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How Sámi teachers' development of a teaching unit influences their self-determination

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*Five teachers from a Sámi lower secondary school participated in two workshops on culturally-responsive mathematics teaching. During the first workshop, the teachers chose to focus on developing a unit about *lávvu*, the Sámi tent, to be taught between workshops. Their experiences are analysed with respect to Self-Determination Theory, which claims that all humans have a basic need for autonomy, competence and relatedness to others. The analysis of teachers' written notes reveals that the need for autonomy appeared as a need for inspiration and for courage. The need for competence concerned relating mathematics teaching to the two community resilience factors i) Sámi language competence and ii) traditional ecological knowledge. The need for relatedness to others was linked to Indigenous peoples, other teachers at their school, and teachers at other Sámi schools.*

Keywords: Sámi, teacher, self-determination, indigenous, culturally-responsive teaching.

Introduction

This paper explores teachers' perspectives on culturally-responsive mathematics as it is imagined and utilized in the design and implementation of a teaching unit on the Sámi¹ tent, *lávvu*. This artefact, its design and its building, carries important connections to the Sámi people's intangible cultural heritage by embodying cultural traditions and ceremonies as well as rules for behaviour. To many Scandinavians, however, the *lávvu* is merely a tent; a cone-like building made with some poles that are covered by cloth. In modern Sámi societies, traditional knowledge of *lávvu* is not necessarily widespread as people use modern, factory-made *lávvtut* with metal poles. Reindeer herding families use *lávvu* regularly and often are more familiar with traditional knowledge about *lávvu* than other Sámi. The younger Sámi generation consists of a variety of people with different interests.

Guovdageainnu nuoraidskuvla is the lower secondary school in the village Guovdageaidnu, Kautokeino, in Norway. North Sámi is mother tongue of more than 90 % of the students and it is the school's official language. The teaching is translated into Norwegian by an assistant teacher for students who do not understand Sámi well. The school follows the Sámi curriculum, which is equivalent to the national one. The school's teachers realised that *reahpen*, the north Sámi word for the smoke hole in the *lávvu*'s top, was considered a strange word by many grade 10 students. In order to increase students' cultural and mathematical knowledge, the teachers developed a culturally-responsive teaching unit about *lávvu*. The teaching unit was carried out in the period between two

¹ The Sámi are an Indigenous people of the Arctic. They live in the northern parts of Norway, Sweden and Finland and on the Kola Peninsula in Russia. The Sámi is a heterogeneous group of people with different occupations.

workshops about culturally-responsive mathematics teaching. At the first workshop, the teachers planned the teaching, and, at the second workshop, they presented the outcomes. We consider this work to contribute to this group's self-determination as an Indigenous group.

Smith (1999/2006) highlights the importance of self-determination for Indigenous people, by describing it as the aim of a non-linear developmental process that departs from survival and recovery. We consider that self-determination is important in understanding Indigenous mathematics teachers' motivations for developing and implementing culturally-responsive teaching. Previous research about teachers' reflections about Sámi-fization of school mathematics identifies several important issues. Jannok Nutti (2013) noted teachers' ability, drive and possibility, while Fyhn, Jannok Nutti, Nystad, Sara Eira and Hætta (2016b) describe relations between teachers' *autonomy* and their development. Fyhn, Jannok Nutti, Sara Eira, Børresen, Sandvik, and Hætta (2015) point to the importance of including teachers from other subjects, when the context for the teaching is related to their area. According to Kirmayer, Sehdev, Whitley, Dandena, and Isaac (2009), self-determination also relates to resilience, as general discussions of identity tend to underemphasize the role of social action or collective agency in the production of well-being. Nystad, Spein, and Ingstad (2014) investigated a Sámi society in Northern Norway and identified community resilience factors including Sámi language competence, use of recreational and natural resources, and traditional ecological knowledge, such as reindeer-husbandry-related activities. These cultural factors appear to strengthen adolescents' ethnic identity and pride. Knowledge about *lávvu* and skills in how to raise a traditional *lávvu* are examples of traditional ecological knowledge in Sámi societies. Kirmayer et al. (2009) point out that resilience has a collective as well as an individual dimension.

Self-determination theory has provided empirical support for the proposition that all human beings have fundamental psychological needs to be *competent*, *autonomous* and *related to others* (Deci & Ryan, 2012). *Autonomy* refers to the perceived origin or source of one's own behaviour; it concerns acting from interest and integrated values. *Relatedness* is the psychological sense of being with others in a secure community. *Autonomy* is emphasized in traditional Sámi child rearing (Hoëm, 1976; Balto, 2005) and Balto (2005) highlights *autonomy* as a Sámi value. *Relatedness* to others is connected to holistically sharing and developing knowledge and so it is also considered an Indigenous value. The theoretical framework is constituted by the three categories *competent*, *autonomous* and *related to others*. Following Glaser (2001), we identified subcategories connected to each category by comparing incidents and named them using the teachers' own words. In this paper, we analyse five teachers' expectations and experiences of the two workshops. Our research question is, how does teachers' self-determination appear in their workshop notes?

Culturally-responsive teaching

Before discussing the workshops, we briefly describe culturally-responsive teaching which was the inspiration for the workshops. Gay (2013) described culturally-responsive teaching as “using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them” (pp. 49-50). Gay suggests that as part of culturally-responsive teaching, teachers conduct their own analyses of textbooks, the Internet and other sources. The investigation should include how different knowledge sources affect teaching and learning and reconstruct or replace existing presentations of issues and situations in the various resources with cultural knowledge and insights. This approach is in alignment

with Smith's (1999/2006) description of self-determination. Gay (2013) considered that interdisciplinary work with teachers of other subjects supported collaboration and provided different insights. Nevertheless, implementing culturally-responsive mathematics teaching needs to be done with care so that cultural artefacts are not simplified, to the detriment of both the culture and the mathematics. An example of simplification is to claim that the tipi, which is similar to the Sámi's *lávvu*, is a cone:

That is surely wrong; the tipi is not a cone. Just look at a tipi with open eyes. It bulges here, sinks in there, has holes for people and smoke and bugs to pass, a floor made of dirt and grass, various smells and sounds and textures. There is a body of tradition and ceremony attached to the tipi, which is completely different from and rivals that of the cone. (Doolittle, 2006, p. 20)

According to Doolittle, there is a risk that Indigenous students who are presented with such oversimplifications feel that their culture has been appropriated by a powerful force for the purpose of leading them away from their culture. Thus, a teaching unit about *lávvu* has to respect the tradition and ceremony attached to it. Traditionally, a *lávvu* consists of two cloths that are wrapped around a set of poles and is a place for sleeping, working, relaxing, storytelling and even more (Nergård, 2006). It is easy to set up and take down and its permanent material, cloth and skins are transported when the family moves between living places. Other materials are gathered from the area where the *lávvu* is placed, making it local as well as mobile. There are rules for where to sit in the *lávvu* for parents, grown up children, workers and smaller children. In the old days, the innermost area was sacred and only the bear hunter returning from a successful hunt was allowed there (Pettersson, 1905/1979). He entered from the back bringing the bear meat with him. Nowadays, people sleep anywhere and in modern *lávvu*, the floor is covered with carpets and stoves are used for cooking. Still, the tangible and the intangible cultural heritage remain important.

The workshops

Teachers from two Sámi schools participated in two two-day workshops, with six months in between. The workshop participants were a) teachers from the three subjects Sámi language, mathematics and *duodji*, Sámi handicraft at *Guovdageainnu nuoraidskuvla*, b) all teachers for grades 1-10 from a small Sámi school in another municipality, and c) some pre-service teachers from Sámi University College, who had a practicum at *Guovdageainnu nuoraidskuvla*. The teachers joined the workshops so they could contribute to the further development of culturally-responsive teaching in their schools. *Guovdageainnu nuoraidskuvla* had already started developing culturally-responsive mathematics teaching (Fyhn et al., 2015; Fyhn et al., 2016b) and the principal is one of the mathematics teachers. The two workshops included lectures and school-based group work. The group work was about the culturally-responsive mathematics teaching done in the period between the workshops. At the first workshop, the mathematics teachers who participated in the earlier project (Fyhn et al., 2015) presented their work. In addition, researchers presented theoretical perspectives connected to Indigenous mathematics education, mainly through examples from Sámi and Māori classrooms. The second workshop continued with theoretical perspectives and included an online lecture with two Indigenous mathematics teachers and researchers from New Zealand. At the first workshop, each school chose a theme for the culturally-responsive mathematics teaching and started the planning. The schools presented the results of their culturally-responsive mathematics teaching at the second workshop. *Guovdageainnu nuoraidskuvla* focused on *lávvu* and eight teachers from this school co-

authored a paper about their work (Fyhn, Sara Eira, Hætta, Juuso, Skum, Hætta, Sabbasen, Eira and Siri, 2016a).

The teaching unit about *lávvu*

During workshop one, the Sámi language teachers suggested to focus on *lávvu*, because many students did not know the names of central parts of the *lávvu*. The mathematics teachers agreed that *lávvu* would provide possibilities for teaching mathematics, among other things by having the students make a small *lávvu* model. Students could discuss different aspects of mathematics related to *lávvu*. Consistent with cultural symmetry (Trinick, Meaney, & Fairhall, 2016), the teachers designed the teaching unit so that it started with a history section that discussed *lávvu* and *goahti* (another common Sámi housing) and central concepts regarding these. The teachers highlighted the different parts of the *lávvu* construction and how each part functioned. Each part was connected to specific traditions and the students had to learn the North Sámi words for them. In this way, the teaching valorised the local culture, as recommended by Trinick et al. (2016) and Doolittle (2006).

The mathematical aspects of the unit focused on the three *válddahat*, the structural poles, the location of *árran*, the fireplace, and the size of the floor. The *válddahat* have a Y-shape in one end and are the first three poles raised. This triangular construction is common for Sámi frameworks; as constructions made by three sticks are stable and reliable (Fyhn et al., 2016a). Locating the *árran* can be done through eye estimation, which includes trial and error for those who are not skilled. *Árran* may also be located just below a *skerttet*, a special iron hook that hangs in a chain from the top of the *lávvu*. Locating *árran* can be connected respectively to a numerical approach or a geometrical approach, with both providing appropriate answers. The size of the floor depends on how many people are to stay in the *lávvu*; the steeper the walls are, the smaller the floor's area. In earlier times, people could determine from a distance how many people lived in a *lávvu*, based on the angle between the wall and the ground. The *lávvu* floor is covered with layers of *duorggat*, twigs in appropriate length that are cut from willow or birch. Eye measuring is used to estimate the amount of *duorggat* needed. The students used a trial and error approach to determine this, while skilled people fetch the correct amount first time.

The students raised a *lávvu* near the school. The teachers focused the students' attention on the three *válddahat*. The students also made a mini *lávvu*, which became a gift that the students enjoyed giving to an old people's home. The model's scale was 1:8. Afterwards the teachers regretted that they had chosen this scale, because the task would have required more mathematics if the students had to decide the scale themselves. Still the model proved mathematically challenging for the students, who had to choose materials and decide how to make everything in correct proportions.

Method

Five teachers from *Guovdageainnu nuoraidskuvla* participated in both workshops and their responses to the workshop are analysed in this paper. They work in a school where North Sámi is main language and were educated as Sámi teachers. The five teachers Bigga, Duri, Vide, Sire and Aile are north Sámi native speakers and experienced teachers who teach two, three or four subjects each. Two of them teach *duodji*, four of them teach mathematics, and four teach Sámi language. The work between the workshops contributed to strong cooperation between the teachers in these three subjects. Sámi language and *duodji* are subjects that, among other things, aim to strengthen the students' cultural

identity. At the bequest of the researchers, the participants wrote about their expectations and experiences of the workshops at the beginning and end of each day. Fyhn et al. (2016b) studied relations between teachers' *autonomy* and their development of a culturally responsive mathematics exam. In this study, we chose to focus on more aspects of self-determination. In alignment with self-determination theory (Deci and Ryan, 2012), we analysed the teachers' writings in regard to a) being *competent*, b) being *autonomous* and c) being *related* to others. Designing and implementing a culturally-responsive teaching unit about *lávvu* requires the teachers to have the necessary *competence* about how to integrate cultural knowledge with mathematics teaching; this is an example of what Kirmayer et al. (2009) call community resilience. As well, the teachers need a capacity for and a desire to experience *autonomy*; that the work is regulated by themselves and that their integrity is kept through the work. When teachers from one school work together as a group, they are *related* to others and not alone in facing possible resistance or other difficulties in implementing a culturally-responsive teaching unit.

The teachers' experiences of self-determination during the workshops

The teachers' expectations and experiences are analysed with respect to the three issues *autonomy*, *competence* and *relatedness* to others (see Table 1). *Competence* was identified as the ability to include two community resilience factors i) Sámi language competence and ii) traditional ecological knowledge in the teaching of mathematics. *Relatedness to others* could be separated into three categories, relatedness to other teachers at their school, relatedness to teachers at other Sámi schools and relatedness to (teachers from) other Indigenous peoples. Before the workshops, the teachers' expectations mainly concerned their individual *autonomy* and *competence*, but during the workshops, most of their discussions of their experiences focused on *relatedness to others*. The analysis of the written notes reveals the teachers' need for *autonomy* manifested itself as a need for encouragement and for ideas or inspiration. These findings are in line with Fyhn et al (2016b).

Autonomy	Competence	Relatedness to others
Inspiration/ideas from others Becoming encouraged Awareness about competence	Include resilience factors: a) Sámi language and b) traditional ecological knowledge in mathematics teaching	Other teachers at their school Teachers at other Sámi schools Other Indigenous peoples

Table 1: Framework

The first morning, the teachers expressed their expectations towards the workshops. Sire and Aile referred to a need for supported *autonomy*, "I hope that I dare to do more interdisciplinary work", (Sire, expectation notes, March 2, 2015) and "Hope it motivates to more interdisciplinary work", (Aile, expectation notes, March 2, 2015). Vide, Aile and Duri expected to hear about experiences with including resilience factors in mathematics teaching, "to get some ideas and hear about some experiences with culture-based mathematics", (Duri, expectation notes, March 2, 2015). Aile expected ideas about how to connect different subjects, and Vide (expectation notes, March 2, 2015) wrote "To get input from other teachers about how to integrate more subjects in an interdisciplinary work where all subjects feel included". The teachers' references to interdisciplinary work are in line with Gay (2013), who points out that interdisciplinary work leads to collaboration, plus expectations

about knowledge. Interdisciplinary work in this setting means mathematics that treats Sámi traditional knowledge with dignity and respect. Nystad et al. (2013) identified traditional knowledge as a community resilience factor. Ability to integrate resilience factors was among Bigga and Sire's expectations. Bigga (expectation notes, March 2, 2015) expected to "be able to base more of the subject mathematics on culture".

In the experience notes, four of the teachers explicitly referred to a lecture about other Indigenous people, "We have learned about others' challenges, Indigenous thinking and perspectives", (Duri, experience notes, March 2, 2015). This is categorized as *relatedness* to other Indigenous peoples, "we have learned that other Indigenous peoples have many things similar to us, the same challenges", (Sire, experience notes, March 3, 2015). Four of the five teachers had experiences that concerned their *relatedness* to other teachers at their school, like "the final part with concrete reflections and discussion/talk about *duodji*/mathematics at our school was very useful.", (Bigga, experience notes, March 2, 2015) and "good to focus on culturally based mathematics again, so that we can coordinate it in our school's plans", (Vide, experience notes, March 2, 2015). The second day of workshop one, the notes mainly concerned *relatedness* to other teachers at their school and to other Indigenous peoples, "the group work constitutes a basis for further work at our school. Informative to see that other Indigenous people have similar thoughts about this work. We see that they have similar challenges" (Aile, Sire, Duri and Vide, experience notes, March 3, 2015). Bigga also noted that she experienced *relatedness* to teachers at the other Sámi school.

None of the teachers referred directly to being *competent*, but three of them made implicit references to this: "Alan Bishop's six fundamental activities makes us teachers more aware of our actions, teaching and thoughts about mathematics and language", (Duri, experience notes, March 3, 2016), "I become more aware of my solid knowledge about Sámi culture. I can base more of my teaching on this knowledge... The theoretical part was more useful this time" (Sire, experience notes, March 2, 2016). Three of the teachers referred to supported *autonomy*, which was caused by the increased awareness about their *competence* and the fellow teachers' positive attitude and contributions to the workshop. These are examples of overlap between the basic needs *autonomy* and *competence*; the three basic needs do not constitute distinct categories.

The analysis of the second workshop's experiences mainly reveal *competence* and *relatedness* to others. Four teachers pointed at *competence*, Aile wrote, "the lecture about language and mathematics was very interesting, because I could see relations between Sámi language and mathematics", (experience notes, October 21, 2015). "I become more and more conscious about my own solid knowledge in Sámi culture, I can use this in my teaching", (Sire, experience notes, October 21, 2015). All five teachers pointed to the importance of *relatedness to others*. "The sessions where each school worked together, was very developing for us... The sharing of experiences was useful, between schools as well as within each school" (Vide, experience notes, October 21, 2015). Sire wrote, "It has been informative to learn about the international, and gives a wider spectre to think about other people's situations". The teachers had to start the last day one and a quarter hours earlier, in order to have a Skype meeting with two Māori mathematics teachers/researchers in New Zealand. The Skype meeting took place the day after the workshops' final conference dinner and the early morning attendance confirmed the participants' commitment to talking with the Māori teachers/researchers. They really looked forward to this meeting. The analysis reveals that three of the teachers experienced

relatedness to other Indigenous people from the Skype meeting: “This day has been useful in many ways ... what Uenuku [Fairhall] said about the importance of how you teach mathematics ... throw away the textbooks and teach mathematics at theme level :-)”, (Aile, experience notes, October 21, 2015).

Conclusion

The teachers expected increased *competence* and supported *autonomy* when they joined the workshops. They had no expectations regarding *relatedness* to others, but this seemed to become their most characteristic way of describing their experience. The analysis of the teachers’ needs for *autonomy*, *competence* and *relatedness* to others identified the ways in which these needs appeared. Subtypes of the three needs revealed information about the important factors that the teachers considered that they needed to succeed in developing their self-determination. Regarding *autonomy*, the teachers expected and experienced inspiration and being encouraged. They experienced *competence* in regard to relating mathematics teaching to the two community resilience factors i) Sámi language competence and ii) traditional ecological knowledge. *Relatedness* to others was linked to: Indigenous peoples; other teachers at their school; and teachers at other Sámi schools. The teachers’ notes also revealed that they would have benefitted from group work related to the introduced theory, but this was not fulfilled. They wanted and expected to learn more about how to integrate culture in their mathematics teaching; culturally responsive mathematics teaching.

The use of self-determination theory as a methodology for understanding teachers’ perceptions about culturally-responsive mathematics teaching reveals that the teachers’ development is influenced by several cooperating factors; inspiration and encouragement, working with theory and experiencing relatedness to other Sámi teachers as well as to other Indigenous people. Future workshops need to link culturally responsive mathematics teaching more closely to teachers’ group work.

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