påstand	Sann	Usann
Flytoget har første avgang fra Asker kl. 04:38.		
Flytoget bruker 49 minutter fra Asker til Oslo Lufthavn.		
Når flytoget starter i Asker kl. 04:58, er toget på Skøyen kl. 05:19.		
For å være på Oslo Lufthavn kl. 05:47, må du ta toget senest kl. 05:11 fra Lysaker.		

Fig 3