

Call your Mothers! Sámi Culture-Based Curriculum Development Based on Mathematics Teachers, Students and Mothers in Joint Research Actions

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This paper describes the collaboration between home and school during the planning of a mathematics teaching experiment involving *ruvden*, a Sámi braiding procedure. The experiment was conducted in a Sámi lower secondary school. In Sámi schools, Sámi language and culture shall constitute the basis for the teaching, but no cultural implementation usually takes place in the mathematics teaching. The teachers' investigations of *ruvden* took place in collaboration with researchers and students during workshops, meetings and math days. The participants investigated the braiding procedure with different numbers of yarns; during one workshop, two girls' mothers were invited to participate. The contributions of these new participants opened up for research questions with a focus on home-and-school cooperation. The first research question is: How did the mothers experience their involvement in the development of the Sámi culture-based teaching experiment? Analyses of that question prepared for another research question: How may home-and-school collaboration contribute to culture-based curriculum development? The mothers experienced their involvement positive, and the home-and-school cooperation had even implications for the content of the teaching experiment. The home-and-school collaboration took part on the basis of the perspective of *shared responsibilities*.

Keywords: Sámi traditional knowledge, culture-based curriculum development, collaborating with the community, curriculum enrichment, Indigenous mothers, Sámi mathematics teachers

Introduction

This paper describes a case of cooperation between home, school and research. Two mothers were spontaneously invited to participate in the planning of a Sámi culture-based teaching experiment in mathematics. The experiment was

conducted in a Sámi lower secondary school in Northern Norway. The Norwegian directorate for education and training (2005, p. 11) has stressed that "[t]here should be a close interaction between upbringing at home and the education provided by the school." Despite this, the National Parents' Committee for Primary and Lower Secondary Education (2015) has claimed that four out of five parents in Norway experience no or very little

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influence on the teaching and the students' learning environment. The cooperation described in this paper is in line with the intentions of Norway's Education Act.

The Sámi culture-based teaching experiment in mathematics was developed on the basis of the teachers' investigations of *ruvden*, a Sámi braiding procedure. Initially, to be able to integrate *ruvden* into the mathematics teaching, the teachers had to investigate how the procedure is performed, namely how to braid the *ruvddebáttit*, the round-shaped braided cords. The investigations took place during workshops, meetings, and math days. During these gatherings, the mathematics teachers worked in collaboration with lower secondary school students and researchers from the field of Sámi education and mathematics education. During one of the workshops, the mathematics teachers and two female students performed *ruvden* with different numbers of yarns, and the girls' mothers were spontaneously invited to participate. The presence of these new participants opened up for research questions with a focus on home-and-school cooperation. The first research question is: How did the mothers experience their involvement in the development of the Sámi culture-based teaching experiment? The data for exploring this question consist of interviews with the mothers. Analyses of the question give rise to another research question: How may home-and-school collaboration contribute to culture-based curriculum development?

Collaboration Between Home and School

Teachers are expected to involve parents in school (Epstein, 2011). Today, ideas about family-and-school relations have moved toward greater teacher-and-parent cooperation with six different types of involvement of parents. The first type is *parenting*: the school is providing programs and services to support the efforts of the family. The second is *communicating*: the school is establishing effective communication networks between home and school. The third is *volunteering*: the school is recruiting and organizing volunteer activities that support the children's learning. The fourth is *learning at home*: the school is supporting parents to be able to help their child with its homework, as well as in their efforts to assist their child academically and socially at home. The fifth is *decision-making*: the

school is attempting to increase the level of parent participation in school governance and in school advocacy. The final type is *collaborating with the community*: community-based resources are identified and integrated as a way of strengthening the school programs and support the parents in their efforts to help the children in their learning.

Home-and-school collaboration in the study by Jannok Nutti (2010) was mainly visible in the perspective of *collaborating with the community* (Epstein, 2010) or *the curriculum enrichment model* (Swap, 1993). Teachers emphasized that they felt that collaborations with parents, grandparents or other family and community members were needed if the teachers were to be able to develop and implement a Sámi culture-based teaching (Jannok Nutti, 2010). A teacher developed her culture-based knowledge by asking questions to *elders* in the community, and thereafter implemented the knowledge into teaching. Another teacher invited a grandfather to share his knowledge as a reindeer herder with the students as well as to participate during a session outside of school. Two other teachers cooperated during a school project involving grouse hunting, and invited a father to participate in this work. In the reindeer herding-themed case just mentioned, the grandfather acted as an expert, and he showed and told the students how and why reindeer herders measure snow depth. In the hunting-themed case, the father also acted as an expert sharing his knowledge directly with the students. Two female teachers were learners, too. One of them was interested in the practical work, while the other was more interested in his hunting stories. The father acted as an expert during a lesson in school and a lesson in the forest. After the lesson in school, the father was invited to the teachers' room, where informal knowledge exchange took part. There the teachers had a further opportunity to learn about the theme by asking questions to the father.

Swap (1993) instead described collaboration divided into four different models: *the protective model*, *the school-to-home transmission model*, *the curriculum enrichment model*, and *the partnership model*. *The protective model's* goal is to maintain the boundary between home and school, and it emphasizes the different roles and functions of

parents and teachers. The goal for home-and-school connections is to reduce conflicts. The second model, *the school-to-home transmission model*, emphasizes continuity between home and school. The teachers need parental support, since shared expectations between teachers and parents are assumed to result in good school results. *The curriculum enrichment model* expands the school curriculum by including experiences and knowledge from the family framework. *The partnership model* is a visionary model that lifts up the necessity of creating new school reforms, school structures, and school practices, which demand joint work between school, home and community.

Attempts to involve parents in school have not always led to close cooperation between home and school (Flising, 1995). According to Erikson (2004) the goal in the Swedish school system has historically been to modify the parents' behavior. Education for Sámi children earlier used to imply a form of schooling where Sámi children were taught Western values and ways of life (Kuokkanen, 2000). Today parents belonging to minority groups tend to distrust school and the educational system (Bunar, 2001), but minority parents still have a desire for maintaining a partnership between home and school (Bouakaz, 2007). The partnership creates a continuity between home and school, but Bouakaz (2007) revealed that both teachers and parents are afraid of being subjected to control. Teachers' felt that the parents sometimes contradicted the wishes of the school, and the parents, on the other hand, felt that they needed to protect their children from the influence of Western norms and values in school (Bouakaz, 2007).

Norwegian schools struggle with establishing close collaboration with the students' homes (National Parents' Committee for Primary and Lower Secondary Education, 2015). The parents' strong interest in their children's education and wellbeing at school could be used as a starting point for the collaboration (Flising, 1995). Home-and-school collaboration can be expressed from three profoundly different perspectives (Epstein, 2011). An assumption based on the first perspective is the *separate responsibilities of families and schools*; it stresses the inherent incompatibility, competition, and conflict between families and schools. This perspective assumes that school and family organizations are directed by teachers and parents whose goals, roles, and responsibilities are best fulfilled independently. In

addition, the goals in school and at home are achieved most efficiently and effectively when teachers maintain their professional, universalistic standards and judgments about the children in the classroom and the parents maintain their personal attention and particularistic standards and judgments about their children at home. The opposing assumption, based on *shared responsibilities*, emphasizes the coordination, cooperation, and complementary nature of schools and families and encourages communication and collaboration between the two institutions. On the basis of this assumption, schools and families share responsibilities for the socialization and education of the child. The third perspective, *sequential responsibilities*, emphasizes the critical stage of parents' and teachers' contributions to child development. This approach is based on the belief that the early years of a child's life are critical for later success, and on that basis, the parents have to teach their young children needed skills and arrange educational programs that are guided by social and educational agencies to prepare children for school. In school, the teachers are expected to take the main responsibility for the education.

Epstein (2001) emphasized that "... the most effective families and schools had overlapping, shared goals and missions concerning children, and conducted sometime works collaboratively" (2001, p. 43), and home and school is then rather considered and perceived as 'overlapping spheres of influence'. Epstein (2011) suggested that a school takes the following steps to promote close working relationships between parents and teachers: creating an action team, obtaining funds or other forms of support, identifying the starting points, developing a three-year plan, and continuing with planning and the on-going work. Schools and families vary when measured along the dimensions that are supposed distinguish family and school treatments and attention to children. There are family-like schools and school-like families, and in Jannok Nutti (2010) the teachers' motivation to develop and implement a Sámi mathematics teaching was founded, as one teacher said, on the wish to bring knowledge at home into school, to connect the culture with the teaching in school.

From *Ruvden* to Culture-Based Teaching

Ruvden, the Sámi braiding procedure, is part of *duodji*, Sámi craft, and the people who do craft work with cultural expressions that arise out of the culture's traditional knowledge (Guttorm, 2007). Sámi traditional knowledge encompasses knowledge of how to use the nearby nature and its resources (Sara, 2004). Sámi traditional knowledge is "the collective wisdom and skills that the Sámi people used to enhance their livelihood for centuries. It has been passed down from generation to generation both orally and through work and practical experiences" (Porsanger & Guttorm, 2011, p. 18). *Ruvdebáttit*, round-shaped braided cords, are traditionally part of for example weaved shoelaces or the fur-coat in the Sámi traditional clothing. The shoelaces have practical, decorative, and symbolic functions (Dunfjeld, 2006). The practical function is that it prevents snow from entering the shoes. The decorative and symbolic functions concern the use of different colors and patterns, which vary across different Sámi areas and times, as well as between men and women, adults and children (Porsbo, 1988). *Ruvden* can be done with four and eight threads (Guttorm & Labba, 2008), but this can probably vary between areas and families. The first author has written notes about the *ruvden* braiding procedure with four, eight, twelve and sixteen yarns. Earlier it was mainly women who made clothes, and younger learned how to sew, braid and weave from the elders (Porsbo, 1988).

Education for Sámi students differs between the countries, and this paper mainly focuses on Sámi education in Norway; similar education also takes place in Sweden and Finland. In Norway Sámi syllabi in several subjects were introduced 1987, and the first Sámi curriculum was applied in 1997. The 2006 Sámi curriculum's Quality Framework (Udir, 2007) emphasizes that Sámi culture, language and social life have to constitute the basis for the teaching. However, the Sámi mathematics syllabus is a mere translation of the national one, and it is therefore up to each teacher to implement Sámi traditional knowledge into the mathematics teaching. The result is that no cultural implementation usually takes place (Jannok Nutti, 2010). Hirvonen and Keskitalo (2004) pointed out a need for a curriculum change in order for Sámi culture to become the basis and premise for the teaching rather than just an appendix. Several research projects (for example Balto & Johansson, 2007; Hirvasvuopio-Laiti &

Hirvonen, 2013; Jannok Nutti, 2010; 2013) have been conducted to help transform teaching on the basis of Sámi culture. In one of the earlier studies (Jannok Nutti, 2010) teachers implemented Sámi culture-based mathematics teaching activities in other school subjects like language, craft, social and natural sciences.

Promoting Home-and-School Collaboration

In Alaska, teachers connect the teaching with Yupik students' everyday life through collaboration with local communities, families and parents (Barnhardt, 2000; Mohatt & Sharp, 1998). Parental involvement is about getting both teachers and parents to work together to develop certain activities that benefit the child's schoolwork and social development (Bouakaz, 2009). In Alaska, parents were actively involved in the teaching in school, and they supported their children's learning outside in this work (Barnhardt, 2000). Bouakaz (2009) showed that teachers could experience feelings of inadequacy with regard to collaboration with parents; whereas the teachers in his study on the one hand had a positive attitude toward parents' presence in school, they felt, on the other, that they to some extent lost parts of their role as teachers.

Sjögren (1996) showed that in Swedish urban schools, English-speaking parents were highly active in home-and-school collaboration, and English was accepted as a language to use in class as well. However, parents belonging to various immigrant groups in schools located in socially underprivileged areas seldom came to meetings. Sjögren (1996) pointed out that it appears to be a high degree of equality in power between the different parent groups, and the English-speaking parents seemed to achieve prestige through their knowledge of a high-status language and the issues of class become evident in order to give the parents a better chance to make their voices heard. Bunar (2001) claimed, that relations between parents and schools in Sweden are passive; both parties act as if they were satisfied with the degree and type of cooperation they already have, and neither party seems to attempt to explore ways of strengthening their relations to each other. However, Jannok Nutti

(2010) showed that teachers in Sámi schools put an effort into establishing positive attitudes among the parents toward Sámi culture-based teaching. As one teacher put it: "It is important that the parents are positive (have a positive attitude towards the teaching in school); because if the [parents] are negative the students also will become negative." (Jannok Nutti, 2010, p. 94; author's translation). Nytell (1996) underlined teachers' attitudes toward cooperation as an extremely important factor for establishing well-functioning home-and-school collaborations. The teachers have a key-role in the outcome of parents' involvement in school (Johansson & Wahlberg Orving, 1993). Successful home-and-school collaboration is, according to Eriksson (2004), developed on the basis of three strategies used by the teachers to create and build up trusting relationships with parents: positioning the parent as an interested and responsible parent, creating a room for open communication, and placing the child at the center of their relations to the parents.

Theoretical Tools

Bouakaz (2009) used Bourdieu's concepts *capital*, *habitus*, *field*, and *agent* to analyze parental involvement in school. Although his study focused on an urban school in Sweden and the Arabic speaking parents' involvement in the school, Bourdieu's concepts will also be used in this paper. Bourdieu's (1986) concept *capital* consists of economic, social, cultural and symbolic capital. *Economic capital* comprises material assets, and income is seen as an expression of socioeconomic acceptance. *Social capital* concerns such matters as family ties, one's circle of friends and acquaintances, close contacts, earlier contacts and membership in organizations. *Cultural capital* concerns such matters as use of legitimate forms of language and being readily accepted in different cultivated circles. *Symbolic capital* can represent the accumulation of social capital, but any type of asset can serve as symbolic capital in those contexts in which values are assigned to it (Bourdieu, 1984; 1991) Symbolic capital must be made public in some way and be assigned symbolic value by one or more observers (Broady, 1998).

Bourdieu's (1993) concept *habitus* is described as the disposition to act that individuals acquire in the earliest stages of socialization, and which they consolidate by their subsequent choices in life.

Habitus is a set of capabilities one has for being able to act, think and orient oneself effectively within the social world. Beck, Engen, Østerud, Øzerk and Aasen (2010) connect Hoëm's concept *identity* with Bourdieu's concept *habitus*, and the development of both features takes place through interactions between the individual person and the surrounding environments. The concept of *field* is by Bourdieu (1993) characterized by movement, and the fought for positions in social room. 'Social field' refers to a system of relations between different positions that are assigned to specialized agents and intuitions (Broady, 1991). According to Bourdieu (1993) *agents*, or different types of people in the field, do not act in a vacuum, but rather in concrete situations governed by a set of objective social relations. A change in positions of the agent entails a change in the field's structure.

Research Method

The study was conducted on the basis of Indigenous research methodology, which can be described as a combination of existing methodological points of departure and Indigenous practices (Smith, 2004/2012). In this case this means a combination between action research and Sámi School practices. Indigenous culture-based teaching aims to make Indigenous knowledge systems visible, as many Indigenous researchers (for example Battiste, 2000; Hirvonen, 2004; Kuokkanen, 2007; Smith, 2004/2012) stress is needed. Indigenous culture-based teaching aims to rebuild Indigenous "peoples, communities, and selves by restoring Indigenous ecologies, consciousness, and languages and by creating bridges between Indigenous and Eurocentric knowledge" (Battiste, 2000, xvii). Cajete (1994), who has been acquainted with the paradigmatic sides of research on Indigenous peoples, emphasizes that education should pay attention to the cultural foundation of teaching and learning, where educational processes are based on traditional values. Educational principles and working methods that are based on the Indigenous people's culture and traditions and that are developed in cooperation between the institutional education and the Indigenous people's community, yield education that will be linked

with every area of life—students’ wellbeing as well as the environment and land (King & Schiermann, 2004). The foundation of the Indigenous values, goals, and aspirations should be noticed in order to be able to together decide what, when, and why students should learn something.

Action research (Hansson, 2003) grabs “a ‘real’ problem of practice” and the research aim both to solve the problem and to gain better knowledge of the phenomenon, and additionally the researcher learns more by participating in the process of change than by just being an observer. In action research the participants’ active participation are central. Participation based on cooperation, mutual learning and shared expertise. In action research, continuous evaluations are central, which allows for changes. In our case, this led to a new research focus, namely home-and-school collaboration, when this focus initially not was included. Action research aims to lead to both practical problem solving and theory development.

John Dewey is often cited as the source of action-oriented research (Berge & Ve, 2000; Hansson, 2003). Dewey’s *Pragmatism* united theory and practice, and two components that were particularly important for Dewey were *creating knowledge through practical action* and *emphasizing democratic participation*. In order to denote a project as *educative*, Dewey (1998) pointed out four conditions that would have to be fulfilled. Firstly, the project must be of interest. You cannot tell the class they never will be playing football or that they never will be singing during the lessons just because some of the students do not take an interest in these activities; in that case you will end up with a state of apathy where nothing is done and nobody will learn anything. Dewey problematizes this by pointing out the very great individual differences that exist, and that teachers must not try to force one model upon all students. Secondly, the activity must have some consequences beyond the immediate pleasure of engaging in it. This can be interpreted as meaning that just to do something for fun or to learn to know each other or to improve the social environment in the class is not enough to classify a project as *educative*. Thirdly, the project has to awaken new curiosity and raise new questions; it must lead the mind into new fields. The final condition concerns continuity: The students have to develop their understanding. The students may develop their abstract thinking related to local Sámi culture through gathering experiences with generalizations of structures embedded in this

culture. If the students develop their abstract thinking in this way, then they develop their understanding of relations between braidings with different numbers of threads. Dewey pointed out that there are close connections between the second and the third conditions.

Meaney (2002) warns us that choosing activities from experiences of Indigenous students can result in the original purpose of the activity becoming lost or denigrated through the concentration on the Western mathematical idea that appears to be embedded in it. If Dewey’s four conditions are fulfilled as described above, then Meaney’s warning is considered because one aim of the teaching is increased understanding of abstract thinking embedded in the culture. The above description of how Indigenous practice is included in the project shows how Indigenous research methodology (Smith, 2004/2012) is used. If Dewey’s conditions were treated as conditions related to pure mathematics, then the warning would be highly relevant and important, and no Indigenous practice would be included. The inclusion of mothers as culture experts is a way to consider Meaney’s warning and to ensure the Indigenous methodology.

Research material for this paper is observational data that focused on home-and-school collaboration, collected during formal workshops and meetings, as well as informal meetings at home. The research material comprised sound recordings, observations and research notes. The research material has been constructed through communication, and knowledge has therefore been created in collaboration with the participants and assessed by the researchers. Research material was categorized and divided into meaningful components, but by preserving the connection to entirety. The research material was organized inductively; thus, the analysis is inductive and data-driven (Tesch, 1990).

The Cultural and Educational Contexts

The term “Indigenous” refers to an internationally recognized identity for Indigenous peoples, and emerged in the mid-1970s (Kuokkanen, 2007). Indigenous peoples, whatever their historical, political, social, economic, and geographical differences, share certain experiences of colonialism as

well as ways of viewing the world on the basis of a holistic philosophy encompassing a close relationship to the natural environment (Kuokkanen, 2007; Smith, 2004/2012). Similar to other Indigenous peoples, the Sámi people's culture, languages and traditional knowledge have to a very little extent been incorporated into the educational institutions (Keskitalo, 1993; Jernsletten, 2007). Instead, the school has played a key role in the colonization process. Edvardsen (2011) characterizes the Norwegian school system's long-lasting suppression of the Sámi culture, and stresses: "Not only are the children and young people to be educated, but also the culture itself." (Edvardsen, 2011, p. 118).

Today the Sámi culture is at a turning point where traditional skills and knowledge may get lost (Keskitalo & Määttä, 2011). Bergstrøm (2001) claimed that there is a need to preserve traditional knowledge, because it is part of a weave of meaning and represents a common horizon of understanding. Sámi teachers expressed feelings of a need to implement Sámi culture-based teaching on the basis of the belief that teaching then becomes more meaningful for the students (Jannok Nutti, 2010).

The local environment in the Sámi local society was well-known, and many adults were around the children (Hoëm, 1982). The children participated in livelihood activities together with parents, relatives or other children thereby the children gain knowledge (Sara, 2004). Children learn by observing, listening to instructions or stories, and by trying things out (Balto, 1997; 2005; Jannok Nutti, 2007; Sara, 2004). Sámi children were allowed to learn by doing things, and the children received training in managing their everyday lives Balto (1997; 2005). Balto highlighted that the goal in Sámi upbringing is to develop independent and responsible individuals who can master their lives in a given society under given conditions. Asking questions was an important factor for the learning, a crafter said: "I would have missed a lot [if I hadn't got the advice to ask elders questions about craft]. I now know how important it is to ask questions" (Jannok Nutti, 2007, p. 61, author's translation). Another elder stressed that if you ask questions, you show interest, and by that the persons who possess the knowledge will be inspired to share.

Research has showed (for example D'Ambrosio, 2001; Meaney, 2001; Jannok Nutti, 2010) that Indigenous teachers and parents want Indigenous children to grow up with a strong Indigenous

identity, but also to succeed at school and have the opportunity to obtain well-paid jobs. Parents want children to undergo the national mathematics curriculum in order to prevent any disadvantage they might otherwise face when they reach upper secondary and higher education (Jannok Nutti, 2010). According to Bishop (1990) Western mathematics is one of the most powerful weapons in the imposition of the Western culture. Pais (2011) points out that "mathematics empowers people not so much because it provides some kind of knowledge or competence to them, but because it gives people a value" (Pais 2011, p. 217). Mathematics functions as a gatekeeper that allows students to continue studying, and this gatekeeper is involved in the process of social exclusion and might foster social injustice. So school mathematics is not a "neutral" subject. According to this perspective, the mathematics teacher is a powerful person; she or he is the gatekeeper's relative. This means that the relation between the mathematics teacher and parents is asymmetric; the parents are aware of the mathematics teacher's importance to their children's future life.

The Teaching Experiment

The *ruvden* teaching experiment was introduced to six mathematics teachers (three men and three women) at a mathematics teacher meeting at their school in August 2011. The teachers started to develop a culture-based teaching experiment at a workshop two months later. The first result was a school mathematics day with *ruvden* as one of the tasks for the students in grade 9 during fall 2011. The *ruvden* task had questions such as: "What is *ruvden*? What do you know about *ruvden*?" Then the task was: "Braid, and use different colors when you braid. Describe how you intertwine. What colors did you choose, and why? How many numbers of yarns can you use? Describe the system. What do you see?" During the mathematics day two girls conducted a large-scale school project about *ruvden*, and the girls were invited to participate at a workshop for teachers and researchers.

At the workshop in April 2012 the girls showed their project to five teachers (three male and two female teachers) and the

researchers. The girls and the teachers tried to braid with different numbers of yarns, and a question was raised: Is it possible to perform *ruvdet* with more than four yarns? Although some of the teachers were already familiar with *ruvden*, not all of them were so familiar with the braiding procedure, so the girls' mothers were invited as resources. This paper is conducted on basis of collected data from this workshop, and also the following sessions and informal meetings:

1. Informal meetings during the summer 2012. The girls and their mothers braided during the summer holiday with a large number of yarns; more than four, eight, twelve and sixteen yarns.
2. A dialogue meeting in September 2012 between two girls, two mothers, and two researchers; knowledge was exchanged concerning *ruvdet*.
3. A workshop in October 2012 with five teachers (one of the male teachers was not present) and the researchers as participants; the focus was on the teaching experiment.
4. A meeting in October 2012. The two girls, the two mothers, one male teacher (the girls' mathematics teacher) and the researchers participated. The girls explained the braiding procedure with a large number of yarns to their mathematics teacher; the girls got support from their mothers.
5. A workshop in April 2013 for five teachers (one of the male teachers was not present) and the researchers. The teachers continued to develop the teaching experiment.
6. A meeting in May 2013 between the two girls, the male teacher, and the researchers, where the girls together with their teacher tested out the teaching experiment.

Not Knowing Opened Up for an Invitation

The two girls showed their teacher and the other teachers at the school how to *ruvdet* with four yarns on the basis of their earlier schoolwork. Initially the teacher said that they needed to teach him, because he could not manage to *ruvdet* himself. During the girls' demonstration, the teacher asked questions both about the braiding procedure and about the final product. The girls had the practical skills to conduct the activity, but

the teacher did not, so his questions were genuine. It was traditionally mainly women who braided, and perhaps it still is, so the question did not appear strange to the girls. During this demonstration, the girls increased the number of yarns. When the girls increased the number of yarns to twelve, a situation of uncertainty occurred, and another female teacher got involved in the braiding procedure. Together they all tried to find out how to braid both by trying out, and by studying different Sámi craft books. The discussion went on like this: "When you have six yarns in each hand, you cannot do the same as when you have 2 or 4 in each hand ...". The project had awakened a curiosity, and hence fulfilled one of the factors Dewey (1998) claimed is needed to denote a project as *educative*. The girls and teachers' curiosity resulted in efforts to try to determine whether it was possible to *ruvdet* with more than eight yarns. When the common investigations did not result in adequate answers, the girls' mathematics teacher asked the girls: "Call your mothers!" The mothers were therefore spontaneously invited to participate.

Afterwards, one of the mothers said: "It felt so natural to come when the teachers asked, because when it comes to braiding, I started to braid as a little girl; so it just felt so natural. I went there immediately, because it felt nice to be able to jump in; it did not feel uncomfortable at all." The mother arrived and started to braid with different number of threads; in this area, four threads are used for the cords that are part of traditional shoelaces. That means of course that *ruvden* with an increased number of threads would require an investigation. After a while, the other girl's mother was also invited. The mother also came immediately. She said afterwards that she went immediately when her daughter called, and it did not feel strange at all. She also said that when she arrived there "I got a memory loss [when I arrived], it suddenly felt so serious, and I did not remember anything at first, but then afterwards, when I left [the group], I thought this was so easy [not difficult at all]."

The braiding work started out from something with which the girls were familiar, namely *ruvdet* with four threads; and when the braiding continued with increased numbers of threads, the girls, in collaboration with the

teachers, tried to figure out how to *ruvden* by trial and error. When the teachers didn't feel that they could guide the girls, the male teacher asked the girls to invite their mothers as assistant experts. Traditionally, *ruvden* is performed by women, and men are not even expected to be able to perform the braiding. Perhaps that background made it easier for the male mathematics teacher to ask for help in an area where he is not expected to possess knowledge. The importance of asking questions was highlighted by Jannok Nutti (2010). It is important because when you ask questions, you show interest both toward the persons who possess the knowledge and toward the knowledge. Asking questions thereby gives the knowledgeable a possibility to share her/his knowledge, and gives the learner a possibility to learn. The questions and the invitations opened up for home-and-school collaboration, where the mothers were treated as experts and the mothers' knowledge and resources were identified and integrated as a way of strengthening the teaching and the teaching experiment, in accordance with Epstein's (2011) perspective *collaborating with the community*. The teachers' invitation and interaction with the mothers were steps that can promote close working relationships between parents and teachers, and it created a temporary action team that Epstein (2011) suggested is a starting point for developing productive home-and-school collaborations. The invitation also brought Indigenous knowledge into the teaching.

The Indigenous Development of Teaching Actions

During the summer holiday the mothers and daughters had been visiting each other and tried out braiding with different numbers of threads. This summer work took part on basis of the interest kindled when the mothers were invited to share their knowledge of Sámi craft during the workshop. Initially the girls and the mothers tried out *ruvden* with four threads. They made patterns with more traditional colors, but they also chose colors beyond the traditional. Red, white, blue, green, and yellow are traditionally used in fur-coats, gloves, and so on. Then they started experimenting and creating artistic expressions with several different color combinations including modern colors such as pink, purple, black, and so on. The investigations started out from the interest in solving the problem: 'How to braid with a large number of yarns'. On the basis of the

daughters' and mothers' summer work, it seems that the 'project' a) was of interest, b) was worthwhile, c) awakened new curiosity and raised new questions, and d) made the girls develop their abstract thinking. The project thus fulfilled Dewey's (1998) four conditions for denoting a project *educative*.

The mothers described their work thusly: "We started out with four yarns and it was *ruvden*. We continued to braid with eight yarns, and tested out with six yarns; but it did not become round shaped, but then we began to multiply...". They came up with the solution to this problem by subdividing the yarns into four sets with an equal number of yarns in it. Each time a yarn was moved to a new location, one yarn from this new location was moved back to replace it in order to keep the number of yarns in each subset equal. When they met the research team after the summer, the mothers immediately wanted to show braidings with a large number of yarns. They said that when you are going to braid with large numbers of threads, such as 40 and 60, you really need to be focused. Given the way they applied multiplication, solving the problem involved the knowledge of properties of what the language of mathematics denotes as *the multiplication table of four*, *combinatorics* and *permutations*. They used a different procedure when they braided with a high number of yarns, so they even invented a new braiding procedure. The mothers claimed that their summer work had been interesting and instructive, both for the daughters and themselves. As Dewey (1998) further pointed out, an activity must have some consequences, and problem solving is definitely not a merely trivial activity. When the mothers and girls tried to *ruvden* with more yarns, the activity was not trivial; they had to develop their understanding of relations between braidings with different number of yarns, and their curiosity guided their efforts. The summer work had similarities with Sámi traditional learning; there children gain knowledge by participating in activities, by trying out.

The teachers continued the work and during the last workshop the teacher asked themselves: "How should we, as mathematics teachers, be able to relate this to mathematics?". Then the teachers started to investigate 'What is the first thing you need to

do to be able to explain *ruvden* in mathematical terms?', and based on this question they conducted a mathematics solution. During the workshop each single teacher added comments, and together they developed their knowledge about *ruvden* as a mathematics teaching experiment. One teacher said: "I started to ask questions. I have become more concerned in taking it step by step; now I just want to see what happens.". The teachers had different expectations, but all of the teachers became more confident in trying to develop Indigenous mathematics teaching.

At the final meeting at school, the girls were going to present *ruvden* to the teacher in the language of mathematics. The teacher was initially not sure about the outcome of the activity, but still he took his role as a mathematics teacher by providing for a learning room. He supported the girls' through their explanation by guiding them through their presentation of a generalized rule for how to braid with different number of yarns. Here the mathematics teacher utilized his skills.

Agents in an Indigenous Teaching Field

The mothers' experience of involvement in the development of the Sámi culture-based teaching experiment felt natural, as one of the mothers expressed it. Firstly, when a teacher ask for help, then a mother would most likely want to provide assistance. Additionally, since both of the mothers were competent in braiding they probably felt that they possessed the requested competence.

Thereafter, when the mothers' interest for the experiment was awakened, they started to try out braiding with large numbers of yarns. This braiding even demanded a new braiding procedure, so the invitation from the school opened up for the mothers' engagement in problem solving at the school arena, a problem-solving task that had many similarities with Sámi traditional learning, where the girls and their mothers developed their understanding of relations between brandings with different number of yarns by trying it out. Their new understanding was thereafter used in the teaching experiment, and the home-and-school cooperation had therefore implications for the content of the teaching experiment.

The fruitful collaboration between home and school could occurred due to several factors. Initially the mothers and teachers shared a common network of relations, and they also

shared a common understanding by their everyday life in the community (Bergstrøm, 2001). The *agents* (Bourdieu, 1993), the mothers and the teachers, do not act in a vacuum but rather in concrete situations governed by a set of objective social relations. The agents' *habitus* (Bourdieu, 1993), dispositions to act, think and orient themselves, were based on a shared background. The *economic, social, cultural, and symbolic capital* (Bourdieu, 1984; 1986; 1991) of the mothers and teachers in this context was such that it gave them the possibility to act. Therefore, when the mothers got an invitation to participate in the teaching experiment, they possessed capital that enabled them to accept the invitation. Furthermore, the similarity of background between the mothers and the teachers meant that they did not need to use time to start to get to know each other, or start by developing a common understanding; instead, they could start to act and to exchange knowledge about the topic right away.

Actions take place on a *field* (Bourdieu, 1993). According to Bourdieu, a *field* is characterized by movements and battles being fought for positions in social space. In this case the invitation to the mothers opened up the field. The teachers' invitation showed that the mothers' knowledge was recognized as important, and therefore no struggle occurred. Instead, there was a temporary change in the field's structure when the teachers, by letting the mothers act in the mathematics teaching arena, gave away some of the power they possess as mathematics teachers (Pais, 2011). Then, later on, the teachers resumed their roles as mathematics teachers when they guided the girls to explain the braiding procedure with mathematical terms during the last part of the experiment. The teachers' actions showed that the teachers did not compete with the parents; instead, they showed that home and school *share responsibilities* (Epstein, 2011); this encouraged the communication and collaboration between the two institutions.

Concluding Remarks

It is a need to continue to develop Sámi culture-based teaching based on close home- and school collaborations. However, in

mathematics there is a tension, as shown in research (Jannok Nutti, 2010; Johansson, 2009; Balto, 2008; Meaney, 2001), between Indigenous teachers and parents' wishes that Indigenous children should grow up with a strong identity, on the one hand, and that they should be successful and have the possibility to obtain well-paid jobs, on the other. Based on that tension, teachers and parents prefer that the children undergo the national mathematics syllabus to prevent any disadvantage they may otherwise experience when they reach upper secondary and higher

education. Collaborative work like this, between teachers and parents, can provide Sámi students with knowledge that does not necessarily entail a choice between mathematics based on either Sámi culture or mathematics, but teaching that unites Sámi traditional knowledge with school mathematics. According to Battistes (2000), this could build bridges between the two contexts.

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