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Perspectives on Sámi Mathematics Education

Anne Birgitte Fyhn, *University of Tromsø, Norway*

Ellen J. Sara Eira, *Guovdageainnu Nuoraidskuvla- Kautokeino Ungdomsskole, Norway*

Bharath Sriraman, *The University of Montana, USA*

Abstract: The Sámi are an indigenous people of the Arctic, and through a resolution of the United Nations, Norway is bound to take care of the Sámi culture and language. Since 1987 the Sámi have had their curriculum, but they have no mathematics syllabus. In this paper we summarize the legal acts that take care of the Sámi culture within the Norwegian educational system, and then discuss three examples of Sámi mathematics, which can be part of a possible Sámi mathematics syllabus. First, a unit of measurement is presented, second, a unique way of treating the ratios 2 : 1 and 1 : 2 is described, and finally the use of some Sámi versus Norwegian geometry terms are exposed. The three examples are situated in relation to the Yupik Eskimo Mathematics in a Cultural Context (MCC), as described by Lipka, Webster and Yanez (2005) and their contribution in this special issue of Interchange.

Keywords: *beali unnit*; *beali eanet*; indigenous issues; Mathematics in Cultural Context; multiplicative structures; Sámi measurement; Sámi; Sámi mathematics education

Introduction

The Sámi are an indigenous people of the arctic. They live in the northern part of Norway, Sweden and Finland, and in the Kola Peninsula of Russia (Kuhmunen, 2006). In 1989 The Norwegian Sámi received syllabi for almost all subjects (KUD, 1989), but not for mathematics. Sámi has been an official Norwegian language since January 1st 1992, the very day the "Language Act", the Sámi Act's supplement[1], became operative. In relation to Sámi education, the Act Relating to Primary and Secondary Education and Training, and the Education Act, is in force. This means, at least legally the Sámi language is on par with the Norwegian languages in the Norwegian educational system.

This paper presents the acts that juxtapose the Sámi and the Norwegian languages. Through the UN, Norway is bound to take care of the Sámi culture and language. The paper presents some perspectives on mathematics, before it exposes some issues that might be included into Sámi mathematics teaching. At the end it exemplifies the discussion by examining the use of terminology in Sámi mathematics education. For

[1] The administrative area of this act is nine local councils in northern Norway: Guovdageaidnu / Kautokeino, Kárášjohka / Karasjok, Deatnu / Tana, Unjárga / Nesseby, Porsáŋgu / Porsanger, Gáivuotna / Kåfjord, Loabáid/ Lavangen, Divtasvuodna/ Tysfjord and Snåase/ Snåsa. Due to the *Language Act,* these councils' names are written in both Sámi and Norwegian in every official connection.

the future there are implications such as developing teaching aids for the Sámi mathematics teacher education. These also can be used in post experience courses and post graduate studies for Sámi mathematics teachers. Another suggestion is to develop a Sámi mathematics syllabus which can constitute a basis for a Sámi mathematics textbook series for primary and secondary schools. Teaching material that is developed for Sámi teacher education and schools, in turn might contribute to increasing the Norwegian teachers' and pupils' insight into Sámi conditions.

The Probematique

Like Arctic Canada, the situation of the Sámi within the Norwegian educational system is somewhat analagous to the Inuit with Inuktitut language instruction and schools (see Rasmussen, this issue). Educational policy and administration is directed from officials in Oslo, far removed from the local context. Unlike the situation in Nunavut, where schools are "settled" by teachers from provinces like Ontario and NewFoundland, who conduct instruction in English, in Finnmark, schools are confronted with a different problem, namely local Sámi teachers confronting decontextualised curricular materials in Norwegian. The problem transposes itself into the paucity of culturally congruent tasks in mathematics textbooks and other materials which result in misinterpretation or misunderstanding test items on large scale assessment instruments. Numerous theorists have pointed out that mathematics is commonly perceived as the antithesis of human activity - mechanical, detached, emotionless, value-free, and morally neutral (Mukhopadhyay & Greer, 2001). Others like Ernest (1998) posit that in its roots, culture, values and humans inform mathematical activity. Aside from the intra-mathematical issues, larger legal issues and governmental approaches that surround the context of Sámi mathematics education which are next highlighted.

There are differences in the methods used by Canadian and Norwegian governments in the wording and implementation of legal acts that erode indigenous rights. As Rasmussen in the context of the Inuit mentions, the Canadian Government tried to block Inuit protections on language and educational rights in the land claim legislation, whereas legally the Norwegian government is bound to preserve the Sámi language and way of life, but the reality is far different. According to the Norwegian Constitution's section 110a

> "It is the responsibility of the authorities of the State to create conditions enabling the Sami people to preserve and develop its language, culture and way of life" (Stortinget, 2008).

Further, according to the *Language Act*'s section 3.8 (Lovdata, 2010), everyone has their rights to learn Sámi language. Even though this Act has been in place for 20 years, the Education Act (Det juridiske fagbibliotek, 2008) *does not* treat Sámi as an official Norwegian Language. For example the Education Act Section 9-4, regarding textbooks and other teaching aids states:

> In subjects other than Norwegian, textbooks and other teaching aids may only be used when they are simultaneously available in both Bokmål and Nynorsk[2] at the same price. In special cases the Ministry may make exceptions from this rule. (ibid)

The Regulations' sections 17-1 and 17-2, regarding the claim of books being available in both languages, *do not* mention Sámi language,

> The Education Act's section 9-4 part one, claims more than anything an equal offer of teaching aids in both languages. At the same time the rules have to make it easier to the pupils to benefit from the teaching, and the pupils' language rights have to be ensured. The rules must not restrict the pupils' use of a broad material of teaching aids through the education. (Faktaforlaget, 2009, p. 179, author's translation)

The Act intends to ensure the pupils' rights regarding language. "Both languages" here refers to Bokmål and Nynorsk. When the 2006 Curriculum was introduced, the School Adviser in Kautokeino/Guovdageaidnu[3] sent a letter (Kautokeino kommune, 2006) to the Minister of Education and Research. She asked about the Sámi pupils' legal rights to have textbooks in their language on the same level as pupils who use Bokmål or Nynorsk as their written language. Regarding the Education Act's claims for textbooks in Bokmål and Nynorsk, the Minister answered "The Education Act contains no similar claim regarding Sámi teaching aids" (KD, 2006a, authors' translation).

Several textbook series in mathematics are available in both Bokmål and Nynorsk. The newest textbook series translated to Sámi is from 1997, and this translation was completed in 2008. In February 2010 the Sámi Parliament of Norway announced an open competition regarding textbook series in mathematics, translated into Sámi language. (Sámediggi/Sametinget/ The Sámi Parliament of Norway, 2010a). This was a translation competition, not a preparation of a Sámi mathematics textbook series. The Norwegian Sámi Parliament decided which textbook series that will be translated (Sámediggi/Sametinget/ The Sámi Parliament of Norway, 2010b).

Norway's International Obligations

Norway has some particular international obligations regarding the Sámi people. The 1997 Sámi curriculum's foreword (KUF, 1997b) informs that the ILO Convention 169 "Indigenous and Tribal People Convention of 1989" was ratified by Norway in 1990. This means that the Convention guarantees the indigenous place of the Sámi people in Norway. The Convention aims to emphasize indigenous people's rights to protect and develop their culture. The Norwegian Government is obliged to support this. The United Nation's Declaration on the Rights of Indigenous Peoples, Article 14, claims:

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[2] The Norwegian language has two written forms, Bokmål and Nynorsk. Bokmål (book language) is the most widespread one. Nynorsk (new Norwegian) is based upon dialects from the countryside.

[3] Kautokeino/ Guovdageaidnu is a council which is located in the Sámi core area in northern Norway.

> Indigenous peoples have the right to establish and control their educational systems and institutions providing education in their own languages, in a manner appropriate to their cultural methods of teaching and learning (UN, 2007, p. 6).

One important issue for Norway is how to implement this Declaration. Twenty years after the ratification of the Indigenous and Tribal People Convention, the onus has largely fallen on individual school teachers to take on the responsibility of implementation of the law.

The Core Curriculum was introduced in 1997 and applies to all pupils in Norway. The paragraph "Cultural Heritage and Identity" pertains to a particular responsibility to take care of Sámi language and culture:

> The development of individual identity occurs through becoming familiar with inherited forms of conduct, norms of behavior and modes of expression. Hence education should elaborate and deepen the learners' familiarity with national and local traditions - the domestic history and distinctive features that are our contribution to cultural diversity in the world. The Sami language and culture are a part of this common heritage which Norway and the Nordic countries have a special responsibility to safeguard. This legacy must be nourished so that it can grow in schools with Sami pupils, in order to strengthen Sami identity as well as our common knowledge of Sami culture.
>
> (KUF, 1997a, p. 9)

It is not obvious what is meant by "this common knowledge of Sámi culture". Most likely it refers to the knowledge, which is shared by the inhabitants of southern Norway's cities and the people in the fishing villages in the Northern Norway, which are geographically far removed and very different from one another! If this is the case, it means that the so called common knowledge of Sámi culture is nothing more than lip service to legislation and in reality is expected to be non-existent or miniscule at best. The curriculum therefore is interpreted to mean that the non-Sámi people in southern Norway are going to have strengthened their knowledge of Sámi culture. In turn this means that the curriculum intends to carry out what is stated in the Constitution.

One reason why existing textbook series in mathematics are direct translations from Norwegian series may be that there is no Sámi syllabus in mathematics. But Sámi pupils have to compete with Norwegian pupils for admission to upper secondary education and higher education. So maybe there are benefits in taking part in the Norwegian mathematics syllabus. A Sámi mathematics syllabus might turn out to be a non desirable route to mathematics understanding for many pupils. But such a plan could also become a positive contribution to these pupils' learning. So research in this field might be of great value to the politicians and the decision makers.

The Declaration on the Rights of Indigenous Peoples may be interpreted in several ways. There are different interpretations of "a Sámi mathematics teaching that is appropriate to Sámi cultural methods of teaching and learning". In a traditional Sámi context for knowledge transfer, the small children participate in work as observers (Gaup Eira and Nystad, 2005). They are offered participation according to their qualifications, and in addition they take part in the actual terminology. While they

observe the grown ups making Sámi moccasins, they are asked to fetch several objects needed. Then the children may try to perform the work while the grown up is a supervisor and the principal part. Supported by the supervisor, the child after a while takes more and more control (ibid.).

Syllabuses and textbook series also will influence the interpretation of Sámi mathematics education. Clean translations from Norwegian textbook series might restrict the use of information and examples from Sámi culture. And in addition Sámi cultural methods of teaching and learning, as described by Gaup Eira and Nystad (2005), might be excluded from the lessons.

Mathematics and Mathematics Education

In the ancient Greek, mathematics was a common word for the four arts (arithmetic, geometry, astronomy and music) worth being pursued by free men. This is what mathematics was, and not what it is (Freudenthal, 1991). We focus on what mathematics is and what it might be. According to Bishop (1988) mathematics must be understood as a kind of cultural knowledge that does not necessarily look the same from one cultural group to another. In this vein we uncover some of the mathematics that is included in today's Sámi culture and social life. A later step might be to discuss how and to what extent this mathematics can be included in school mathematics.

Traditionally, mathematics is taught deductively in Norwegian schools (Freudenthal (1991; Sriraman & Adrian, 2004); the teacher goes through a new formula and then the pupils work with these formulas by solving written tasks from their textbooks. A large amount of student are taught as if the subject just concerns the use of rules and algorithms. There has been little room for basing the teaching on the pupils' intuition and feelings. Freudenthal (ibid.) points out that tradition might be one important reason why the teaching goes on this way. This is the way the teachers were taught, but they have forgotten that this was not the reason why they understood (ibid.).It is not obvious that traditional deductive mathematics teaching might be adapted to the traditional Sámi transfer of knowledge described by Gaup Eira and Nystad (2005).

The MCC model (Mathematics in a Cultural Context)

Lipka, Webster and Yanez (2005) describe a cultural based mathematics curriculum. The Yup'ik culture constitutes the basis for this curriculum. Every curriculum is culture based, but most indigenous people in the US follow a curriculum that is based on the major culture (ibid.). The MCC (Mathematics in a Cultural Context) resulted from a group of elders and teachers who experienced a threat towards their culture and language. During years the MCC was developed. Subject, culture, context and pedagogy are closely connected, as shown in Figure 1. Through demonstrations and explanations these elders presented cultural knowledge regarding different topics: how to build a kayak, how to navigate by using the stars and how to sew a pattern. These elders presented how the Yup'iks transferred their knowledge to the next generation. The indigenous culture here constitutes the basis for the mathematics teaching and so the MCC is an example of what the Sámi Learning Poster (KD, 2006c) claims. The MCC also is in line with Hirvonen and Keskitalo's (2004) demands.

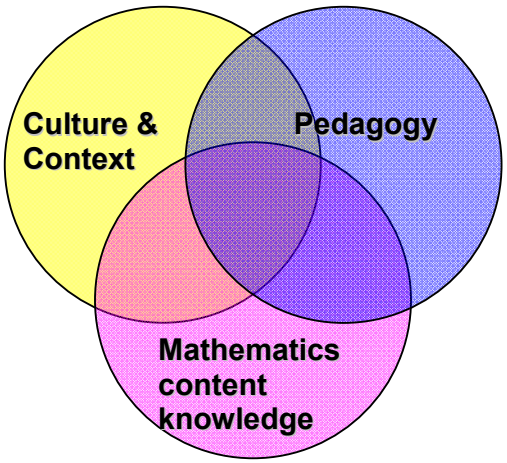

Figure 1. MCC's theoretical model (Lipka, Webster and Yanez, 2005, p. 4).

The present work with Sámi mathematics education is inspired by Lipka's MCC program that was incepted in the mid 1990's. Just like the situation in regions of southwestern Alaska that led to the Cross-Cultural Education Development Program (X-CED) of the University of Alaska Fairbanks, and work led by Lipka, Yanez, and Andrew-Ihrke (see Lipka et al., this issue), the current work is largely due to the efforts of the first author (Fyhn) based at the University of Tromso in conjunction with support from the second author (Sara Eira) as a principal in a Kautokeino based Sámi school, and the third author (Sriraman) providing research support during field visits for data collection and dissemination. Like Lipka and colleagues in Alaska (e.g., Watt et al, 2006), it is our hope that this work is the beginning of along term collaboration between the authors resulting in the development of culturally congruent Sámi mathematics modules that can be field tested and implemented in schools in the Finnmark region of Norway.

In the next sections we will discuss an implementation of some Sámi cultural elements in mathematics teaching. The MCC model is central to this discussion. Two possibilities emerge; a) a production of some Sámi teaching material for the compulsory school, and b) a focus on Sámi teachers and teacher education. According to the *Language Act* (Lovdata, 2010) and the Education Act (Det juridiske fagbibliotek, 2008) all pupils shall have access to Sámi teaching aids. But this is not easily carried out. An effort with Sámi teachers and teacher education might lead to a situation where a group of teachers, elders and mathematicians cooperate in designing some teaching material meant for teacher education. Such work is still at an experimental stage but increasingly seen as important in many regions of the world, including Alaska, and Alberta, Canada (see BIRS 2009).

This teaching material in turn may be used in follow up courses for mathematics teachers. After a while the material may be used to include elements of Sámi culture in mathematics teaching for non-Sámi pupils as well, as the Core Curriculum (KUF, 1997a) points out.

Sámi Culture and Mathematics Teaching. The ”Goartil” Example

The International System of Units, SI, was introduced in Norway in 1977. This is a modern form of the metric system. Traditional Sámi culture makes use of body measurements instead of meters and centimeters. Examples of Sámi units of measurement are “goartil”, which is explained in Figures 2a and 2b, salla (fathom), and lavki (step). Several bodily units of measurement are in use in the production of traditional Sámi clothes. This context might be of less interest to some of the boys, so there needs to be more than one approach in order to meet the diversity among the pupils.

The Constitution claims that the authorities of the State have to create conditions which enable the Sámi people to preserve and develop their language, their culture and their way of life (Stortinget, 2008). Sámi units of measurement are included in the syllabi for Sámi language and for the Sámi handicraft, duodji[4]. The curriculum makes no claim regarding Sámi units of measurements in the mathematics syllabi. All Norwegian pupils would benefit from learning about Sámi units of measurement as part of their mathematics syllabi.

----------Insert Figures 2a and 2b here----------

According to Hirvonen and Keskitalo (2004), there is a need for a change in the curriculum in order to make Sámi culture become the basis for teaching. This claim is also found in the Sámi Learning Poster (KD, 2006c) which was introduced by the 2006 curriculum. The Sámi Learning Poster has one more paragraph than the Norwegian Learning Poster,

> “The Sámi school and apprenticeship-training enterprise shall facilitate for pupils and apprentices/trainees to get high quality education based on Sámi language, culture and social life” (ibid., p. 1).

Sámi units of measurement are included in “being able to do mathematics” in two subjects: Sámi as first language and duodji. One interpretation of the Sámi Learning Poster is that Sámi units of measurement constitute the basis for the teaching in several subjects. The pupils use Sámi units of measurement to do mathematics in several subjects, and that decreases the need for working with these measurements as part of the mathematics lessons. A different interpretation of the Sámi Learning Poster is that each teacher might choose to what extent Sámi units of measurement are included in mathematics teaching. This suggests that Sámi culture to a less extent is the basis for the teaching, particularly when the mathematics teacher has a non Sámi background.

The word *goartil* means quarter of an ell[5], and a *goartil* equals the distance between the outstretched thumb and the forefinger (Kåven et al, 1995), as shown in Figure 2a. This word is pronounced quite similarly as the Norwegian word “kvartil”, which

[4] The term duodji includes Sámi traditional handicraft and handicraft products. The Sámi curriculum includes a syllabus in duodji

[5] *Ell* is an old unit of measurement, and one ell is just as much as two feet

means quartile in English. In descriptive statistics a quartile divides a data set in four equal parts. The second quartile, the median, divides the data set into two equal parts. One of Norway's mathematics syllabus competencies aims for lower secondary school concerns the concept of median; It states "… the pupils shall be able to … order and group data, find and discuss and elaborate on the median, mode, average and spread" (KD, 2006d, pp. 6-7). The competency aims do not include the notion of quartiles, which are not part of the syllabus. Sámi pupils would benefit from including this term in their work with statistics.

Ellen (the second author) has been teaching mathematics to Sámi pupils for almost 30 years and has been headmaster of a Sámi school for 17 years. She comes from a duodji home. Her mother uses *goartil* as a unit of measurement. The 15 cm *goartil* is usually used in making male Sámi moccasins. The reindeer leg skin is cut in order to prepare a pattern. In measuring the lower part of the male moccasins, the *middle finger goartil*, as presented in Figure 2b, is used as one of the tools. The *goartil* is dependent on the size of each person's body. *Goartil* is particularly used in leather sewing and gákti (traditional Sámi jacket) sewing. The rules are however changing; the lower board of the Guovdageainnu gákti (the traditional Sámi jacket from Kautokeino/Guovdageaidnu), was one *goartil* for a period of time, but at the moment it is slimmer.

The Ratios 2 : 1 and 1 : 2

"Half" is denoted "bealli" in Sámi. The Sámi term *beal* or *bealli*[6] is a richer term than just "half", because it also is used in different contexts in describing the ratios 2 : 1 and 1 : 2. It is not easy to translate *bealli* to Norwegian (or English). A translation creates an unclear meaning or a misleading expression. Common ways of expression in Sámi are *beali* "unnit" and *beli* "eanet". *Unnit* means "less" and *eanet* means "more". Directly translated *beali unnit* means "a half less", while *beali eanet* means "a half more"; a precise Sámi term sounds odd when translated. The Sámi understanding is that *beali eanet* means "twice".

One contextual use of *bealli* is in combination with seaggi (thin, slim, slight) and gasit (thick). Professor Ole Henrik Magga[7] describes *bealli* through *beali seakkit* "half as thick (half thinner)", and *beali gasit* "twice as thick". Magga denotes this as a language habit and not as mathematics. He further writes that intellectually it seems as if you always calculate a half of the largest one. From a mathematics education point of view, Magga's utterance is interpreted to mean that the Sámi language has one particular term for the ratios 2 : 1 and 1 : 2. Because this term refers to a multiplicative structure, it has to be separated from addition and subtraction.

In mathematical terms *beali unnit* and *beali eanet* might be expressed as the relationship between two proportional magnitudes in the ratio 1 : 2 or 2 : 1. This may

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[6] *Bealli* is written with a double *l* in nominative and a single *l* in accusative.

[7] E-mail January 6, 2010 to Ellen J. Sara Eira, headmaster at the upper secondary school in Kautokeino/Guovdageaidnu. Magga here refers to Konrad Nielsen's Lappisk (samisk) ordbok (Nielsen, 1979), which is a thorough and detailed old Sámi dictionary in several volumes. In 1995 the *Sámi-dáru SÀTNEGIRJI Samisk-norsk ordbok* (Kåven et al, 1995), was published. Opposed to Konrad, this one-volume dictionary follows the newest North Sámi writing standard.

be expressed shortly and concisely in several ways; either by formal mathematical language or by daily Sámi language, as presented in Table 1.

	Daily Sámi language	Formal mathematics language
The number 6	12 lea *beali eanet* go 6	12 = 2 * 6
	3 lea *beali unnit* go 6	3 = 6 : 2
The variable *x*	*y* lea *beali eanet* go *x*	$y = 2x$
	z lea *beali unnit* go *x*	$z = x : 2$

Table 1. Examples of *beali unnit* and *beali eanet*

The word *bealli* has more meanings than just *half*. It might mean "corresponding", such as regarding the corresponding side, more or less symmetric. Both the right and the left halves of something you can divide lengthwise into two corresponding parts, like for instance a fish or a reindeer, are denoted *bealli*. And metaphorically, "mu beallelaš" means my partner/ one's better half.

The Ratios 2 : 1 and 1 : 2 in Mathematics Education

The 2006 Norwegian curriculum (KD, 2006b) introduces proportionality to the pupils in lower secondary school; as part of the competency aims in the area of "functions". Pupils who have integrated *beali eanet* and *beali unnit* in their daily language might benefit from being introduced to proportionality notions at an earlier stage.

According to Alseth (1998), it seems as if the strong focus on repeated addition in the introduction to multiplication in the Norwegian school, creates the idea that repeated addition equals multiplication. This idea might influence the pupils when they meet tasks with a different multiplicative structure as opposed to repeated addition. *Beali* eanet and *beali* unnit here represent a valuable contribution to the teaching of multiplication.

> As everybody can observe, children who have just managed additive arithmetic up to ten, are proud to tell you that 10 + 10 = 20, or even that 20 + 20 = 40, that 3 x 3 = 9, and to recite the multiplication table of 1, of 110, or even perhaps of 5. In their informal arithmetic, doubling and halving often precede systematic learning of the multiplication table…(Freudentahl, 1991, p. 117)

A Sámi mathematics syllabus may enlighten doubling and halving in a way that treats Sámi culture and language as the basis for the pupils' approach to multiplication, fractions and proportionality. This is in line with the MCC (Lipka, Webster and Yanez, 2005). Sámi culture and language then will constitute the premises and the basis for the teaching. Another possibility is to make a thorough chapter about the *bealli* term in a textbook series dedicated to Sámi mathematics teacher education. Highly educated Sámi mathematics teachers might eliminate the need of a Sámi mathematics syllabus. Textbook series for Norwegian mathematics teachers also should include a presentation of and discussion about how the term *bealli* is used in Sámi daily language and culture.

When she is at home, Ellen uses different expressions than at school. That is because she does not want to confuse her pupils. She expresses to her pupils that there is a

difference, she is conscious that there exist different uses of this term. For example regarding age, where it might be difficult to use *beali/bealli, beali* boarráseabbu (half older) and *beali* nuorat (half younger). There she needs to be careful in her choice of words. "One half elder" than ten years old, means the age of twenty. If you are "one half younger" than ten years old, it makes no sense to subtract ten years, because then you are not even born! Pupils with Sámi as their mother tongue, use the terms *beali* boarráseabbu and *beali* nuorat correctly in daily contexts. But the term often causes trouble in the mathematics lessons[8].

If Ellen did not know Sámi culture and just talked about "twice as much" and "twice as big", then her pupils would have missed something important. Pupils and teachers, who are not familiar with *beali unnit* and *beali eanit,* may have trouble in understanding how this can cause trouble. Sámi pupils who learn that two different terms are equally translated to Norwegian cannot be expected to conclude that this mathematics has any meaning.

Sámi speaking teachers have possibilities of making *beali unnit* and *beali eanet* become the premises and the basis for the teaching of multiplication, just as Hirvonen and Keskitalo (2005) have argued. The oral use of language terms are in line with Lipka, Webster and Yanez' (2005) model, where culture, context, mathematics and pedagogy are closely related. And these use of terms are interpreted to be in line with the traditional Sámi way of knowledge transfer, as described by Gaup Eira and Nystad (2005).

Examples of Trade Terms: Angle and Triangle

Mathematics teaching in Sámi does not necessarily imply that each and every word has to be translated into Sámi. The first Sámi – Norwegian/Norwegian – Sámi mathematics dictionary (Utsi Gaup, E. Nergård, A., Nystad, A. and Valkeapää, N. H., 1991) was published in 1991. Many of the words in this dictionary are made up words, and there is an ongoing discussion regarding which words are the best to use in school; the newly made Sámi words or the traditional words that are used in Norwegian school mathematics. We try to extend our work on the use of Sámi language in multiplicative situations modestly to discussions regarding the words angle and triangle.

According to the 2006 curriculum (KD, 2006b) second grade pupils have to learn about properties of geometric figures. And learn to deduce that triangles with equal angles are similar. Many geometrical figures have names with meanings far from obvious for the pupils, for instance the word rectangle (*rektangel* in Norwegian). The first syllable in this word comes from the German "recht", which means right (angle). The second syllable some from the Latin "angulus" which means angle (*vinkel* in Norwegian). So the word rectangle refers to a right angled figure.

A triangle is called "trekant" (three-edge) in Norwegian. In Swedish a triangle is called "trehörning" (three cornered). A weakness with the Norwegian *trekant* is that it

[8] This interpretation of the half more and half less was consistently noted among younger Sámi students by the third author during a visit with A. Fyhn to E. Sara Eira's school in Kautokeino in January 2010.

refers to a two dimensional figure with no edges but three sides. But *trekant* is established in the Norwegian language, and a change of term most likely causes a lot of confusion. Maybe a focus on the figure's name in different languages can cause an improved understanding of the properties of triangles for pupils in Norway. The Sámi word *golmmačiegat* means "three angled" or "with three corners" (golbma means three, and čiehka means angle or corner). Maybe this word is more understandable to the Sámi pupils than the Norwegian *trekant*. Just before the 2006 curriculum (KD, 2006b) was introduced, the Sámi word changed from the adjective *golmmačiegat* to the noun *golmmačiegahas*. The Sámi Parliament of Norway's language board continuously works with the dictionaries. Changing terms in mathematics causes some trouble to the teachers, the parents and the pupils.

The English word "angle" refers to the old French "angle" or to the Latin "angulus", which is a diminutive of the Greek word "agkos" (bend) (Fowler and Fowler, 1964). This gives no reason to believe that the word *angle* makes any obvious sense to the pupils in English speaking classrooms. The Dutch word for angle is "hoek", which corresponds to the English word "hook". There are several words in the English (and Norwegian) language that refer to a bent shape. In Norwegian daily language *vinkel* (angle) occurs both as a noun and as a verb, but in the Norwegian school mathematics context *vinkel* just occurs as a noun (Fyhn, 2007). The word angle is probably a loanword in the Norwegian language because its meaning is not obviously understandable to Norwegians. The word is also found in the German "Winkel", and Swedish and Danish languages use "vinkel" just as Norwegian does[9]. *An angle* can be defined from three different perspectives (Henderson and Taiminia, 2005): angle as geometric shape, as a dynamic notion (angle as movement) and angle as measure. Measurement is the only one of these perspectives that is included in the 2006 curriculum aims (KD, 2006b), despite the fact that the easiest approach to angles is through recognition of bent shape (Fyhn, 2007).

The Sámi as well as the Norwegian language separate between the outer and the inner corner of a house. The inner corner is denoted "en krok" in Norwegian and "čiehka" in Sámi. The outer corner is denoted "et hjørne/ hushjørne" in Norwegian, and "nurki" in Sámi. *Nurki* also is synonymous with the Norwegian "nov", which is a kind of mountain pier. A Sámi approach to *angle* might be to introduce the pupils to a discussion of the meaning of the words *čiehka, nurki* and other words that refer to bent shape.

In Ellen's mathematics lessons everything is conducted in Sámi language. But sometimes she uses Norwegian terms as a support. She believes that pupils will benefit from knowing the Norwegian as well as the Sámi terms. She is afraid that a strong focus on the choice of words might restrict the pupils' mathematics learning.
The Sámi language consists of several recently made mathematics words. One idea behind these words might be that the Sámi language is better preserved by being used in several connections. Another idea is that words increase their status by being used in the mathematics lessons. But the Sámi language might as well be used in the mathematics lessons supported by the Norwegian mathematical terms.

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[9] Internationally there are several different words for angle. Spanish: ángulo, French: angle, Italian: angolo, Finnish: kulma, Estonian: nurk, Bosnian: ugao, Croatian: kut, Polish: kąt

Many Norwegians know that the Norwegian word "brøk" (fraction) comes from the Low German "brok" which means broken.[10]. The Sámi word for fraction, "cuovka", is the same word as "broken". The Sámi "cuovkaneapmi" means crushing, cracking, abortion – something that is broken. The point is that something is not a whole anymore, as often occurs with fractions. One approach to fractions is to treat fractions as small parts. A teacher who is familiar with the Sámi culture and one of its languages, may use this knowledge in her or his mathematics teaching.

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Figure 2a. A *goartil*, the distance between the outstretched thumb and the forefinger. This unit of measurement is widely used, among other places in sewing traditional clothes.

Figure 2b. ”Middle finger goartil”, the distance between the outstretched thumb and the middle finger. A *middle finger goartil* is a bit longer than a *goarti*l. This unit is widely used in patterns for male clothes.