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Mathematics teaching in *lávvues* from the perspectives of Indigenous education and critical peace education

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ABSTRACT

This study focuses on how teaching is affected when two cultures meet: the Sámi culture, represented by the *lávvu*, and the culture of teaching mathematics in a school. It describes the use of the *lá*vvu (a Sámi temporary dwelling) as a classroom for teaching mathematics. For several years, and in cooperation with researchers, the teachers at the Guovdageaidnu Lower Secondary Schoolg have been developing interdisciplinary teaching content related to Sámi traditional knowledge. The findings of this study describe how tenth-grade students taught younger students. The empirical data used in this study originated from students' teaching in *lávvues* and consisted of audio recordings, field notes, and notes from conversations between the authors. The teaching was carried out at another Sámi school for students of the same age and younger. The organization of the teaching and the teaching itself can be seen as a hybrid of Sámi child rearing and the ordinary teaching occurring in Sámi schools in Norway.

KEYWORDS

Lávvu; Sámi; Indigenous education; critical peace education; critical mathematics education; Sámi education

Introduction

The Sámi population originates from Sápmi, an area that extends from Central and Northern Norway, Sweden, and Finland to the Kola Peninsula in Russia. The land mass is divided into several areas, and there are 10 Sámi languages, each comprising its main dialect and subdialects. Northern Sámi is the language spoken in Guovdageaidnu, where the professional teachers and teenage students in this study are located. In Norway, the Sámi population has the status of Indigenous people, which means that they have the right to develop their own culture and language on their own premises (Ministry of Local Government and Modernisation 1987). Nowadays, the debate about Sámi culture and society in Norway revolves around, among other things, how the Norwegian authorities do not protect the Sámi people rights. This is

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because the Sámi are often not included in decision-making processes that affect how the Sámi lives (NRK Sápmi 2019; Sámediggi - The Sami Parliament 2021; forskning.no 2023; NRK Sápmi 2021). It is worth pointing out that in February 2023, the Sámi Parliament and the Norwegian government experienced a breakdown in consultations over proposed changes to the Education Act (Sametinget 2023; NRK Sápmi 2023). The Sámi Parliament is concerned that the changes would weaken Sámi children's rights to education in their own language and culture and accuses the government of not taking their concerns seriously.

Mathematics and mathematics teaching can be understood as social systems because they affect political and economic systems (Bishop 1990; Skovsmose 2006). Teaching mathematics in a *lávvu*, a Sámi temporary dwelling[1] (Figures 1 and 2), gives the school an opportunity to acknowledge Sámi traditional knowledge in a subject that has traditionally been seen as universal, that is, not influenced by culture. Working with Sámi traditional knowledge in mathematics teaching can help Indigenous students develop their understanding of mathematics and use it in a way that is not perceived as foreign (Meaney 2002).

Figure 1. Modern *lávvues*.

Figure 2. Traditional *lávvu* (Photo: Skum, 2016).

Carter (2004) suggested incorporating mathematics as a school subject into peace education, the aim of which is to use mathematics to enable students to uncover and analyze injustice and conflict. This study aims to create an awareness that mathematics teaching has the power to include and empower, as well as the potential to lead to suppression and alienation. These features also characterize critical peace education, which concerns uncovering and changing social injustice through school teaching (Huaman 2011; Bajaj 2008, 2015; D'Ambrosio 2007).

The data collection methods used in this study were developed from the perspective of culture-based mathematics education. In this context, culture-based mathematics teaching is understood as mathematics teaching based on the Sámi language and culture (Jannok Nutti 2013b), as indicated in the works of Fyhn et al. (2016, 2017, 2017, 2018) and Nutti (2013a, 2015) about Sámi mathematics education. The study is also connected to other Indigenous studies, such as that of Meaney, Trinick, and Fairhall (2013) about the teaching of mathematics in consultation with members and elders in the Māori community in New Zealand. The collaboration between Lipka, Mohatt, and The Ciulistet group (2013) and the Yup'ik elders who lived on traditional lands in Alaska also highlights culture-based mathematics teaching rooted in community practices.

For several years, teachers at the lower secondary school in Guovdageaidnu have been developing teaching units in mathematics based on Sámi traditional knowledge (Fyhn et al. 2016, 2016, 2017, 2017 Jannok Nutti et al. 2015). Some of these teaching units are about the *lávvu* and related issues. The teaching units for final-year students focused on developing and conducting their own teaching in and about the *lávvu*. In September 2016, the tenth-grade students taught at a school in Tromsø and at the Forskningsdagene[2] at UiT The Arctic University of Norway campus in Tromsø (NRK Sápmi 2016; Nordkild 2017; Utdanningsforskning.no 2016). The analysis presented in this article is based on empirical data from the teaching done by the tenth-grade students from the lower secondary school in Guovdageaidnu at another Sámi school elsewhere in Norway.

The school where the fieldwork and teaching took place is a Sámi primary and lower secondary school that teaches first grade to tenth grade. In this paper, this school is denoted as the learning school. The study participants were as follows:

- The learning students (LS): A group of first-grade to tenth-grade students at the school where the teaching and fieldwork took place.
- The teenage students (TS): A group of tenth-grade students from the Guovdageaidnu Lower Secondary School who taught in the *lávvues*.
- The professional teacher and second author: Ole Einar are a professional teacher who taught a TS group and is hereafter denoted as the professional

teacher or second author. Five professional teachers were involved in this study, one for each TS group.
- The researcher and first author: Siv Ingrid were a participating observer, is the first author, and is hereafter denoted as the researcher or first author.

The research question developed for this study is as follows: How can teaching in a non-prototype classroom contribute to a dialogue between the culture of teaching mathematics in a school and Sámi culture? This research question is approached by focusing on how the TS prepared for and taught other students in *lávvues* and how *lávvues* can be used to solve mathematical problems in a cultural context. This study also describes how student-centered teaching can take place in mathematics, which is considered unusual in traditional mathematics teaching. In this context, the *lávvu* meets Skovsmose's (2006) definition of a non-prototype classroom, that is, a place where teaching takes place that we traditionally do not associate with teaching, and it considered as an opportunity in the teaching. The study is also captured in the context of the traditional Sámi upbringing, as described in the next section.

Literature review

Culture

In this study, the concept of culture is understood as the content of a society (Schackt 2009). This means that culture and society are separate, with the implication that a society can contain several cultures. The content of a society can be understood as the ideas, values, rules, norms, codes, and symbols that current generations inherit from previous generations, which are then passed on – usually with some changes – to the next generation (Klausen 1992, 27).

Mathematics

In this study, mathematics is understood as a cultural product. Contrary to how the subject of mathematics is understood in school, Bishop (1988) maintained that just as each cultural group generates its own language and religious beliefs, each cultural group is also capable of generating its own mathematics. According to Barton (2008a, 10, 1999), mathematics is 'a system for dealing with quantitative, relational, or spatial aspects of human experience,' that is, a quantitative, relational, spatial (QRS) system. Barton (2008a) also referred to mathematics as a discipline in educational institutions, as well as an international discipline or near universal conventional mathematics (NUC mathematics).

Sámi upbringing and pedagogy

Historically, the Sámi people lived as hunters and gatherers and, thus, lived a nomadic life. The design of the *lávvu* reflects the Sámi communal culture, and its simplicity enables the Sámi to move quickly. Reindeer herders who follow the reindeer as they move between their summer and winter pastures use *lávvues* as temporary dwellings (Paine 2009). In recent times, *lávvues* have been used in outdoor life by both Sámi and non-Sámi people. The Sámi people have traditionally lived close to nature and used what their local surroundings provide; in a historical sense, the society can be characterized as self-sufficient (Guttorm 2011). Sámi traditional knowledge is related to this way of living; it has evolved over generations and has been transferred between generations via oral communication.

Historically, in the area of this study, the Sámi did not have a formal institution responsible for education (Jannok-Nutti 2010; Balto 1997; Hoëm 1978). The children received guidance from their parents and others in their community. Child rearing was also performed by members of the extended family, such as aunts and uncles. For example, grandparents were important educators and played an active role in their grandchildren's lives.

Sámi children learn through observation, participation, and trial and error (Balto 1997). It is expected that they will try things and fail in some tasks. There is patience for trial and error, and children participate in a practice on their own terms. Freedom and opportunity in relation to trial and error enable independence. The Sámi child's upbringing involves learning through legends, storytelling, and practices, and the stories told contain messages and lessons about how one should behave and act in different life situations. Another way of transferring Sámi traditional knowledge is by involving children in practical tasks and work, enabling them to become active in the learning process, while adults play a guiding role. The freedom to explore and decide allows the child to take responsibility and be autonomous, which is important for success in adulthood (Hoëm 1978). Balto (1997) highlighted that while Sámi children have traditionally been involved in family chores as part of their upbringing, their participation has been on their own terms. Further, Keskitalo and Määttä (2011) pointed out that, whenever necessary, teaching must be outside the classroom and, thus, must be considered in a school that values Sámi culture.

Sámi school history in Norway

The Sámi people in Norway have been subjected to assimilation or Norwegianization, which meant that the Sámi language and culture would be replaced by the Norwegian language and culture (Hansen and Olsen 2022). Sámi school history in Norway must be considered in the context of the Norwegianization of the Sámi population. The Norwegianization of the Sámi

population in Norway began in the 18th century and was designed as a policy after 1814, with a marked surge after 1850 (Minde 2005). Thus, it must be understood in the context of the development of the nation of Norway after the dissolution of the union and the adoption of the constitution in 1814, and the rise of Norwegian nationalism in the 19th century. The Sámi were exposed to Norwegianization for several reasons, one being that the Norwegian authorities perceived the Sámi culture and language as foreign and primitive. Another was that Finland was perceived as a threat to Norway, and people living in the northern part of Norway were seen as more or less disloyal to the Norwegian state. This meant that the Norwegianization process was intensive in these areas.

In 1739, Norwegian authorities introduced a law on compulsory schooling, with all children from the age of seven had to attend school, which also applied to Sámi children (Hansen and Olsen 2022). From the beginning of the eighteenth century, missionaries performed the schooling and education of the Sámi population in Norway. Following the formulation of Norwegianization as a policy, the school became an institution where Norwegianization was carried out. This meant that Sámi children were not allowed to speak Sámi and were placed in boarding schools. It was not until after World War II that the Norwegianization policy ended. After the war and up to the 1960s, Norwegian society was characterized by the ideals of the welfare state, and traditional Sámi values and way of life were seen as old-fashioned. This meant that having Sámi ancestry was often associated with shame. From around the 1960s, a process began in which the Sámi people in Norway demanded their right to practice their culture and language. On 20 June 1990, Norway ratified ILO Convention C169 – Indigenous and Tribal Peoples Convention, 1989 (No. 169), which entitled the Sámi in Norway to develop their culture.

In 1997, the first Sámi curriculum in Norway was introduced, and according to Hirvonen (2004), the purpose was to put Sámi culture and values on the school agenda. The curriculum, which was introduced in 2006, and the Sámi curriculum was made equivalent to the Norwegian curriculum (Kemi Gjerpe 2017; Ministry of Education and Research 2006). The Sámi curriculum consisted of a general part, principles of education, and curricula for the subjects Sámi, *duodji*/Sámi handicraft, music, food and health, and knowledge of Christianity, religion, philosophies of life, and ethics. The mathematics curriculum was common for both Sámi and Norwegian. In 2020, a new curriculum was introduced, and it continues with parallel curricula for the subjects Sámi, duodji/Sámi handicraft, music, food and health, and knowledge of Christianity, religion, philosophies of life, and ethics. The new curriculum does not have its own general Sámi curriculum (Ministry of Education and Research 2019). The teaching described in this study is based on the competence aims of the 2006 curriculum.

Critical mathematics education and critical peace education

Mathematics as a school subject is often deemed lacking in cultural influence (Bishop 1990; Barton 2008a). According to Bishop (1990), this can be explained by the fact that the education conducted in schools and universities is based on Western values. Mathematics in school is often taught through a deductive approach, or what Skovsmose (2001) called the exercise paradigm: the teacher presents a new topic to the class; the students solve problems related to the topic; and the correct answer is held by either the textbook, the teacher, or both.

The basis of critical mathematics education is that mathematics is not universal or unaffected by culture (Skovsmose 2014). This means that mathematics must be understood as a constructed concept, thereby being influenced by cultural, social, economic, and political tendencies. As such, critical mathematics education specifies that this backdrop must also be considered in mathematics teaching.

Critical mathematics education refers to the teaching of mathematics that aims to foster students' critical thinking and reflection on mathematical concepts (Ernest 2016). Here, the term *critical* is understood as the ability to have a deeper understanding of a mathematical problem. For example, a student might be able to analyze why a phenomenon is as it is, as well as point out why the item is not as it is. In critical mathematics education, the ability to look at the strengths and weaknesses of a phenomenon is also critical. Further, it is critical to put a phenomenon in context with other objects, items, or events. What mathematics is in relation to other phenomena is a question that can be characterized as critical. Critical mathematics education also promotes an individual's ability to think critically, thereby enabling the individual to ask critical questions in a democratic society (Valero 2007). According to Brantmeier (2011, 357), critical thinking is also significant in critical peace education, and it enables individuals to promote 'social and cultural change toward a nonviolent, sustainable, and renewable future.' The ability to think critically about structures and institutions that have historically carried out structural and cultural violence against ethnic groups in a society can help put an end to such injustices.

Critical peace education and critical mathematics education have several features in common, including the following:

- A focus on social justice: Both approaches prioritize addressing issues of social inequality and oppression in their respective fields.
- An emphasis on critical thinking and active participation: Both critical peace education and critical mathematics education encourage students to think critically about the world around them and actively participate in creating positive change.
- Recognition of the role of education in shaping society: Both critical peace education and critical mathematics education recognize the powerful role

that education can play in shaping individuals and societies and aim to use this power to promote positive change.
- Collaboration and community building: Both critical peace education and critical mathematics education encourage collaboration and community building among students, teachers, and communities.

D'Ambrosio (2007) identified several aspects of peace: inner peace, social peace, environmental peace, and military peace. Mathematics can be taught as a subject that promotes inclusivity in relation to diversity and that incorporates various problem-solving traditions. By providing a framework for understanding and valuing the mathematical knowledge and practices of different cultural groups, mathematics can help promote greater social inclusion, mutual understanding and respect, and, ultimately, social peace. Mathematics taught as a subject that promotes inclusion can be linked to the non-prototype classroom because both prioritize contextual learning and adapting to available resources (Skovsmose 2006; D'Ambrosio 2007). This is because teaching mathematics as a subject that values and incorporates different cultural practices can foster respect, inclusivity, and, ultimately, social peace.

Skovsmose (2006) characterized the prototype classroom as a room with walls, windows, and doors. It also has electricity, desks, chairs, whiteboards, blackboards, and learning equipment, such as textbooks and digital devices (e.g. tablets, computers, and notebooks). However, mathematics teaching happens in a diverse range of environments, including places that have been exposed to war or natural disasters and those with high levels of poverty and crime. According to Skovsmose (2006), classrooms that do not meet the above-mentioned criteria are non-prototypes. A non-prototype classroom refers to a classroom that does not conform to the traditional classroom model, in which the teacher is the main authority figure and students are seated in rows facing the front of the room. Non-prototype classrooms can take many forms, depending on the needs, available resources and preferences of the students and teachers.

Sámi child-rearing practices, critical mathematics education, and critical peace education have several common characteristics. In this study, we examine the shared features of learning in context. We focus on the fact that mathematics must be understood in a context, the details of which are presented in the next section.

Methods

This study aimed to develop an in-depth knowledge of the effects on mathematics teaching when Sámi traditional knowledge intersects with the culture of teaching mathematics in a Norwegian school. The study can be categorized as

a descriptive case study (Yin 2018). Our focus was on what the TS and the professional teacher had done prior to and while teaching in the *lávvues*. The researcher (first author, Siv Ingrid) participated as an observer, following one of the TS groups through all the *lávvues*. Siv Ingrid is a Norwegianized Sámi educated in the Norwegian school system who speaks Norwegian as a native language. The professional teacher (second author, Ole Einar) was the teacher for the TS. Ole Einar is a native Sámi speaker and was educated in the Norwegian school system.

The lower secondary school in Guovdageaidnu was not anonymized because the knowledge in this study was developed in collaboration with and is owned by the teachers. The teachers at the school conducted research on their own practices and developed knowledge, which has been published on several occasions (Fyhn, Eira, and Sriraman 2013; Fyhn et al. 2015; Jannok Nutti et al. 2015; Fyhn et al. 2016, 2016, 2017, 2018; Nordkild, Fyhn, and Hætta 2022). This study is in the context of this research.

The data sources for this study were audio recordings of the TS' teaching, the authors' discussions and conversations about the TS' teaching, and field notes describing all the teaching in and around the *lávvues*. The field notes were written during the actual teaching in the form of keywords and figures. Later, on the same day, the notes were typed up as continuous text on a computer.

An audio recorder was placed near the *árran*, close to the center of the *lávvu*. *Árran* is the fireplace in the *lávvu* and is located in the middle of the round base of the *lávvu* (Buljo 1994), and it allows the *lávvu* to be habitable throughout the year. The authors' discussion and conversation about the TS' teaching occurred before and after the teaching. The audio recordings were transcribed and then translated from Sámi into Norwegian and English. The transcription and translation of the audio recordings were performed by an external expert. As differences between cultures and languages make direct translation complicated, the translation of the audio recordings from Sámi into Norwegian was done by a person who had mastered and spoke the specific Sámi dialect spoken by the TS, LS, and professional teachers. Engaging someone in translating the audio recordings can entail distancing the researcher from the data. The translation from Norwegian into English was done by the researcher. Photos taken and field notes written during the teaching unit were used to supplement the audio data.

The data were analyzed by categorizing the actions of the TS and the dialogue between the TS and LS before and during the teaching, based on some of the characteristics of Sámi pedagogy. The analysis was inspired by inductive category formation based on a reading of the data material (Mayring 2015). The aim of the analysis was to reduce the data material so that only the essential points remained. The themes were determined prior to data categorization.

The analysis process started with the first author listening to the audio recordings from the teachings. The first author then read through the translated transcripts of the audio recordings and simultaneously categorized the transcripts. These categories were closely linked to the data material and could be recognized as descriptions or sentences in the field notes. Examples of these categories included 'Sitting around *árran*' and 'Pointing toward *árran*.' In the next step, these two categories were combined into the overall category 'Focusing on a center.' This category can be described as being influenced by NUC mathematics. A revision of the categories resulted in changing this category to 'Activity around *árran*.' This revision also described the preconception of the first author during the first reading and the way this was changed through the analysis process.

When the categories were interpreted in terms of the aims of the analysis, the category 'Activity around *árran*' was integrated into the main category '*Lávvu* as classroom.' The rationale was that the focus was on how the *lávvu* as a classroom could be described as a characteristic of the way in which knowledge is transferred and how child rearing is practiced in Sámi culture. The analysis process revealed that the teaching by the TS contained elements of ordinary mathematics teaching (Skovsmose 2001), while the teaching that the TS themselves experienced comprised elements of Sámi upbringing (Hoem 1978; Balto 1997, 2005; Keskitalo and Määttä 2011). Below, we present examples of the data material showing the characteristics of a non-prototype classroom (Skovsmose 2006), traditional Sámi upbringing, and ordinary teaching (Balto 1997, 2005; Keskitalo and Määttä 2011). The findings are linked to theory and empirical data, a combination that provides an answer to the research question.

Findings

The findings are presented in three sections: the organization of the teaching unit, teenage students' teaching in L2, and the space in the *lávvu*.

Organization of the teaching unit

Another Sámi school in northern Norway requested that the lower secondary school in Guovdageaidnu teach mathematics in *lávvues*. The teaching was carried out in five *lávvues* located in the school's outdoor areas. Various topics were taught in each *lávvu* by a TS group. Each group of LS visited all the *lávvues*. Consistent with Keskitalo and Määttä (2011), we concluded that this teaching was situated in *lávvues* because when the teaching was about a *lávvu*, one had to be in a *lávvu*. Based on the definition provided by Skovsmose (2006) earlier, the teaching occurred in a non-prototype classroom.

In the first *lávvu* (L1), the LS and the observer participated in teaching about the uses of *lávvues*. This teaching session was also about the traditional uses of

the *lávvu* and what it is used for today. In the second *lávvu* (L2), the LS were taught about how the *lávvu* can be seen in connection with NUC mathematics. The teaching in the third *lávvu* (L3) focused on Sámi traditional cooking around and on the fireplace. In the fourth *lávvu* (L4), the LS learned about storytelling and *luohti* (Sámi traditional singing). In the fifth *lávvu* (L5), the LS participated in building a traditional *lávvu*.

Each lesson lasted approximately 30 minutes. Keskitalo and Määttä (2011) indicated that ordinary teaching is limited in time and divided into various subjects, which is the case in the Norwegian school system. Thus, in the reflection with the professional teacher, it emerged that teaching about the *lávvu* would have been incomplete had mathematics been the only topic. As such, it was necessary to include L1, L3, L4, and L5 because the *lávvu* must be understood contextually. It is worth noting that in Sámi culture, there is a holistic conception of knowledge (Balto 2005; Keskitalo and Määttä 2011). It considers the individual, the community, and the environment as interconnected and interdependent and emphasizes the importance of understanding the relationships between the various elements of a subject or phenomenon in order to fully understand it. Holistic knowledge in this context is understood as practices and traditions that can be seen in connection with the *lávvu*, some of which were included in the *lávvues*. The *lávvu* could be considered a place where family life happens, making it difficult to provide a complete picture of what happens in a *lávvu*. However, this teaching focused on some of the main features of living in and around a *lávvu*.

Teenage students' teaching in L2

The TS assigned to teach in L2 were given the task of developing a mathematics lesson related to the *lávvu*. They had the freedom to decide what to teach and how to teach it in L2. This approach mimics the traditional Sámi upbringing practice of allowing the child freedom to decide, which results in the child taking responsibility and becoming independent (Balto 1997; Hoëm 1978; Jannok-Nutti 2010). In fact, the active, autonomous child is central to Sámi upbringing (Balto 1997, 2005; Keskitalo and Määttä 2011).

According to the professional teacher, the TS in L2 decided to focus on the competence aims in the mathematics curriculum related to geometry after seventh grade (Ministry of Education 2013). The professional teacher supervised the teaching planning but did not control what the TS did and was absent for the majority of the teaching time (field notes). Given that a key characteristic of critical mathematics education is that students develop and strengthen their critical knowledge about the use of mathematics, they must be in control of their own learning process (Skovsmose 2001).

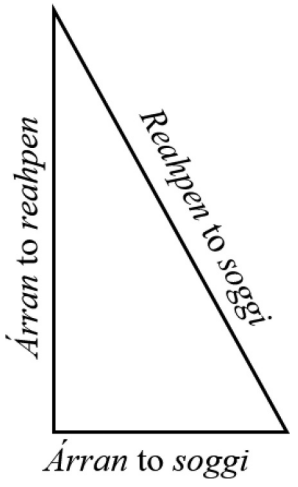

Figure 3. The relationship between the árran, reahpen, and soggi in a lávvu from an NUC-mathematics perspective.

During the teaching in L2, the TS, LS, and observer sat around the fireplace. The TS asked the LS questions about the relationships between some of the areas in the *lávvu* and NUC mathematics:

> When everyone is inside, one of the TS asks if the LSs can see the triangle in the *lávvu*. All the TS focus on the *reahpen*, and the TS who is talking points their hand from *reahpen* to the *árran*. The TS indicates that this is one side of the triangle, and that from the *árran* to there (the teacher points from the *árran* to the *soggi* in the *lávvu*) is another side of the triangle. Then, one of the other TS starts talking, saying that the other side of the triangle is from the *árran* to there (points toward the outer edge of the *lávvu*). The TS continues to ask questions about the third side of the triangle (Field notes from the teaching unit in L2).

Reahpen is a small hole in the top of the *lávvu*, which allow the smoke from the *árran* to exit. The *soggi* is the area at the outer edge of the circular base of the *lávvu*. No textbooks were used during the teaching in L2. Textbooks are central to traditional mathematics teaching and are often part of the learning equipment in a prototype classroom (Skovsmose 2001, 2006). Figure 3 illustrates the relationship between the *árran*, *reahpen*, and *soggi* in a *lávvu* from a NUC mathematics perspective.

This knowledge about the relationship between the *árran*, *reahpen*, and *soggi* can also be considered an NUC mathematical understanding of the structure of the *lávvu*. This may be useful when the subject of mathematics is taught in school. The TS described the *árran*, *reahpen*, and *soggi* as forming a geometric triangle. While this can be seen as a mathematical model, it is not accurate because the three points do not form a perfect triangle. This is important because it emphasizes that models in NUC mathematics are pictures of reality, not reality itself.

The space in the lávvu

One of the topics discussed during teaching in L2 was the space in the *lávvu*. The TS and LS explored the space by discussing how many people could fit into the *lávvu* when the inhabitants were standing, sitting, or lying down. For this, they had to consider the shape of the *lávvu* in its entirety. In an excerpt from the audio recording, a TS could be heard asking an LS whether there would be less or more space if they were to stand, sit, or lay down in the *lávvu*:

TS: If we were to stand up? Will there then be more or less space?

LS: Less.

This response by the LS implies that they thought that by standing in the *lávvu*, there would be less space and that fewer people would fit. This could be because the tallest part of the *lávvu* is in the middle, and the lowest parts are toward the outer edges. The TS went on to ask additional questions about the space in the *lávvu*:

TS: Yes. Then, if we sit down?

LS: More.

The LS replied that there was more space when people were seated. Thus, the LS concluded that there would be room for more people sitting than standing in a *lávvu*. The TS then asked about the amount of space available if the inhabitants were to lay down:

TS: What if we lie down?

LS: Smaller?

The LS then answered, with a question, that there would be less space. In this exchange, the TS and LS experienced and tested the spatial aspect of the *lávvu*; thus, according to Barton (2008b), they dealt with mathematics. The task set by the TS can be characterized using an inductive approach to measure the size of a base when the ceiling is slanted. The LS also had to consider the height between the floor and the canvas of the *lávvu*. The unit used for measuring and providing an answer was the student's own body. The discussion of space during L2 teaching can promote critical thinking, aligning with the goals of critical mathematics education and critical peace education (Ernest 2016; Skovsmose 2014; Bajaj 2008, 2015). The teaching in L2 when the TS and the LS were measuring the space using their bodies align with the principles of a non-prototype classroom (Skovsmose 2006). This was done by adapting to available resources and emphasizing contextual learning through creative teaching methods.

The teaching in L2 was controlled by the TS, which is a characteristic of ordinary teaching (Keskitalo and Määttä 2011). The TS asked questions that could be answered by the LS performing NUC mathematics calculations or measuring with their own bodies (Ministry of Education and Research 2013).

Discussion

In this study, the teaching in the *lávvues* was based on the 2006 Norwegian curriculum, which included a separate Sámi core curriculum. The Sámi core curriculum states that the school should facilitate and provide opportunities for Sámi students to receive education in the Sámi language, culture, and society (Ministry of Education and Research 2006). The mathematics teaching in *lávvu* L2 was not based on distinctive Sámi learning objectives in mathematics. Instead, it was related to the competence aims of the Norwegian curriculum for mathematics as a school subject (Ministry of Education and Research 2006). There was no separate Sámi curriculum for mathematics in the 2006 curriculum, which meant that mathematics education in Sámi schools followed the same curriculum as that in Norwegian schools.

The TS developed a lesson in which the relationship between the *árran*, *reahpen*, and *soggi* of the *lávvu* could be understood as forming a geometric triangle. Modeling in NUC mathematics is overarching and abstract, and the purpose of a mathematical model is to present a simplified version of a phenomenon. The knowledge associated with the *árran*, *reahpen*, and *soggi* is regarded as Indigenous knowledge, and this form of knowledge also aims to describe complex phenomena (Doolittle 2006). The Sámi student may not accept the simplification of comparing NUC mathematics with the relationship between the *árran*, *reahpen*, and *soggi*. In NUC mathematics, the *árran* can be seen as one part of a triangle. However, in Sámi culture, the *árran* is much more than this. It is a place where, among other things, cooking takes place and people gather.

Our interpretation is that the teaching conducted in this study combined the Sámi culture and the Western curriculum. The students investigated the space in the *lávvu* with their own bodies – not by using NUC mathematical formulas and modeling. According to Barton (2008a, 10), they presented mathematics as a 'spatial aspect of human experience.' By using this method to solve problems related to mathematics, the students demonstrated that different cultures and societies can have distinct approaches to mathematics. Since we do not have data on the students' understanding, we can only state what the teaching unit offered in terms of understanding the *lávvu* in the context of NUC mathematics.

Using the *lávvu* in teaching and in relation to the subject of mathematics presents one way for the school to acknowledge Sámi traditional knowledge. This can be seen as an instance of both counteracting social injustice and achieving social justice. According to D'Ambrosio (2007), social justice leads to

social peace, which can be achieved by showing students that cultures and societies can have different approaches to mathematics.

During their planning and teaching, the TS exhibited characteristics associated with Sámi upbringing. They were active and autonomous when conducting the mathematics teaching in the *lávvu*, which can be considered a non-prototype classroom. This indicates that these schools acknowledge and include aspects of Sámi culture in their teaching of the younger generation. As in many other Indigenous cultures, the Sámi have also been subjected to social injustice and cultural violence. The fact that the teaching took place in *lávvues*, which is a component of Sámi culture, connotes a step in the direction of social justice. The teaching itself embodies as a way of constructing a teaching unit that meets Norwegian school guidelines and standards while acknowledging Sámi culture and values (Huaman 2011). 'Raising consciousness through dialogue about various forms of violence' is one of the characteristics of critical peace education (Brantmeier 2011, 356). Our interpretation is that this teaching represents a dialogue between the majority and Indigenous culture in an attempt to build social justice. Historically, this dialogue has been characterized by structural violence and social injustice.

Teaching mathematics in a non-prototype classroom offers several contributions to the dialogue between the mathematics teaching culture in schools and Sámi culture:

- Emphasizing the cultural context of mathematical knowledge: By highlighting the ways in which mathematical concepts and practices are shaped by the cultural and societal context, a non-prototype classroom can promote greater understanding and respect for the mathematical knowledge and practices of Sámi culture.
- Active participation of Sámi students and community members: A non-prototype classroom can provide opportunities for Sámi students and community members to actively participate in the construction of mathematical knowledge and share their perspectives, allowing for a more inclusive and equitable learning environment.
- Incorporating Sámi mathematical knowledge and practices: *Lávvues* can incorporate Sámi mathematical knowledge and practices, such as traditional methods of counting, measuring, and problem-solving, into mathematics teaching. This can help promote a more inclusive and equitable understanding of mathematical concepts and practices.
- Collaboration and community building: A non-prototype classroom can encourage collaboration and community building among Sámi students, teachers, and community members, fostering greater understanding and respect for cultural diversity.

Overall, teaching mathematics in a non-prototype classroom can create a space for dialogue and understanding between the culture of teaching mathematics in a school and Sámi culture by valuing the different ways of knowing and understanding that come from different cultures and perspectives.

Closing words

The findings in this study are discussed in light of how teaching mathematics in a non-prototype classroom, the *lávvu*, represents Sámi pedagogy, critical mathematics education, and critical peace education, which share a focus on student-centered teaching and social justice. Sámi pedagogy emphasizes cultural relevance and identity, critical mathematics education challenges power structures, and critical peace education promotes nonviolence and conflict resolution. Together, they can lead to a transformative education that empowers learners to critically engage with social issues and work toward creating a more equitable society.

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Notes

1. The *lávvu* is a cone-shaped structure. Similar structures are found in other Indigenous cultures. The *yurt* is used by nomads in Siberia and Central Asia; the *chum* is a dwelling used by the Nenets in northwestern Siberia in Russia; the *yaranga* is used by some nomadic groups in northern Russia; and the *tipi* was used by Indigenous people in North America.
2. Forskningsdagene is an annual national interdisciplinary festival in Norway under the auspices of the Research Council in Norway.

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