Journal of Outdoor and Environmental Education
https://doi.org/10.1007/s42322-024-00172-6

ORIGINAL PAPER

"It is easier to learn when you are out": an ethnographic study of teaching science subjects through outdoor learning at compulsory school

Katarina Haraldsson[1,2] · **Magnus Göranson**[1] · **Eva-Carin Lindgren**[3]

Accepted: 4 May 2024

Abstract
Previous research has shown that feeling engaged in schoolwork is crucial for pupils to achieve, but engagement and motivation decline with age in many countries. To address these issues, we consider it is important that how we conceive learning include opportunities for learning outside the classroom. This study aimed to explore pupils' experiences of being taught science subjects using outdoor learning, including the learning they achieved. The research was conducted using an ethnographic research design, a useful method for research in this type of environment where a greater understanding of teaching and learning processes is sought, enabling researchers to explore events more deeply. The study took place during one school year and was conducted for pupils in grade 6 in a school on Sweden's west coast. This study provides unique insights into how these teacher efforts to offer outdoor learning opportunities have improved pupils' willingness to participate. Likewise, how the pupils have developed knowledge of and used scientific concepts and skills in different contexts became visible when the pupils were allowed to try, explore, be creative, and observe in real life contexts in various places. In addition, the pupils have been given opportunities to ask, discuss and reflect on questions about various phenomena and processes in nature and humans. From the pupils' point of view, this has contributed to their easier understanding of the content of the science subjects. These results significantly improve science literacy for science subjects in a school context (Holbrook & Rannikmae, 2009).

Keywords Ethnographic · Outdoor learning · Pupils · School · Science subjects · Teaching

Extended author information available on the last page of the article

Published online: 29 May 2024

Introduction

Feeling engaged in schoolwork is a crucial factor that impacts pupils' learning, but in Sweden, as in many other countries, we see that engagement and motivation decrease with age (Inchley et al., 2020). Since there is a diversity of pupils and a variety of situational conditions that affect their capacities to succeed in school, we believe there is a need for better ways of arranging learning, with the main aim being to improve the educational experience for all pupils by introducing more flexible teaching methods (Kelly et al., 2022; SFS 2010:800).

We consider it essential that how we conceive of learning is broadened to include opportunities for learning outside the classroom, in accordance with aspects of Dewey's pragmatist philosophy (Quay & Seaman, 2013). This means emphasising the importance of experience and reflection about method and subject matter, i.e., to do and to know, and emotional experience. Teaching needs to be meaningful to pupils as individuals here and now and not just be something they can benefit from in the future; hence teaching outdoors provides great opportunities to embrace Dewey's reasoning (Quay & Seaman, 2013). In addition, when pupils are allowed to reflect and communicate with others based on their own experiences in different outdoor environments relevant to their schoolwork (as emphasised via a sociocultural perspective), we believe it increases their opportunities to connect their experiences to more scientific understanding (Quay & Seaman, 2013; Säljö, 2019).

Today, school curricula tend not to connect easily with pupils' authentic worlds outside the classroom (Mann, 2018). Therefore, we argue that there is a need for more research supporting the development of teaching practice which strengthens learning outside the classroom (Hawxwell et al., 2019). While significant research has been conducted on learning outside the classroom focusing on social and emotional skills, team building, and collaboration, studies that focus on learning the content of the subjects outside the classroom are much less common (Faskunger et al., 2018; Hawxwell et al., 2019).

In this study regarding outdoor learning, we take our starting point partly from Kelly et al. (2022), who describes a pedagogy that provides rich opportunities for experience-based, varied and authentic learning where the outdoors provide context. We also lean on a Swedish review that emphasises the importance of the interaction between practice and theory in outdoor learning and where the importance of place for learning is highlighted (Faskunger et al., 2018).

If teachers are to be encouraged to consider teaching outside the classroom as a relevant pedagogical method, research must focus on empirical investigation of the challenges and the benefits (Hawxwell et al., 2019). When teachers are challenged to expand their subject and methodological competencies to teach successfully beyond the traditional classroom, external partners must also support them through exchange experiences with colleagues and opportunities for methodical freedom (Sahrakhiz, 2018). In this context, taking advantage of pupils' views on the teaching they are offered is important, and something that should be sought after, noting the Convention on the Rights of the Child which gives children extensive rights to be heard and to have their say on issues that concern them (United Nations, 1989).

Since there are knowledge gaps in outdoor pedagogical learning for teachers and how the content of particular subjects can be learned outside the classroom, a decision was made in a municipality in Sweden to undertake a research project aimed at pupils in 6th grade, where the teaching of the science subjects (biology, physics, and chemistry) was conducted outdoors during one academic year. This study aimed to explore pupils' experiences of being taught science subjects using outdoor learning, including the learning they achieved.

Methodology

Design and settings

Ethnographic research designs are commonly used in educational contexts where a greater understanding of teaching and learning processes is sought, enabling researchers to explore events more deeply (Speldewinde, 2022). We used an ethnographic research design (Atkinson et al., 2001) to explore and understand practices central to outdoor learning and the meaning participants ascribed to these practices (Atkinson et al., 2001). Ethnography also supported the longitudinal nature of this research (Last, 2019). We have approached these practices with an outsider's perspective to critically examine and question what the participants took for granted as insiders, but also be aware of the risk of 'going native' (Atkinson et al., 2001). This study's first and last authors are experienced in qualitative research methods, and the second has substantial knowledge of outdoor learning.

The fieldwork conducted by the first and second authors was situated in a "compulsory school" (grundskola; The Nordic Council and the Nordic Council of Ministers, n.d.) on Sweden's west coast. The school´s district is located on the outskirts of a city with approximately 100,000 inhabitants. The area is relatively socio-economically prosperous, with mixed housing, villas, condominiums, and rental properties. The school has approximately 450 pupils from grades 4–9. The fieldwork was conducted during 2020 and 2021 and comprised participant observation, conducted when teaching was occuring in science subjects using outdoor learning in three classes. One of the school's certified science teachers was responsible for the teaching. However, this teaching was supported by two external teachers with school development expertise focusing on outdoor learning, where one of these were present at each lesson. These teachers were also certified science teachers. This was helpful for the school's capacity for building outdoor learning.

Procedure

The teaching for all three classes was planned based on the compulsory school curriculum and the syllabuses of the science subjects with the core content for grades 4–6 (Skolverket, 2022). During the academic year, teaching was divided into four work areas (biology 1, physics, chemistry, and biology 2) based on what the pupils had left to learn in the science subjects for their grade (Table 1). The teaching of the science subjects in these work areas aimed for the pupils to learn more about nature

and phenomena and processes in the world as well as the human body (Skolverket, 2022).

The teachers made a rough plan for the teaching of each work area, incorporating suggestions for various lessons and associated content to have a more significant outdoor component. It is worth noting that the pupils were not familiar with being taught outdoors. Before each work area, the pupils, to different extents, less at the beginning and more at the end of the school year, participated and gave their opinions on the plan. The teaching was conducted in varying locations and situations, which were selected based on the content of the science subjects (Table 1). The extent of the outdoor lessons consisted of an average of 75 min/week/class. When teaching further away from the school, the lesson consisted of 130 min. When taught these science subjects, the pupils also had one more weekly lesson indoors (40 min).

A general layout of the outdoor lessons had the following structure: The lessons began with a gathering in which the class received information about the lesson's content and structure. Afterwards, the pupils moved (walk, bike, bus) to the different places where the teaching took place (Table 1). Additional tasks/assignments, e.g., narrative walk or quiz walk (Table 1), were carried out during walks to the school's immediate area as part of the lesson plan. In this way, steps were taken to maximise the lesson time available for teaching. The teaching at the chosen location began with the teacher explaining and demonstrating practically how the various science subjects' methods and activities for implementing content were to be carried out (Table 1). Then, the pupils went into action, engaging with the different methods and activities, e.g., field studies, using nets, mineral hunting, and different games. The pupils usually worked in groups or pairs but also individually. In connection with the first work area, the pupils in the class participated in creating a shared campsite in a forest clearing within walking distance of the school. According to a blueprint, the pupils had to build one table and two benches per class. Many remaining work area lessons were then carried out at this campsite. During the lessons, the teachers guided the pupils by talking to them, answering questions, challenging them, and confirming, supporting, and praising them. The lessons ended with a joint gathering where the content was discussed.

Complementing the outdoor learning sessions was a research circle (cf. Fändrik et al., 2018) involving participating teachers, the school's principal, and the research group. In this research circle discussion and reflection occurred, focused on teaching experience and research on outdoor learning. Everyone's knowledge in the research circle was considered equally valuable, where practical and theoretical knowledge enriched each other.

Data collection

The empirical material consisted of field notes from lesson observations and transcripts of focus group interviews. All three classes from grade 6 ($N=71$) participated in the observations. The pupils were 12 years old, 38 were girls and 33 were boys. Among the participating pupils, there was a need for adaptations for children with special needs. Some of the pupils were also taught Swedish as a second language.

Table 1 Outdoor learning in the science subjects showing the four work areas core content, the varying places the lessons were conducted, the subjects' methods and activities for implementations of content used

Work area core content	Places	Subjects' methods	Activities
Biology 1: *Nature and society* - Ecosystems in the immediate environment, species, and relationships between organisms - *Biology and the world view* - The development of life and adaptations of organisms to different habitats	- Sea and beach - Wetland - The school's immediate environment - Campsite	- Field studies - Identify, sort and group animals and plants	- Collection of animals in sea with waders and nets. - Collection of animals in wetland with nets - Species determination in the field of animals and plants - Search for beach finds - Relay game: species
Physics: *Physics and the world view* - The solar system, the human in space, time measurement? - *Physics in nature and society* - Energy indestructibility and flow, different types of energy sources	- Soccer field in the school's immediate environment - Schoolyard - Campsite	- Observations - Experiments	- Narrative walk: practice concepts while walking - Get a sense of distance in space with the help of a visual model - Sorting game: the planets - Drama: the solar system and time measurement - Relay game: planets - Build and launch PET rockets - Create constellations of stars - Movement play: the energy beams - Discovering and photographing forms of energy while walking - Concepts game: energy - Cooperative/relay game: energy
Chemistry: *Chemistry in nature* - Classification of subjects and materials based on properties. - Photosynthesis, combustion, and other chemical reactions. - The substances' solid form, liquid form, and gas form - *Chemistry in everyday life and society* - The cycle of matter	- Gravel pit - The school's immediate environment - Schoolyard - Campsite	- Observations - Experiments	- Collection and photography of various materials - Quiz walk: chemical concepts - Collection and exploration of decomposers - Build chemical rockets - Bake cinnamon buns on outdoor gas stove - "cooking chemistry." - Bicycle excursion to a gravel pit: mineral hunting
Biology 2: *Nature and society* - The life of animals, plants, and other organisms - *Biology Body and health* - Human puberty, sexuality, and reproduction	- The school's immediate environment - Campsite	- Field studies - Identify, sort and group animals and plants	- Explore the components of flowers (with magnifying glass, digital tools, and pictures) - Conversation workshop: question box - Game: quiz hunt - Walk: find examples of internal/external fertilisation in organisms

In total, 42 lesson observations were conducted by the study's first and second authors. The observations covered all work areas and were thus spread out during the school year. They were also evenly distributed between the different classes. The observations were focused on pupils' actions and learning when they were taught science subjects using outdoor learning. When the pupils built benches and tables and created a campsite, this was not part of the science curriculum. Still, this was

included in the observation material due to the close belonging to the lessons later conducted in this place. During the observations, thick, descriptive, and reflective field notes were taken that were written directly in connection with the observation occasion.

Six focus group interviews were conducted with pupils, three groups for girls and three for boys. The selection procedure was expedient (Polit & Beck, 2004), where it was the regular science teacher who, based on class lists, asked every third girl and every third boy about possible participation. Altogether, 16 girls and 20 boys volunteered to participate, divided into 5–8 participants per group. All classes were represented during each focus group. The focus group interviews were conducted by the first and second authors, who took turns acting as moderators and observers, in a secluded and undisturbed place on the school premises. Each focus group interview began with background questions about leisure interests to create a good interview atmosphere, helping the pupils to feel comfortable. It then transitioned into open questions about pupils' experiences when they were taught science subjects using outdoor learning, the advantages and disadvantages of outdoor learning, experiences of different places and their possibility of participation. Follow-up questions were asked continuously based on the pupils' answers. The length of the focus group interviews varied between 50 and 75 min. All interviews were digitally recorded and then transcribed verbatim.

Data analysis

The analysis followed an abductive approach when interpreting the empirical evidence, resulting in development of themes (inductive) connecting back to theoretical starting points (Alvesson & Sköldberg, 2017). First, to analyse the rich body of data collected, the focus group interview transcripts and notes from the observations were read several times to enable researchers to gain an appropriate level of familiarity with the data and to start the process of developing interpretations. Second, the transcripts and notes were organised into units of fundamental meanings relevant to the study's aims. Third, the meaning units were condensed into codes. These codes enabled discernment of patterns and contradictions in the data set (Bryman, 2016). In this step, the field notes supported our understanding of how the perception of meaning was put into practice, and central aspects of the interaction between teachers and pupils and between pupils. Fourth, the first and second authors collated the codes into potential themes separately and then all authors jointly reviewed the tentative themes through alignment of the coded extracts. In doing so they searched for patterns that might help convey what the event or experience was about. Throughout the entire analysis process, constant comparisons were made back and forth in the empirical data. Fifth, to increase the trustworthiness of the results, some preliminary analyses were presented to the members of the research circle, and their reflections on the preliminary results were included in the results. Sixth, all the authors defined the themes by refining the specifics of each theme, using the overall analysis process in the generation of these definitions. The themes were reviewed by all authors to ensure they adequately captured related patterns. Finally, a deductive summary of the process was prepared, conveying this analytic narrative (Bryman, 2016). The description of

the analytic procedure may appear to be a linear process, but analysis involves important back-and-forth moves between different parts and the whole.

Findings and discussion

In this section we describe pupils' actions, learning and experiences of being taught science subjects using outdoor learning. The analysis resulted in the following two themes that convey important elements of these actions and experiences, and the learning achieved: (1) willingness to participate, and (2) understanding of the content of the science subjects.

Willingness to participate

The willingness to participate concerns pupils' interest and motivation in outdoor learning situations with the associated lesson content, as well as their influence in lesson structure and implementation.

Interest and motivation

During the observations, we saw pupils' joy and interest aroused when they came to a new place for teaching and learning, while practically performing various tasks and exploring the content of the science subjects (Table 1). The pupils showed with their whole bodies that participating was fun and exciting by laughing, jumping, and running. At the same time, we heard expressions such as "Wahoo!" "Oh, so cool!" "Oh, my God!" "Look here!" "I'm the king of this!" "I'm glad I created this!", along with curious questions, conversations, and reflections on the lesson content between pupils and between pupils and teachers. All observed lessons had continuous movement moments, which the pupils also expressed as fun, and which in turn had an impact on their willingness to participate in the lessons. The willingness to participate also became apparent when the pupils asked if they could redo certain elements or did not want to finish the lesson or the task they were doing. "Just wait a minute," or "No, we have more to show," were signals of this.

The pupils also made comments that highlighted the importance of being in a real place in the learning situation, linked to the lesson content, as contributing to their willingness to participate. In one of the focus group interviews, a boy shared that "at some point, we talked about bees …. So, we went to a bee place like this …, and then what you are doing became more vital …, you get more interested in it … because you are where there are bees."

The basis of authentic learning is teaching that arouses children's joy and interest (Engel, 2011). Access to varied environments and places (Jansson et al., 2022) that are relevant to what is to be learned provides rich opportunities for varied teaching (Kelly et al., 2022), where pupils get the chance to experience for themselves and practically try, explore, and be creative (Becker et al., 2017). It can also reinforce pupils' engagement and internal motivation (Ryan & Deci, 2020) and lead, as in this study, to pupils' willingness to participate.

For example, we saw the pupils' joy and interest aroused when they were on a walk and discovered things they were not expecting to see, such as hares and deer, during a lesson in the school's immediate area. On this occasion pupils and teachers were heard discussing, reflecting, and exchanging experiences about the animals' behaviour. During the focus group interviews, the pupils returned to occasions such as this as something positive. They said that when they got to experience something for real, their interest in knowing more and their opportunities to remember the lesson content were awakened. The pupils expressed that memorising was easier when based on their own experiences than when reading things in a book. A combination of internal and external motivation, which is not controlling, can strengthen pupils' study motivation (Ryan & Deci, 2020). It is about being motivated in the moment and about motivation being strengthened; both help them remember the lesson content.

Dettweiler et al. (2015) shows that when pupils' motivation in different teaching contexts was examined, the results showed a significantly higher level of motivation for pupils who were taught outdoors, regardless of gender. During the observations, we noticed that outdoor learning seemed to benefit all pupils' willingness to participate, both boys and girls, even when differences between pupils were acknowledged. For an example, in the focus group interviews, a boy shared that "Before, I didn't like the science subjects that much, but it's become much more fun now that we've been outdoors doing new things …, and been on small excursions that have been fun and you get to see new things." Also, a girl shared that "I really liked to learn outdoors because I got more … I have not been so interested in science before, but it has become more interesting." Pupils with visible needs for special support or extra adaptations in teaching showed joy and interest similar to pupils without these needs (Dettweiler et al., 2015). A boy was one such pupil who had special support needs related to attention deficit disorder, and who revealed his joy when learning with and about tadpoles. "I thought it was fun when we walked and talked about tadpoles," he said in one focus group. "I thought it was very exciting. I wanted to learn more …. And I'd like us to work more with tadpoles, because it is easier when you see what we're talking about."

However, we noticed that cold, windy, or rainy weather could negatively affect some pupils' willingness to participate, something the pupils also highlighted during the focus group interviews, where they expressed that they then froze or that it was more challenging to concentrate and to hear. Previous studies confirm that it can take time for some pupils to get used to outdoor learning conditions (Fägerstam, 2014). But there were exceptions to this. When the teaching aroused the pupils' joy and interest, challenging weather did not seem to matter that much, because "then you don't think about being hungry or cold," one girl shared in a focus group interview; "so many things happen, and it's much fun." Thus, when teaching is relevant to pupils' learning and meets their needs, it becomes a trigger to motivate pupils (Holbrook & Rannikmae, 2009).

Influence in lesson structure and implementation

We observed, and the pupils described during the focus group interviews, that the pupils had been involved in influencing the planning of activities and parts of the

lesson content in the teaching, which positively contributed to their willingness to participate in outdoor learning in the science subjects during the school year. The pupils said that this was also helpful for the teachers. "What we thought was good," reported a girl, "is that they [the teachers] learned how we like to have our lessons [organised], so that they could plan better, and we could learn better."

Increased flexibility in the education system would be needed to take advantage of pupils' views about their schooling and how they become motivated and learn (Ryan & Deci, 2020), something to which they are also entitled (United Nations, 1989) and adolescents want their listened too (Haraldsson et al., 2010). When introducing outdoor learning, we drew attention to the fact that pupils needed to gain some experience in what it means to be taught outdoors to have some opinion on what works best for them. Pupils were able to express relevant opinions to a greater extent as the year progressed.

Understanding the content of the science subjects

Understanding the content of the science subjects in outdoor learning situations concerns pupil's knowledge and skills, as well as a science promoting learning environment.

Knowledge and skills

The pupils' accounts of their discoveries showed they could give examples of and describe scientific concepts linked to real life contexts. Outdoor learning allowed pupils to start from an everyday event they discover for themselves to understand the more scientifically abstract concepts. When pupils understand these connections and can relate to them, they make the knowledge their own (Säljö, 2019). During the observations, we noticed that the pupils knew and used scientific concepts in different ways and contexts (Table 1). One example is taken from a lesson in physics where the pupils, who were divided into small groups, during a walk to the campsite, were given the task of looking for and photographing different forms of energy and energy conversions in the school's immediate environment. On this occasion a boy takes a picture of me when I move "Kinetic energy," he says and smiles. Later, at the campsite, the pupils show photos they took with the iPad and talk about different forms of energy linked to the photos. "Yes, we took a picture of a garbage truck that we saw," a boy says. The teacher asks the pupils, "Well, what did you think about this?" Here, the pupils realise that several distinct kinds of energies are involved, "Well, kinetic energy when they lift/lower the bins," a pupil report. They further discuss how the retrieval is done and what forms of energy are involved.

In another example, we noticed that the pupils could handle a net appropriately at the wetland, something they learned during a lesson by the sea. In this case, outdoor learning provides pupils with skills and experiences necessary for understanding and solving situations or problems in new contexts (Becker et al., 2017; Säljö, 2019).

Lessons with elements of both play and drama have provided opportunities for pupils to repeat their knowledge from previous lessons and where we have heard the pupils use scientific concepts. Pupils have been heard reasoning and helping each

other solve problems and produce the correct answer in different tasks. The pupils express that the play has made it easier to understand the subject content and helped them remember in later written tests. During one lesson, the pupils had to show with their bodies and movements how celestial bodies move in relation to each other. In one of the focus group interviews two girls explained, "When we did the play on the solar system, you saw how everything moves." The moderator asked, "How did you do that?" "Yes, someone was the sun, someone was the moon…," "…and one was the Earth." "Yes! And then you could see how they moved." The moderator then asked, "What did you think of it?" "I thought it was fun to see, and you learned what it was actually like."

Play contributes to developing cognitive skills in younger children (Coates & Pimlott-Wilson, 2019). Although the pupils in this study are in a sensitive period developmentally as they approach adolescence and puberty, which could mean that they do not feel comfortable playing, they have expressed that the play in the lessons has helped them understand the science subject's content. Davies (2013) describes that creative environments for learning outside the classroom with "playful" approaches positively impact pupil outcomes. Drama and games for learning purposes are ranked highly by pupils as opposed to more strictly structured book assignments (Niemi et al., 2015).

The play could also be used in assessment situations, which we saw during an observation in the work area of physics where the pupils' understanding of concepts was tested. The grouped pupils had to look up placed questions in the schoolyard, talk together, and then present their answers orally and physically to the teacher. Through the teachers' feedback, we noticed that a pupil with a mother tongue other than Swedish who had difficulty expressing in writing now showed an understanding of the scientific content. In this example, we saw that outdoor learning allowed the pupil to show an understanding of the science subject content and reach the knowledge goals based on the pupil's condition. However, more knowledge about outdoor assessment is needed (Faskunger et al., 2018).

The pupils expressed that it was easier to learn and understand when they were doing by themselves. In one of the focus group interviews, a boy said that "I think it can be easier to learn when you're out, because then you understand what you're doing, and it's easier to learn when you know what you're doing."

During the observations, we saw that when the pupils were active and exploring, they continued to do the task until they succeeded without anyone urging them. At the same time, we heard expressions such as "The lid came awry, that's why; we're doing it again." The groups delight greatly when they succeed, and the rockets fly away, "Oh my god!" "Let's go again!" When, as in this chemistry lesson, pupils' first-hand experiences of conducting a scientific survey practically and reflectively (Hodson, 2014), where the experience itself is at the centre, this contributes to positive learning benefits (Becker et al., 2017). However, more research on pupils as performers, where they are encouraged to observe and explore, is needed because even in outdoor learning, it is more common for teachers themselves to talk about and explain various phenomena (Alon & Tal, 2017).

Academic requirements are a prominent risk factor for adolescent mental illness (Pascoe et al., 2020). In one of the focus group interviews a girl shared, "It gets

so serious when you're indoors, and you have to complete tasks … you get more stressed." The pupils further expressed that they did not have to devote as much time to their schoolwork at home, e.g., homework, which helped them to keep up with the leisure activities that were important to them. The reason for this was that they felt that it was easier to remember the lesson content and that they learned better when taught outdoors and thus experienced less stress, the girl continues, "When you are outdoors, there is more; you can relax, be, have fun and learn at the same time." When pupils have time to engage in things that feel meaningful to themselves, such as, in this case, leisure activities, it contributes to a sense of well-being and can also help adolescents cope with stress (Antonovsky, 1987; Haraldsson et al., 2010). A learning environment where pupils' stress management skills can be promoted is an important goal for change in school (Pascoe et al., 2020).

A science promoting learning environment

A science promoting learning environment is, in this study, about the relational process between social, physical, and educational environment, which has made it easier for pupils to understand the content of the science subjects.

During the observations, the pupils contributed to a positive cohesion while taught outdoors. The pupils were involved in designing one of their outdoor learning places when they built benches and tables for the campsite. Joint activity in the class where there is a positive connection between social context and the physical environment can positively affect school belonging (Arslan, 2018; Jansson et al., 2022). The pupils described in the focus groups interviews that it was worth the effort to spend time on something useful, and during observations, we heard pupils express that they were afraid that someone would destroy the benches and tables in their absence. The pupils further told us that they used the campsite in their spare time to have a picnic and saw people outside the school using it for the same purpose. According to the pupils, it felt good that the campsite was being used, and it contributed to them feeling proud of it, "Because then … when I'm sitting on that bench (laughing) and, you know, or writing on that table, it's probably more of a special feeling," a boy said in one focus group.

The connection between the pupils in this study has been observed when helping each other and being keen for everyone to participate in an activity or try out tools and where they praised each other. "I want everyone to be involved …. Who hasn't used the screwdriver?" "Come on now!" "Goood!" were signals of this. A strong correlation exists between belonging and well-being, especially emotional well-being (Arslan, 2018).

When young people feel secure in their relationships with other peers and teachers, it can be seen as a promoting learning environment and contribute to a sense of well-being (Antonovsky, 1987; Haraldsson et al., 2010) since there is a link between social relationships, stress, and psychosomatic symptoms, especially for girls (Giota & Gustafsson, 2021). The pupils expressed in the focus group interviews that the collaboration and group discussions with friends have made understanding the science subject content easier and helped them remember in later written tests. The pupils further said that it was easier to dare to talk, say what they think and show what

they can when they were divided into smaller groups outdoors, with which they felt comfortable and safe. “I don’t like to talk loudly in class and raise my hand…, there are other ways you can be active … that you are in small groups and then the teacher goes around and checks what you talked about instead,” one girl expressed in a focus group. The pupils also said that during outdoor lessons, it was easier to dare to talk to and ask their teachers if they wondered about something or felt that something was difficult, “I feel like there’s quite a big difference because then you can talk more privately, and not everyone hears if you are going to ask,” a boy shared in one focus group.

In this study, the teaching was usually carried out in a natural green environment in the school’s immediate area. The pupils preferred to be at the campsite in front of the schoolyard, where they were more easily distracted by other pupils having a break. According to the pupils, the larger space available outdoors contributed to them being able to work undisturbed and it also benefited group cooperation, “If I’m out, we’re more spread out; I don’t hear everyone’s disturbing voice,” a girl reported in one of the focus group interviews. During the observations, we also noticed pupils mentioned the noise level outdoors in conversations with their teacher, stating, “It is much better here.” However, some pupils expressed in the focus group interviews that it was sometimes harder to hear what the teacher was saying during outdoor lessons, “If the teacher is a little bit further away, you can’t hear because it’s … there are no walls that confine the sound,” a boy said, which we also noticed in some observations when the pupils had been spread over a larger area. Pupils’ opportunities to hear must be considered in future outdoor learning. The noise level is important for a promoting learning environment, not least for adolescents with some form of attention deficit who are more sensitive to disturbing sounds (Blomberg et al., 2019).

During the observations, we paid particular attention to the fact that some pupils were hesitant and cautious about trying new elements or expressed that it was difficult. Reaching all pupils based on their different cognitive conditions is a challenge. Therefore, teaching must be supportive by providing a challenging but manageable task that pupils feel ready to master (Ryan & Deci, 2020). However, we observed that when the teacher or other pupils provided support to a hesitant pupil by doing the learning moments together, repeating or in words praising and encouraging the pupil to try, they completed the task and showed great contentment. For example, we heard a teacher ask a hesitant pupil, “Will we succeed together?” The pupil nods and says, “Yes!” We also observed when a pupil who had learned to handle the net appropriately supported a hesitant pupil who did not know how to use it “You move it back and forth along the seabed.” From a sociocultural perspective, learning is considered a process in which people communicate with each other (Säljö, 2019), as in the examples above. At the same time, the examples shows that it is a more knowledgeable pupil who supports the person who is less knowledgeable in a practical skill, which can be seen as the hesitant pupil being in the nearest zone of proximal development (ZPD) and getting help from the more knowledgeable (Säljö, 2019). Harris (2018) points to the possibilities of outdoor places for a co-creative learning environment between pupils and teachers that positively affects both teaching and learning.

Conclusion

This ethnographic study provides unique insights into how these teacher efforts to offer outdoor learning opportunities have improved pupils' willingness to participate and, from their point of view, being comprehensible, they understand the content of the science subjects. This is an essential contribution to enhancing the scientific literacy of science subjects in a school context (Holbrook & Rannikmae, 2009). Our main conclusion based on the analysis of this study is that outdoor learning appeared as an opportunity for pupils to develop their curiosity and interest in knowing more about science subjects and the world around them. This became visible when the pupils had access to varied learning and experiences by, for example, trying, exploring, being creative, and observing in real life contexts in various places. In addition, the pupils have been given opportunities to ask, discuss and reflect on questions about various phenomena and processes in nature and humans. This is also relevant for the other main findings where pupils have developed knowledge of and use scientific concepts and scientific skills in different ways and contexts, as well as for a science promoting learning environment, which has made understanding the science subject content easier.

This study confirms the necessity of broadening learning outside the classroom, and hopefully, the findings can contribute to more teachers seeing opportunities to do just that. Thus, a supportive school organisation is needed because the conditions for more pupils can then have access to learning adapted to their learning ability. We also wish that outdoor and environmental education professionals from all settings benefit from the findings and what they can contribute to discussing outdoor learning relative to scientific literacy. The joint analysis of lesson observations and focus group interviews strengthens the credibility of the study's findings.

As for methodological limitations, our findings are based on a small sample. Most of them were ethnically Swedish pupils. Therefore, the findings can only be transferred to similar groups of pupils. A possible direction for further research would be to take an intersectionality approach to examine the impact of gender, age, class, ethnicity, and pupils needing special support or extra adaptations in outdoor learning. Such an approach would provide further insight into marginalised groups of pupils and a critical understanding of power, privilege, and subordination. More studies are also needed where pupils' opinions about what promotes their subject-specific learning are considered.

Acknowledgements The authors are grateful to the principal and teachers involved in the study and especially wish to thank all the pupils who agreed to participate in this study.

Author contributions KH designed the study, conducted observations and interviews, analysed the data and wrote the manuscript. MG designed the study, conducted observations and interviews, analysed the data and wrote the manuscript. E-CL designed the study, analysed the data and wrote the manuscript.

Funding No funding was received for conducting this study.

Declarations

Ethical approval This study was reviewed by the Swedish Ethical Review Authority and provided an advisory statement (dnr 2020 – 0233). The advice provided by the board has been followed, as well as the general principles of research ethics.

Consent to participate The pupil's participation was voluntary; they could withdraw at any time, and that any information provided would be treated confidentially. Informed written consent was obtained from the principal, ordinary teacher, external teachers, pupils and guardians. At the beginning of the focus group interviews, the pupils were reminded that participation was voluntary and that they could cancel it without explaining why. When the pupils were informed before the start of the study, it was emphasised that the observations were not grade-based.

Competing interests The authors have no competing interests to declare relevant to this article's content.

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Authors and Affiliations

Katarina Haraldsson[1,2] · Magnus Göranson[1] · Eva-Carin Lindgren[3]

✉ Katarina Haraldsson
katarina.haraldsson@halmstad.se

[1] Department of Research and Development Within Education, Halmstad Municipality, Nässjögatan 6, Halmstad 302 48, Sweden

[2] School of Public Health and Community Medicine, Institute of Medicine, University of Gothenburg, Gothenburg, Sweden

[3] School of Health and Welfare, Halmstad University, Halmstad, Sweden