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Tove Anita Fiskum [a] & Karl Jacobsen [b]

[a] Nord-Trøndelag University College, Levanger, Norway

[b] Norwegian University of Science and Technology, Trondheim, Norway

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Outdoor education gives fewer demands for action regulation and an increased variability of affordances

Tove Anita Fiskum[a]* and Karl Jacobsen[b]
[a]*Nord-Trøndelag University College, Levanger, Norway;* [b]*Norwegian University of Science and Technology, Trondheim, Norway*

In children's lives there are a lot of instigators for actions in every milieu and situation. When children grow older, the cortical activity starts to regulate the action instigation from the limbic system. The school system makes demands of action regulation for children. In outdoor education the many instigators for actions are not under the same demands for regulation as inside the classroom. In this study we have interviewed nine children about their experience with outdoor education. The interviews shows a wide variability of affordances grasped from outdoor education, as well as a tendency toward gender differences in what kind of action possibilities they grasp. These activities give the children useful experiences that are directly and indirectly relevant for their curriculum.

Keywords: *Affordances; Action regulation; Outdoor education; Gender differences*

Introduction

Outdoor education seems to be increasingly popular in many countries. In Norway, where this study is conducted, there is a lot of wild environment, and the public right of access gives schools and people the possibility of attending those areas. This country has a rich tradition in outdoor activities (Humberstone & Pedersen, 2001). The practice of and the amount of outdoor education are relatively new in Norway. It is especially the youngest children who are given the possibility to go for outdoor education; once a week, once every second week, more seldom or more frequently, or randomly. It varies whether it is for the whole day, or only for a part of the day. A trend in outdoor education is to involve both academic subjects and time for free playing. Often the schools seek permissions from the owner of the ground as well as

*Corresponding author: Avdeling for lærerutdanning, Nord-Trøndelag University College, Røstad, 7600 Levanger, Norway. Email: tove.a.fiskum@hint.no

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from the local government to build, for example, shelters, primitive toilets and playing equipment at the places they use most.

Moving the classroom outside may lead to different and more versatile activities, as well as more cooperative play with more civil behavior (Dyment, 2005). Many children seem to prefer a natural environment rather than a manufactured and built environment. The possibility to interact with their environment seems to be important for many children (Titman, 1994). Titman's study was based on 25 small group interviews of children aged 5–12 years from 12 schools in England and Wales. This possibility to claim ownership and to interact with their environments might be increased in the natural environment because of a wider variability of affordances (Gibson, 1986) and, since the natural environment is more unique and variable compared with a built environment, there will be fewer predictions of how to grasp the affordances (Gaver, 1996). For example, a tree may be used for the purpose of climbing one step, two steps, to the top, or it might be used as a shelter, while a standardized climbing frame does not have so many affordances and there is some kind of social custom about how to use it.

An 'affordance' (Gibson, 1986) is an incentive to action. For example, a big animal in front of us might provoke fear and make us start running, while a chair affords us the possibility to sit down and an apple affords us the possibility to eat. When Gibson introduced his ecological approach to perception in 1979 he had used the previous 30 years (Gibson, 1950) to develop his theory. His ideas and thinking contravened the scientific opinion on perception, and was met with doubt by the dominating cognitive approach as the theoretical frame for perception, which was very dependent on computational thinking of perception (Marr, 1976, 1982). Gibson's theory has lately received support from neuroscience by the emotional revolution initiated by LeDoux (1996) and Damasio (2001). They found not only that the visual scene is processed from the eyes to the visual cortex, but that there is a parallel and independent neurological channel from the eyes that processes information directly to the limbic system. Action is initiated from the limbic system and regulated from the cortex (Jacobsen & Svendsen, 2010). The cortical interpretation of the visual scene decides whether the incentive to action from the limbic system should be either stopped, allowed partly or allowed fully. Our cortical activity regulates the tendency to action from the limbic system, in the same way as we regulate emotion (Campos, Frankel, & Camras, 2004; Jacobsen, Bjerkan, & Sørlie, 2009). This knowledge gives a new perspective on affordance (Yoon, Humphreys, & Riddoch, 2010), which may be illustrated by the way affordances in indoor and outdoor schooling have different requirements for cortical regulation. In indoor school settings, the pupil must often regulate and suppress the tendency to actions given by the affordances. Because they do not have to sit quietly at their desk in outdoor education, there is far less necessity to regulate and suppress the tendency to action that is physiologically initiated by the limbic system. Our hypothesis is that regulation and suppression of action is very stressful for some pupils and not for others, and, as a consequence, their behavior will differ.

The outside environment with the great possibilities for physical activity might in itself reduce stress and give benefits with regard to concentration and motivation for

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learning. The increased possibility to act upon the instigated action repertoires and fewer demands to regulate and suppress actions may be a necessary stress reduction for the children, which in turn may help the child to be a better student also in the traditional school setting. This may be supported by an intervention study (Ahamed et al., 2007), which found that increasing the time in physical activity does not decrease the children's academic results, and a review (Trudeau & Shephard, 2008) showing that increasing the time for physical activity at the expense of academic subjects does not compromise academic achievement, while decreasing the time for physical activity with the aim of increasing the time spent on academic subjects does not increase the academic performance. Additionally this increased focus on academic subjects requires pupils to sit still and concentrate on task, which might be a stressful situation for some children.

One explanation for this may be children's need for physical activity (Bjorklund & Bering, 2000). This need for physical activity will require cortical regulation of the limbic system to reduce the physical activity (Campos et al., 2004), and since boys are often more physically active than girls (Harten, Olds, & Dollman, 2008; Haug, Torsheim, Sallis, & Samdal, 2008; Lopes, Vasques, & de Oliveira Pereira, 2006; Nyberg, Nordenfelt, Ekelund, & Marcus, 2009; Waring, Warburton, & Coy, 2007) this regulation may be a more stressful process for the boys. The sex-based segregation we observe already in childhood is reviewed by Pellegrini (2004). In his review he deals with two contradictory hypotheses; one that suggests males are more energetic than females for biological reasons, and this can be seen already before they are born; and one that suggests the segregation is fostered by social roles. Pellegrini argues that these two hypotheses are rather complementary: there are gender differences in energy, and the gender differences in vigorous behavior give rise to specific social roles. We believe these complementary hypotheses may instigate more and different actions for boys compared with girls, and as a consequence boys will have more instigated action to regulate. These gender differences may be relatively small from birth, but may be reinforced through expectations of males and females with regard to socialization.

When school lessons are moved outside the school building, the environment gives the children and teachers other affordances. Different degrees of solidity give different degrees of support for human movement; for example, a softer surface with heath or with swamp does not afford the possibility of running fast to the same degree as gravel does, but it is perhaps a better substance to fall on, and perhaps it gives relatively more affordances for playing in the category of rough-and-tumble play. While a horizontal surface might allow us to maintain an equilibrate posture without offering too much effort, a vertical, flat and extended rigid structure surface will give other affordances. It may be a barrier and stop movement in this direction. If the surface contains something that supports the hands and feet, the vertical surface is climb-able. The affordances from objects vary a lot, and Gibson mentioned some qualities that may affect the variety of affordances. Attached versus detached objects give different affordances, and different sizes and qualities give different affordances. Animals, and especially human beings, provide the richest and most elaborate affordances because

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they interact with the observer in a different way from objects. Behavior affords behavior, and this depends upon our perceiving or sometimes misperceiving what the other person affords us (Gibson, 1986). For a child, an animal may afford, for example, exploring or 'hunting', while another child may afford cooperation, comfort and help as well as the threat of being hit or teased.

We perceive the affordance with reference to ourselves (e.g. with respect to the size), but Gibson did not look at needs or experiences as necessary for perceiving the affordances. The need for experience to know the affordance and grasp it is further explained by Gaver (1996). He argued that there are some cultural choices influencing our behavior. Examples of this are how we use different tools, how we interpret symbols and which side of the road we drive on. Some affordances are very much regulated by culture, as, for example, the way we use a knife and a fork; others have some kind of cultural predictability, as, for example, a standardized piece of climbing equipment; while others have very little cultural predictability, as, for example, how to play in a tree—if and how to climb in the tree, can we sit under it and use it as a shelter, and so on. These affordances and constraints that are not primarily material, but rather cultural, might still influence behavior in outdoor education versus traditional schooling. For example, playing with loud voices is usually more accepted outside than inside. According to Gaver we then may feel more affordances in some directions outside than inside, a fact that is connected to culture.

Heft (1988) has brought affordances into a functional approach for describing children's environments. He argues that affordances are a functional description of the environmental features, unlike the traditional focusing on forms. He used the affordance perspective to review several studies of children's outdoor activities, which resulted in a functional taxonomy of children's environments. He suggests that functional thinking about children's environments is more ecologically meaningful than the form-based classification. In his taxonomy, Heft brought 10 superordinate classifications with several examples of subordinate classification under each. The superordinate classifications are: flat, relatively smooth surface; relatively smooth slope; graspable/detached object; attached object; non-rigid, attached object; climbable feature; aperture; shelter; moldable material; and water.

Kytta (2002) has used Heft's taxonomy in her study of affordances for children in different environments in Finland and Belarus; she excluded one of Heft's superordinate classifications, the classification of aperture, because this classification was difficult to put into operation in her method. She added another category to the taxonomy; the affordances for sociality. Her affordances for sociality included the possibility to play rule and role-plays, playing home or war, being noisy or the possibility to share or follow adults' businesses. Additionally, Gaver (1996) used the concept of affordances to describe how properties in the environment might influence the social interactions between people; that is, the architecture in the society. Another example is the way tables are laid out in, for example, restaurants, which will give different affordances for quiet conversations in small groups or convivial conversations/speeches in bigger groups. The physical properties of the children's environment may give different affordances for social interactions as well; small spaces

between bushes and trees may afford interaction and cooperation in small groups, and big open spaces may afford interaction in bigger groups and perhaps playing games that require wide areas.

Other studies have explored the natural environment as a trigger to enhance children's physical activity (see, e.g., Boldemann et al., 2006; Mygind, 2007), but green school grounds may lead to learning benefits as well. For example, Dyment's (2005) study concluded with several learning benefits such as greater enthusiasm and engagement by the pupils, better knowledge retention and more creative thinking.

Learning during practical projects may be a source for learning different academic topics; for example, Canaris (1995) describes a gardening project that started relatively simply with the aim of improving students' nutrition and nutrition awareness, but the children showed enormous enthusiasm and took the project further themselves. The project grew larger and led to the enhancement of both the quality and meaningfulness of their learning. As a consequence, learning took place in different types of science and mathematics during the project. Another study about school gardening that explored the effect of using both experimental classes and control classes from three schools found a weekly gardening program to be a significant contributor to the aim of improving academic test scores (Smith & Motsenbocker, 2005).

In a study of different Outdoor and Environmental Education Centers' programs by Ballantine and Packer (2009) in Australia, the students identify 49% of the learning events as learned by experience, 31% through teachers and 21% through a combination of the two methods. For the primary students the prevalence for experienced-based learning was even higher. McNamara and Fowler (1975) constructed a study to investigate the differences in learning in the outdoor environment versus the indoor environment. Concepts that are a part of the pupils' physical environment are best learned outdoors, they conclude. They also concluded that the ability of critical thinking is enhanced outdoors, especially for pupils who are at an average level or below an average level in academic skills. They assume that outdoor education increases the pupil's ability to relate things in the environment to the concept. This is in accordance with the results in the study by Dismore and Bailey (2005), who investigated the academic achievement in outdoor and adventurous activities among children whom the teachers had judged as underachieving in numeracy or literacy. The results showed an increased motivation and enthusiasm among the participants. The pupils' structural reflection made it possible for them to understand the connection between outdoor activities and the academic subjects in the classroom. Additionally, the increased possibility for activity outside may claim less inhibition of activity instigated from the limbic system.

Based on these findings mentioned above, and the concept of 'affordances' by Gibson (1986), we should ensure children engage in outdoor education activities, and, as a consequence, their experiences might differ from the experiences on traditional school days.

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To explore the topic of children's experiences from outdoor education, we work from the following research questions:

1. Do the children experience fewer demands for action regulation as well as an increased variability of affordances in outdoor education?
2. Do the children's activities in outdoor education give them useful experiences that produce more effective academic learning?

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Method

Participants and the process of collecting information

In this study the children have reported their own experiences from outdoor education. They used more time reporting from free play compared with the time they used for reporting from academic subjects in this research project. In the time for free playing, they reported that they were allowed to move in a wide area and mixed in their own groups, sometimes they played in gender specific groups and sometimes they played in gender mixed groups. In the spare time, this was their decision.

Pupils were selected from two different classes at fifth-grade level. These two classes sometimes work together, as is normal in outdoor education. These pupils had been having outdoor education once a week in their first four years at school, and once every second week in their fifth year at school. The school has four locations with shelters, a fireplace, a few pieces of playing equipment and a primitive toilet at each one. These locations are called The Ship Forest, The Crofter's Farm, The Astrid Lindgren's Forest and The Torbjørn Egner's Forest. The outdoor education days usually start with a lesson inside the classroom, and afterwards they walk to one of the locations. When they reach the location, they have time both to do what they want and to participate in a program involving different academic subjects, which is led by the teachers. How much time the children had to do whatever they wanted versus how much time was spent on the academic subject varied from one day to another.

The nine participants, four girls and five boys, were randomly chosen among the 31 available children in the two classes. One girl was interviewed alone at first. Because her speech was relatively limited, and required the interviewer to often bring new themes into the conversation, the rest of the children were interviewed in groups; one interview was with one boy and one girl, one interview was with two girls, and two interviews were with two boys participating in each. The interviews were performed in January.

Interviews were conducted like a conversation, and the children were given possibilities to take the conversation further into other themes. The interviewer is the first author of this article. During all the interviews, the interviewer communicated 394 times, of which 40 replies were bringing new themes into the conversations. Examples of themes that were brought into the conversation by the interviewer are: what they think about outdoor education; their feelings before they are going to outdoor education; what they are thinking when they are coming home from outdoor

education; what they are doing in the spare time at outdoor education; whether they have learned something; and what they think about the outdoor education places. The other responses by the interviewer were supportive responses, consenting responses or follow-up questions.

Since bringing the school lessons outdoors is quite a new concept in Norway, the interviewer had only short and sporadic experiences with this kind of organization of the days at school before attending the area. However, she had a rich experience of using spare time playing in nature. Her preconceptions of outdoor education were therefore insignificant, but she did have a belief about the natural environment being a good and inspiring place to stay in and to play for the children. This belief is based on her own experience from childhood, her experience with children in a natural environment as well as from reading theory and other research projects.

Since this study is based on interviews with very open interview-guides, these pupils have the possibility to speak about those activities that they want to. As a consequence, the affordances they have been speaking about may not represent a norm of their activity in outdoor education. Their responses are rather a picture of the activities that are really meaningful and important for these pupils. Open-ended questions might give the children a better opportunity to report the events in narrative ways, and this kind of question for children might give more valid information as well (Aldridge & Wood, 1998). Since children's perspectives are quite different from adults', the children may be likely to misunderstand the questions (Scott, 2000). When carrying out the interview in an open way, we avoid asking questions the children do not understand.

This interview was performed in the last part of a larger study about outdoor education. When these interviews took place, the interviewer had been in the classes for many days, and had been participating during both traditional school days and days with outdoor education, as well as all the pupils having been interviewed earlier in structured interviews about other topics in outdoor education. The pupils had learnt that the researcher's intention in staying with them was to learn more about outdoor education. During observation and earlier interviews, the pupils had been showing that they knew the researcher's role was not like the teacher's, and doing some unacceptable things or telling the researcher about them, seemed not to bother them. During the observations, the researcher gleaned that the pupils have a lot of possibilities and variability in their activities during outdoor education, even though the children were only observed at one of the places.

Analysis

The topics of *affordances* and *learning* are explored and interpreted in Tables 1 and 2. Heft's taxonomy with the addition of affordances for sociality, and affordances connected with animals, provides a tool for analyzing the pupils' experience and activity in outdoor education. In this study, role-plays or games, rough-and-tumble play and talking are examples of affordances placed in the category of sociality. Affordances connected to animals involve all activities with animals, including activities with

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insects and ants. Activities involving animals they know are in the area, but cannot see at the moment, are involved in this category as well.

The information interpreted as most relevant for the research question is presented in narratives and in tables. The relevant content from the different interviews is used in constructing one narrative based on the boys' information and one narrative based on the girls' information. According to Kvale (1996), this is a way to structure the information. These narratives are mainly a reconstruction and paraphrase of the content in the interviews.

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Results

Tables 1 and 2 show the affordances the girls and the boys reported they have utilized. Table 1 (girls) shows many affordances that are not specifically connected to the environment they are in during outdoor education. For example, the girls like to

Table 1. Utilized affordances mentioned by the girls

Utilized affordance	Heft's taxonomy with the addition of animals and sociality
3× Playing	Sociality
3× Playing in an old boat and in created huts and shelters	4: Attached object and 8: Shelter
3× Acting silly and being a bit rude	Sociality
2× Making comfortable seats	3: Graspable/detached objects and 9: Moldable material
2× Go to a place where they are able to play in a smaller group	8: Shelter
2× Playing on the swing	5: Non-rigid, attached object
2× Building small huts or shelters	3: Graspable/detached object
Climbing cliffs	7: Climbable feature
Talking	Sociality
Being together with more pupils	Sociality
Having fun	Sociality
Making a bonfire	3: Graspable/detached object
Creating new games with rules	Sociality and 1: Flat, relatively smooth surface
Sliding	2: Relatively smooth slope
Playing games	Sociality and 1: Flat, relatively smooth surface
Fighting and playing war	Sociality and 3: Graspable/detached object
Practicing balance on balance-equipment	5: Non-rigid, attached object
Playing on the rock slope	2: Relatively smooth slope
Staying in the *lavvo*	4: Attached object and 8: Shelter
Exploring the ants	Animal
Swinging on a rope	5: Non-rigid, attached object

Table 2. Utilized affordances mentioned by the boys

Utilized affordance	Heft's taxonomy with the addition of animals and sociality
7× Building small huts or shelters	3: Graspable/detached object
5× Exploring the ants	Animal
4× Throwing cones, twigs or decomposed cabbages	3: Graspable/detached object
4× Go to a place where they are able to play in smaller groups	8: Shelter
3× Fighting and playing war	3: Graspable/detached object and sociality
2× Chasing or searching for a badger which they do not see	Animal and sociality
2× Whittling	3: Graspable/detached object
2× Collecting cones and stones	3: Graspable/detached object
2× Climbing	6: Climbable feature
Being a spy	7: Aperture
Making comfortable seats from twigs	3: Graspable/detached object
Exploring the wind by standing and moving in the windy area	1: Flat, relatively smooth surface
Making shelters against the wind	3: Graspable/detached object
Cooperating with hiding a pupil. Tricking the adults	3: Graspable/detached object and sociality
Being together with more pupils	Sociality
Creating storage places for their collection	3: Graspable/detached object
Drinking from the small stream	10: Water
Finding insects, mice, frogs or traces of animals	Animal
Jumping from cliffs	4: Attached object
Exploring a piece of old hunting equipment	4: Attached object and 6: Climbable feature
Going to a place with frozen water	1: Flat, relatively smooth surface and 7: Aperture
Playing	Sociality

play, act silly and be a bit rude (but this may be connected to the culture of being outside the traditional schoolyard as well), play in the swing, talk, be together with more pupils, have fun, create new games with rules and play games. Five affordances are connected with the variability of attached objects that are mostly designed for them; playing in an old boat and in created huts and shelters, playing in the swing, practicing balance on balance equipment, staying in the *lavvo* (a big and relatively simple tent) and swinging on the rope. Further, there are some affordances more connected to the environment or to the situation outside; making comfortable seats, going to a place where they are able to play in smaller groups, building small huts and shelters, climbing cliffs, making a bonfire, sliding, fighting and playing war, playing on the rock slope and exploring the ants.

The categorization within the taxonomy by Heft with the addition of animals and sociality for the girls (Table 1) is placed 12 times in the category *sociality*, four times in

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graspable/detached objects, three times in *non-rigid, attached object*, three times in *shelter*, twice in *relatively smooth slope*, twice in the category of *flat, relatively smooth surface* and in the category *attached objects*, and once in each of the categories of *climbable feature, animal* and *moldable material*, while *water* and *aperture* were not used.

The affordances the boys told about utilizing (Table 2) are different. They mentioned only two affordances that were not directly connected to the outdoor area; being together with more pupils and playing (unspecified). No affordances connected to attached objects being designed for the pupils are mentioned by the boys. The taxonomy of the boys' utilized affordances shows 22 affordances in the category of *graspable/detached object*, eight in *sociality*, eight in *animal*, four in the category *shelter*, three in the category *climbable features*, and two in each category of *flat, relatively smooth surface*, *attached objects* and *aperture*. The category *water* has been used once, while *relatively smooth slope* and *moldable material* were not used at all.

Considering learning and relevant experience obviously linked to curriculum topics or skills linked to the necessary adaptations when staying outdoor for a whole day, the girls had eight explicit statements of learning, which may be considered an argument for outdoor education. Among the other statements showing some kind of implicit knowledge is their description about the different plants growing at the different places. This reveals a competence with ecology. Eleven statements reveal this kind of knowledge and three show knowledge learned from staying outdoors, such as their observations of ants. Among the three that show learning, two of the statements involved outdoor life skills and one is about zoology. Among the 11 statements showing some kind of learning, six touch on the topic of outdoor life skills, four are within the topic of ecology, four on the topic of physics, two on the topic of physiology, two on the topic of construction and one on the topic of geology. Topics about mathematics and design have been touched upon within the topics of construction. Each statement might touch on more than one topic. For more detailed information about the girls' learning and experiences, see Appendix 1.

The boys have seven explicit and 28 implicit statements about learning. Among the implicit statements, they show some kind of academic learning in 23 of them and they reveal learning more directly in five of them. In the five statements where they really reveal learning, they show knowledge once in outdoor skills, once in calculating risks, twice on the topic of biology and twice on the topic of zoology. Among the 23 statements where the boys show some kind of knowledge learning, eight are on the topic of physics, seven are within the topic of outdoor skills, five are within zoology, four are within biology, three are on the topic of ecology, three within geophysics, two on the topic of physiology, one within microbiology, one about construction, one within geology, one in topography and one within experience in the use of tools. In addition, mathematics and design have been touched on during the activities within construction. For more information about what the boys reveal with regard to learning events and curriculum-related experiences, see Appendix 2.

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Ingunn's experiences with outdoor education

Ingunn likes to be at outdoor education. When she wakes up in the morning knowing that she is to have outdoor education that day, she starts looking forward to the day at school. Some mornings she just thinks that today she is really going to have fun. At outdoor education she is able to do more of the things she likes to do. And she is able to stay with the children from the other class at the same level as well.

Her day starts with making preparations for staying outdoors for the whole day. She fills her own backpack, and during these years with outdoor education she has learned what to fill the backpack with; it is useful to bring some extra clothes, and something extra for the meal is nice to bring as well. Sometimes, when the weather is not the best, she may feel that she does not look forward to the day outside so much, but during the years with outdoor education once a week she has learned that it will always be okay when she is at the outdoor education area. She has also learned how to dress to avoid getting wet or frozen and, regardless of the weather, it will most certainly be okay. That is her experience.

Ingunn likes to build huts or make new games with rules. She also likes playing in roles or playing traditional games with rules with the other girls. This is possible during the day with outdoor education. At some parts of the day, they are able to decide themselves what they want to do, and this is something she appreciates. As a consequence she participates in a variety of activities during the days with outdoor education. She grasps the possibility to play and have fun. If there is some snow, she may go sliding or she may create a comfortable seat for herself.

They call one of the outdoor education places The Boat Place. There they have an old and broken boat, which Ingunn believes has been used to take people on trips. She likes this place very well. At this place, she and the other girls are able to play in the boat or in the small huts round about; for example, they play that they are cats or mermaids. This place also has some swings and equipment for training balance, and that is something Ingunn likes to play on. Therefore she loves this place, but now, when they are in Level Five, they do not visit The Boat Place so much anymore. Another place they call The Crofter's Farm also has a swing, but Ingunn does not like this place as much. She feels it is more difficult to find something to do there. Because The Crofter's Farm has a steep cliff behind it, they have fewer possibilities to move away from the rallying point. They have tried to climb a way up the steep cliff, but she believes that it is not okay. The cliff is probably too steep to let the children climb there, and they are not able to hear the whistle when they are up there. She, therefore, thinks that The Crofter's Farm is the most boring place to go to. In the fifth grade they mostly visit the places called The Astrid Lindgren's Forest and The Torbjørn Egner's Forest. At these two places they are able to go a bit away from the rallying point. This gives the possibility to play in privacy and in smaller groups as well. Therefore she likes those two places.

Even though Ingunn likes playing games with rules, talking, playing with roles, swinging or exploring the equipment for balance training, she may also enjoy rough-and-tumble games. Sometimes she also participates in war games with the boys.

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During outdoor education she might also try out some boundaries more than she ever would have done in the schoolyard; for example, she might explore new places without being sure that she is allowed, or she might jump into a puddle on purpose.

Ingunn knows about the anthills at The Astrid Lindgren's Forest, but she is not so keen about exploring it as the boys are. But during outdoor education she has learned to get used to ants, and there is no problem if ants crawl on her clothes while she is eating her lunch. She is used to it, and hardly notices it. Sometimes she uses the anthill to predict the weather. Then she puts a stick in the top of the hill, and if the ants start crawling to the top of it, she believes that good weather is coming.

Ingunn believes outdoor education is important. There they are able to learn something about nature. It is better to learn about nature outside than inside because they understand the topics better when they are learning it outside, she thinks. Anyway, she is not quite sure what they have learned about nature staying outside, but she certainly knows how to recognize the species of trees in the area and their different cones.

To be prepared to stay out in nature, we need experience and some kind of knowledge and skills about, for example, filling one's backpack, finding the most appropriate clothes, finding or making comfortable places to rest or making a bonfire. Ingunn's experience from outdoor education has given her some skills for these purposes: She is quite good at filling her backpack in the right way, as well as dressing in the most appropriate clothes. Her experience is helping her to find comfortable places for resting and eating, and sometimes she also uses snow or spruce branches to make comfortable seats. She has experience in making small shelters or huts, and she is used to making bonfires, and knows how to place the wood pieces to make the fire. To be able to stay outside in all kinds of weather is another skill she has gained during her times in outdoor education.

Ingunn thinks that outdoor education has been important for her well-being at school:

> Yes, a little bit I think, because we are able to play and do as we want sometimes in outdoor education, and that is something very different from sitting inside at school and just writing and writing and writing, which we easily get bored of.

Lars's experiences with outdoor education

Lars feels outdoor education is a good place to be. When we ask him what he thinks in the morning before attending outdoor education, he says:

> I think that I am going to go out in the forest, and now there is going to be more free time, and we might find small streams, and up there is a very nice stream we have drunk a lot of water from, and it tastes very good.

It is very seldom that Lars does not look forward to outdoor education. Once in a while, when the weather is rainy and windy, he might be less eager, but he thinks there would have to be a tornado to stop him from going to outdoor education. Windy

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weather can even be fun; for example, to stand on their feet in extreme windy weather might be challenging and that might be fun. To stay outside in all kinds of weather is something he has learnt to do. In addition, he has learnt to walk in the windy weather. Several times his feet have been really freezing, but, all the same, he enjoys being at outdoor education. During his time in outdoor education, he has gained experience at building huts and shelters, and he knows how to build them so that they give shelter against the wind and rain. Therefore Lars is always eager in the morning when he knows it is the day for outdoor education.

When they attend the place for outdoor education, Lars and some other boys hurry into the forest. He has seen for himself that there are some places where they might start a rock avalanche, so he knows to stay away from those places. On the days with outdoor education he also has the possibility to play with the pupils in the other class, which is something he appreciates. In the forest he and his friends find places where there are possibilities to play or build shelters and huts. He spends a lot of time building huts or shelters, and he has learned a lot about building techniques. They play a lot in and around the buildings they have made, and sometimes the play turns into some rough-and-tumble play, which Lars loves. When they are playing war, they find cones and twigs that they throw, and, of course, Lars knows which the best to throw are.

Lars appreciates the affordance of aperture. It gives him the possibility to move around a big area, and he is able to find many exciting places. An old tower used for hunting is very exciting. He guesses that it is probably 100 years old, and he knows that it might be dangerous to climb on it. If it breaks, he will fall several meters. It is still very exciting to play around that hunting tower and to climb a little bit on it. Playing that they are going on a badger-hunt is also very exciting, and he has done that sometimes.

Acting silly and having fun at outdoor education is something Lars appreciates. He might be silly or foolish with the teachers as well.

Climbing is also an activity he likes. After the years with outdoor education he has got to know several species of trees, and he thinks that birch is the best tree to climb. The birch has a suitable number of branches, which are well suited to stand on and grasp hold of. The pine is also suitable for climbing, but the challenge with this kind of tree is the lack of branches in the lower area where he starts climbing. If he is able to reach the branches in the pine, it is a nice climbing place, because it has such big and long branches.

When they are at outdoor education, they have the possibility to use hammers and saws in their buildings. They are allowed to use knives as well, and Lars thinks that is nice, because then he gets experience in using knives, and he gets the possibility to whittle spears for their fences in the war games.

Lars likes the places The Astrid Lindgren's Forest and The Torbjørn Egner's Forest. At these sites they have the possibility to move around in a wide area and find themselves places away from the middle of the site. At The Astrid Lindgren's Forest they have found a stream, which he likes drinking water from. The Crofter's Place is the place he likes least. There is not so much to do at this place. The cliff behind The

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Crofter's Place is steep, and, consequently, the possibility to move to other places is reduced. The Ship Forest is not interesting either. That place has an old boat, which probably is an old ship for Vikings, which they probably have not risked moving to a museum, because the transportation may destroy the ship. It is also possible that it is a ship from the war. Lars is not quite sure. But even though the ship may have an interesting history, the place is not very exciting. Sometimes when they have attended The Ship Forest, the boys have left and gone to a forest nearby. There they found frozen puddles, and that was more fun, but he is not quite sure whether they were allowed to go there or not.

At The Astrid Lindgren's Forest they have a big anthill, and Lars has spent a lot of time exploring that hill. He has tried to feed the ants with marshmallows and chips. After a while they disappear from the anthill, and Lars assumes that the ants have eaten them. He has also given them a worm, and then they attacked the worm immediately and drew it into one of the pathways in the hill. Lars has also seen how the ants react when they splash water on them.

Once in the wintertime when Lars was going to jump down from the cliff, one of his feet went through the snow and into an anthill. When he lifted his foot, he saw that he had trampled on an anthill, because there was anthill material and ants on his foot, but there were not many ants. When he looked down into the hill, he did not see any more ants. He wondered where the ants go in the wintertime. 'Do the ants take a walk to another anthill when winter starts, or are they down there in the bottom of their hill?', he wondered.

Discussion

The interviews show a great variability in the children's choices of activity, as well as variability and a large amount of gained knowledge and curriculum-relevant experiences. Additionally, the results reveal a tendency toward differences between boys and girls.

The results show that both girls and boys report a great variability of grasped affordances. This is in accordance with other studies showing a great variability of affordances or possibilities for activities in the natural environment (A. C. Bell & Dyment, 2008; J. F. Bell, Wilson, & Liu, 2008; Boldemann et al., 2006; Dyment, 2005; Fjortoft & Sageie, 2000).

The affordances the boys have been grasping are even more connected to the specific environment in outdoor education, compared with the grasped affordances the girls are reporting. The girls are telling about several activities that might have taken place in the schoolyard as well as in outdoor education. The girls have also grasped many affordances connected to attached objects being designed for them, while the boys have not mentioned this at all. Their comments are rather about all the affordances coming from their own creativity.

Both girls and boys have many activities placed in the categories of graspable/detached objects and sociality. The girls have twice as many affordances in the category of sociality compared with graspable/detached objects, while the

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picture is different for the boys, who have a lot more affordances in the category of graspable/detached objects.

While the boys tell a lot about building huts and shelters, the girls mention it only when they are talking about their playing in these buildings. It seems like the boys have the building activity more as an object in itself, while for the girls it is the building result that is most important. It seems that the boys are grasping many of the affordances revealed in the outdoor education, while the girls to a greater degree are still regulating their actions also in this arena.

While the girls talk about spending time on equipment designed for them, the boys seem to be more interested in objects not designed for special purposes for them. They find a lot of affordances in graspable and detached objects from nature; that is, building activities, rough-and-tumble play (play-fights or war) and collecting activities with the aim of preparing for rough-and-tumble play. They seem not to care about the designated equipment except for the box with hammers, saws and knives, which they are allowed to use. Whether this is mainly a result of gender differences in activity choices or gender differences in the topics they choose to talk about, is not explored in this study. At this point, the boys are in real accordance with Titman's (1994) findings, while the girls' interest in the designed equipment is somehow in contrast. All the same, the equipment they are talking about has a great variability of possibilities, and it is still in a natural environment. Differences between boys and girls are also shown in other studies (Harten et al., 2008; Haug et al., 2008; Lopes et al., 2006; Nyberg et al., 2009; Waring et al., 2007), which all found a higher level of physical activity among boys. One example is the study made by Harten et al. (2008), which found a difference in choices between genders: the boys were more likely to participate in games involving gross motor skills, and the girls were more likely to play in smaller places; boys were competitive and aggressive, and girls were more likely to cooperate and take turns. A study including 129 children aged eight and nine years found that boys spent more time in ball games, while girls spent more time in conversations, sedentary play, jump-skipping and verbal games. In the children's fantasy-play, the boys' play involved rough-and-tumble activity while the girls' play was more sedentary. The authors suggested that the boys' primary focus was the activity, and that brought them together in groups, while the girls' primary focus was to come together to socialize (Blatchford, Baines, & Pellegrini, 2003). This may explain why the girls in this study make choices of activity that are less influenced by the natural environment and more predicted by sociality, which partially may come from the natural environment. This is also in accordance with findings in another study (Sallis et al., 2001), showing that environmental characteristics explained 59% of the variance in the boys' physical activity, while only explaining 42% of the girls' activity.

In outdoor education the children, during some parts of the day, have a greater possibility to choose activity freely, without too many cognitive considerations. This study shows that boys grasp a lot more of the affordances that invite them to participate in vigorous physical activity, while the girls choose more affordances inviting them towards closer social interactions. This might be connected to gender differences caused by biology and by socialization, according to Pellegrini (2004).

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The narratives show eagerness for outdoor education in both boys and girls. Both genders mention the freedom of staying outdoors for a day. Their preference for places is alike in some ways and quite different as well. They both prefer The Crofter's Place least, and they both explain that this is because of the lack of possibilities for activities there. While the girls love staying at The Ship Forest, the boys do not find this place interesting at all, even if they try to give the boat some kind of interesting history. The Astrid Lindgren's Forest and The Torbjørn Egner's Forest are places they all like. There they have the possibility to move away from the rallying point. This is in accordance with Titman's (1994) study about children's preference for places; showing a preference for places not designed for them, but rather places where they have the possibility to claim their own ownerships.

Even though we have to consider that there is a larger amount of information given by boys than by girls, it seems that the boys reveal more learning about natural phenomena compared with the girls. The learning topics have variability for both genders, but perhaps a greater part within the topic of outdoor life-skills for the girls, as well as a more varied spectrum of topics for the boys. In many cases, in the interviews the children did not directly reveal the learning, but revealed only some kind of insight into the topics (in Appendices 1 and 2 this is denoted as 'some' in the column for 'shows qualifications'). If these topics are being followed in the classroom lessons later, the children probably will gain benefits from their experiences. If the pupils are able to make a structured reflection of the topic, they will have a better possibility of understanding the connection between their practical experiences and the theoretical curriculum (Dismore & Bailey, 2005). The fact that these children are revealing knowledge gained from outdoor experiences is in accordance with other studies (Ballantyne & Packer, 2009; Dyment, 2005; Hartman, Miller, & Nelson, 2000; Rahm, 2002; Smith & Motsenbocker, 2005). In any case, experiencing reality in nature may be the first step in a learning sequence; for example, Bixler, Carlisle, Hammitt, and Floyd (1994) found 564 examples of fears or discomforts expressed by primary and secondary urban students during field trips in wild land areas. The group of the third most observed fears was fear of non-indigenous animals, and the fear of meeting movie-monsters or Indians was relatively common as well. The authors assumed that television was the students' main source of information about nature, and they regarded these fears as a threat to the possibility of enjoying wildlands visits as well as learning from them. Independent of the degree of curriculum learning, the interviews reveal that the children in our study have a more realistic relationship to nature, because no one, for example, mentioned any non-indigenous animals or features, but rather they showed a knowledge about the nature they are playing in. This will probably make it easier for them to learn about nature. The outdoor education context opens up for more caring between the pupils (Quay, Dickinson, & Nettleton, 2002/03). This is not explored in this study, nor is social learning or learning about their friends. Since the girls in this study more often seem to choose activities involving closer social relationships, they probably have gained a greater amount of knowledge about their friends during the outdoor education days.

The learning gained through outdoor education may sometimes be at other levels than the teacher-directed learning in the classroom; that is, the children in the

classroom may learn the names of different trees and remember these names, while the children in this study have got to know the tree species by their names and features. If, for example, we see this within the revised version of Bloom's taxonomy (Krathwohl, 2002), the teacher-directed learning in the classroom will reach the first level of the cognitive process dimension, which is *remember*, and perhaps for some of the pupils the second level, which is *understand*, while the children in this study, for example, have a conscious relationship about the species and their quality and usefulness, for example, for climbing, and therefore reach the third level, which is *apply*. Their analyzing and evaluating of the different species, considering for example, climb-ability of the species, also brings them into the fourth and fifth levels, which are *analyze* and *evaluate*. Anyway, the process of learning will be a result of the whole outdoor education context; the social and physical setting, the individuals collaborating as well as the culture (Brown, 2009; Seaman, 2007).

Conclusion

Children are grasping a lot of the variability of affordances in outdoor education, but boys are grasping other affordances than girls. The culture usually gives fewer preconceptions about the use of different tools and loose parts in a natural environment compared with objects that are designed for a special use. The socialization of girls and boys may give some preconceptions about how to behave in the natural environment, and this culture may be different for boys and girls. How many of the diverse choices are caused by cultural prescriptions and how many are caused by biology is not explored and discussed any further in this study. The boys in this project are, to a greater degree, grasping affordances with fewer social predictions about how to grasp them. They grasp many affordances that make it possible for them to burn off energy as well as giving them fewer demands for action regulation, while the girls, to a greater degree, choose to grasp affordances that are designed for them, and therefore have some kind of prediction about how to use them. This will require a higher degree of cognition and action regulation from them.

A presumption for classroom education is that children from five to six years of age are competent to regulate their own incentives to action. The stressfulness in self-regulation is age dependent, because it depends on cortical development (Campos et al., 2004; Sameroff & Fiese, 2000). Even a 12-year-old child may find high demands to action regulation stressful; the amount of stress experienced may differ from one child to another. Outdoor education reduces the demands for action regulation during the school day, a possibility some of the children are grasping to a greater degree than others. This may be caused by a different amount of stress connected to regulation of action instigations. A new Swedish study about outdoor education and mental health in elementary school children found that boys had a significantly higher outcome from outdoor education than girls (Gustafsson, Szczepanski, Nelson, & Gustafsson, 2012). The findings in this study indicate that the amount of stress in action regulation is predicted by gender. Whether the most predictable variable for this stress is gender or some other variable is not explored in this study, and could be a subject for further studies.

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These results are based on interviews. Further studies will be needed to see whether the differences are evident in the children's behavior. Outdoor education gives the children possibilities that are important for their welfare. But results also indicate that the children's experiences are useful for direct hands-on learning as well as giving them some kind of insight that may be related to curriculum topics. Outdoor education also enhances the children's learning by giving them a connection between real life and curriculum topics.

Author biographies

Tove Anita Fiskum has a PhD and is working on a thesis about outdoor education. Her main focus is how environment and the pedagogic in outdoor education affect children's behaviour and wellbeing.

Karl Jacobsen is a professor, Dr of psychology. His main areas are people with mental handicap or developmental disabilities, perceiving of the senses, treatment of children and psychotherapy of adults.

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Appendix 1. Girls' learning and experiences

What is said	Explicit or implicit	Shows qualification	Possible bridge between theory and experience
Outdoor education is positive because the children are learning more about the nature when they are outside	E	No	
When they are going to outdoor education they choose different clothes in the morning and also fill their backpacks differently	I	Some	Insulation-thermal conductance > PHYSICS Physiology Outdoor life skills

(*Continued*)

Appendix 1. (*Continued*).

What is said	Explicit or implicit	Shows qualification	Possible bridge between theory and experience
How they are able to create a comfortable seat	I	Some	Insulation-nature of material >PHYSICS
They have learnt about animals and plants	E	No	
Explaining what kind of plants are growing at the different places	I	Some	Ecology
Have been observing the ants a little bit, and have also seen some in the trees	I	Yes	Zoology
Explaining how to make a bonfire	I	Some	Outdoor life skills
They sometimes have to bring their own wood, but mostly they find firewood where they are. They know when to bring their own wood	I	Yes	Outdoor life skills
They are learning about nature in outdoor education. The organized lessons outside are specially mentioned	E	No	
It is better learning about nature outside	E	No	
They are learning a lot from being outside, e.g. how to dress	E	Some	Outdoor life skills
They are learning a lot from being outside the whole day, e.g. about nature	E	No	
They are learning more about nature by staying outdoors	E	No	
Outdoor education is useful and they are learning a lot	E	No	
They have more clothes in their backpack to prevent freezing	I	Some	Insulation-nature of material >PHYSICS Outdoor life skills
Telling about the tree species growing at one of the outdoor education places	I	Some	Ecology
Telling about the tree species growing at another of the outdoor education places	I	Some	Ecology
Telling about the cones they might find at one of the places	I	Some	Ecology
Building small huts or shelters	I	Some	Construction >PHYSICS, MATHEMATICS, DESIGN

(*Continued*)

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Appendix 1. (*Continued*).

What is said	Explicit or implicit	Shows qualification	Possible bridge between theory and experience
How they make a bonfire	I	Yes	Outdoor life skills
They have been working together with the adults on an extensive work with the earth in the *lavvo* and the firewood at one of the places	I	Some	Outdoor life skills Construction Soil structure >geology
They fill their backpack differently when they are going to stay the night at one of the places	I	Some	Outdoor life skills Physiology

Appendix 2. Boys' learning and experiences

What is said	Explicit or implicit	Shows qualification	Possible bridge between theory and experience
They have experienced that many strange animals exist	E	No	
They have not learnt anything at outdoor education	E	No	
Gave the ants marshmallows and examined the reaction	I	Some	Zoology
Splashed some water on the ants and examined their reaction	I	Some	Zoology
Started an ant-war by moving ants from one ant society to another	I	Some	Zoology
They are learning more about nature when staying outdoors	E	No	
They fill their backpack differently when going to outdoor education as well as having to choose different clothes depending on the weather	I	Some	Outdoor life skills Insulation-nature of material > PHYSICS
Telling about what they wear at outdoor school education	I	Some	Outdoor life skills Insulation-nature of material > PHYSICS
One of the places gets very muddy when it's raining	I	Some	Soil structure > geology Topography
Building shelters from the wind	I	Some	Weather and climate > geophysics

(*Continued*)

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Appendix 2. (*Continued*).

What is said	Explicit or implicit	Shows qualification	Possible bridge between theory and experience
Has been arguing with his mother about which clothes should be chosen	I	Some	Insulation-nature of material > PHYSICS
Discussing the insulation of different ground pads	I	Some	Insulation-nature of material > PHYSICS
They are drinking from a small stream, and at that point the water in it was clean	I	Some	Microbiology
They are filling their backpacks differently when staying at the place overnight	I	Some	Weather and climate > geophysics Insulation-nature of material > PHYSICS Physiology Outdoor life skills
Two adults were sleeping outside the tents with a mask over their faces because it was cold out there during the night	I	Some	Weather and climate > geophysics Insulation-nature of material > PHYSICS Physiology Outdoor life skills
How to make a bonfire	I	Yes	Outdoor life skills
They are learning during the lessons they have outside	E	No	
Whittling	I	Some	Outdoor life skills Experience in use of tools
The cabbages were rotten because they had been lying outside for a long time	I	Some	Biology
Some species of cones are more suitable for throwing than others	I	Some	Biology Mass density–surfaces–air resistance > PHYSICS
They may find animals outside, and that may teach them more than the mathematics books	E	No	
Outside they may find traces from animals, and they may learn about traces from animals, as well as learning how to survive in nature	E	No	

(*Continued*)

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Appendix 2. (*Continued*).

What is said	Explicit or implicit	Shows qualification	Possible bridge between theory and experience
They learn about the world of nature	E	No	
Building small huts or shelters	I	Some	Construction > PHYSICS, MATHEMATICS, DESIGN
They have found a small stream, and they like to drink from the water there	I	Some	Outdoor life skills
Telling about the stream and the drinkable water in it	I	Some	Outdoor life skills Biology
They have found traces of a badger and they have found a frog	I	Some	Zoology Ecology
Telling about the tree-species growing at one of the outdoor education places	I	Some	Ecology
Have discovered that the ants were not at the top of the anthill in the winter time	I	Some	Zoology
Gave the ants a maggot and experienced the reaction	I	Yes	Zoology
They have been looking at the many paths of entrance the ants have into their hills	I	Yes	Zoology
The old hunting equipment they like to visit is built of boards which are decomposing. It is not perfectly safe anymore	I	Yes	Biology Calculating risks
A forest with water on the ground creates an area of ice in the winter time	I	Some	Biology
Different tree species have different qualities for climbing	I	Yes	Biology

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