



Affordances for physical activity and well-being in the ECEC outdoor environment



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ABSTRACT

Children's everyday experiences with physical activity in Early Childhood Education and Care (ECEC) institutions are important from a health promotion standpoint. Experiencing well-being in physically active play is important, and the affordances of the environment may support such behaviour. The aim of this study is to develop knowledge about how the affordances of the ECEC outdoor environment may facilitate physical activity and well-being simultaneously. The sample in this study consists of 858 video observations of 2 min from eight ECEC institutions. The video observations are analysed both quantitatively and qualitatively. The findings highlight the importance of the physical environment for promoting children's well-being in physical activity and show how different affordances of the environment are important to enhance well-being and physically active play for all children in the outdoor environment of ECEC institutions.

1. Introduction

Early Childhood Education and Care (ECEC) institutions represent an important learning environment for children's development (Phillips & Shonkoff, 2000). The everyday activities in ECEC institutions have a crucial role in a child's life and from a health perspective. Health is an ambiguous concept, holding a wide range of elements. In this study, well-being and physical activity are selected as indicators for children's health. Well-being is understood as a subjective and internal experience of feeling "well" (Koch, 2018; Mashford-Scott, Church, & Tayler, 2012). Physical activity is defined as any bodily movement produced by the skeletal muscles that results in energy expenditure (Caspersen, Powell, & Christenson, 1985). Following the growing concern about children's health linked to sedentary behaviour and the prevalence of overweight (Pate, Mitchell, Byun, & Dowda, 2011), the positive benefits of the outdoors have been highlighted in recent years (Waller, Sandseter, Wyver, Årlemalm-Hagsér, & Maynard, 2010). The outdoor environment is found to be beneficial for children's development, well-being and physical activity (Cooper, 2015; Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004; Ulset, Vitaro, Brendgen, Bekkhus, & Borge, 2017). Hence, the way in which the outdoor environment in ECEC can promote children's well-being and physical activity is the focus of this study.

1.1. The physical environment in ECEC

The theory of affordances (Gibson, 2014) offers a framework for considering the child-environment interaction since this theory concerns the individual's perception of the environment. Affordance is defined as what the environment offers the individual and what it provides or furnishes, either good or ill (Gibson, 2014). Affordance includes both the environment and the child, meaning the affordance is unique and relative for each individual. An affordance emerges from the interaction between the child and the environment, an interaction that is immediate, as affordances are perceived directly in a natural flow of activity (Heft, 1989, 2003). The perception of affordance is influenced by the child's intentions, previous experiences and the context. Because of the dynamic and contextual considerations for affordance, Heft (2003) emphasises that affordances are not a fixed functional property of a feature, rather they are a dynamic entity in the ongoing person and environment process. Affordance may therefore be suitable for studying the interaction between the child and the environment in a dynamic and context-dependent reality.

Affordance has previously been applied to research on how children utilise the outdoor ECEC environment. Such study has demonstrated how both physical and social affordances influence children's physical activity levels (Bjørn, 2016), how different places afford different activities (Cosco, Moore, & Islam, 2010; Smith et al., 2014), the importance of available affordances in the outdoor environment for

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children's social play (Larrea, Muela, Miranda, & Barandiaran, 2019), how the environment affords risky, thrilling, and intense play opportunities for children (Sandseter, 2009), and the benefits of having access to both natural and built environments (Norðdahl & Einarsdóttir, 2015; Zamani & Moore, 2013).

1.2. Children's play

Play is a key concept when studying children in ECEC institutions. From the children's perspective, play is voluntary and self-controlled, it is a fun, active, spontaneous, free, unlimited, natural and self-initiated activity (Fein & Wiltz, 2006). These characteristics of play highlight the inherent value of play and that children play because they enjoy the activity itself. The intrinsic value of play and the positive impact on children's development in general imply that children's play should not be reduced to a means for promoting health (Alexander, Frohlich, & Fusco, 2014; Herrington & Brussoni, 2015). Therefore, a holistic approach to how play can be facilitated in ECEC institutions is favourable.

Building on the theory of affordances (Gibson, 2014), the features of the physical environment can be hypothesised to influence children's play behaviours. Previous research has demonstrated how different places and elements in the environment are significant for children's play (Dyment & O'Connell, 2013; Shim, Herwig, & Shelley, 2001; Torrens & Griffin, 2013). Playing is also found to be related to both physical activity and well-being in the outdoor environment of ECEC institutions (Author). If the aim is to promote children's health, then promoting children's play through a supportive environment might be a fruitful approach.

1.3. Physical activity

The emphasis on physical activity in early years is often rooted in a belief that physical activity habits are established in childhood. However, longitudinal studies have found tracking of physical activity from childhood to adulthood to be non-significant or very low (Telama, 2009). As highlighted by Malina (1996), many contextual factors influence how physical activity tracks across life. One possible important factor is to what degree children perceive physical activity in childhood as something positive. If children are physically active in a playful setting where they enjoy the activity, positive activity habits may grow. Hence, a shift from how much time children are physically active, to how children perceive and experience physical activity may be beneficial.

A growing body of research shows how the physical environment has an influence on children's physical activity. Pathways and open spaces have been found to be positively associated with physical activity (Cosco et al., 2010; Nicaise, Kahan, & Sallis, 2011; Sando, 2019). Studies examining associations between physical activity and nature (Olesen, Kristensen, Korsholm, & Froberg, 2013; Storli & Hagen, 2010), fixed functional equipment (Bower et al., 2008; Dowda et al., 2009; Olesen et al., 2013; Sugiyama, Okely, Masters, & Moore, 2012), and loose parts (Brussoni, Ishikawa, Brunelle, & Herrington, 2017; Bundy et al., 2009; Hannon & Brown, 2008; Sando, 2019) show divergent results, and no clear conclusion about these elements' association with physical activity can be established. This illustrates the complexity of the child-environment relationship.

1.4. Well-being

Well-being is in this study defined as to what degree children feel at ease, are vital, self-confident and spontaneous (Laevers, 2000). Since children who attend ECEC institutions often spend a lot of time in the institutions, and their experiences and activities in a given day are highly dependent on the institution, it is appropriate to believe that the ECEC institution is important for children's well-being. Well-being is also a key component in programme quality, but understandings of

what well-being is and how ECEC institutions can promote well-being are varied and unclear (Mashford-Scott et al., 2012).

Little is known about the influence of the outdoor environment on well-being. Previous research suggests that natural elements may be beneficial for different indicators of children's wellness (Brussoni et al., 2017; Carrus et al., 2012; Sando, 2019; Söderström et al., 2013). In a study of the perspectives of four-to six-year-olds on their well-being, the physical environment and available materials were among factors highlighted as being of crucial importance in ECEC institutions (Sandseter & Seland, 2016). Still, the overall knowledge base of how the outdoor environment may influence children's well-being is limited and needs to be expanded.

1.5. Aim of study

The main objective of this study is to develop knowledge about play episodes where children experience high well-being and physical activity simultaneously in the outdoor environment, and how children utilise affordances in these situations. The following research question will be addressed: *How can affordances in the ECEC outdoor environment promote physical activity and well-being simultaneously?* This can contribute to a better understanding of how the outdoor environment in ECEC institutions may promote physical active behaviour that children perceive positively.

2. Materials and methods

This study was conducted within the project EnCompetence, funded by The Norwegian Research Council, and approved by the Norwegian Social Science Data Services. The project is a three-year study using mixed methods (Creswell, 2013) conducted in close collaboration with three ECEC owners in Norway. Data collection involved systematic and randomised video observations of children in outdoor environments at two data points. The observations were conducted during free play, meaning children could decide what they wanted to do, where they wanted to be and with whom they wanted to interact. Adults was available in the environment, and the adult-child ratio was about 1:6.

2.1. Procedure and sample

Eight ECEC institutions were strategically selected among the partner institutions to allow variation in size, age, location and physical environment. The eight outdoor environments range from small urban environments with mainly asphalt and rubber surface to large (13 000 square meters) natural environments. Five girls and five boys in each institution were randomly selected among the three- and four-year-old children, and written consent to participate was obtained from parents. Data collection was performed over 1 week at two data points in each ECEC institution during the fall of 2017 and 2018 by four researchers and eight co-researchers. The researchers developed a strict data collection protocol that was followed in each of the ECEC institutions. A preschool teacher from each ECEC institution was recruited as a co-researcher and conducted the filming. The researcher wrote field notes and ensured that the protocol was followed. A person familiar to the children performed the video recordings using small neutral cameras with wide-angle lenses, GoPro Hero action cameras, to reduce any impact on the children's behaviour during the observed episodes. The co-researcher attempted to get as close as possible to capture speech, body language and facial expressions without affecting the situation. To ensure that random episodes were filmed, the filming of the children followed a predetermined schedule that stated the order and time that observations were to be conducted. Two children were filmed each day. The first child was filmed for 2 min, followed by a 6-min break. Then, child two was filmed for 2 min, followed by another 6-min break. This alternation between the first and the second child was repeated until six video observations of each child were recorded in the outdoor

environment. If the children were in situations in which filming was not an option due to ethical considerations (such as the child refusing to be filmed, toilet visits or similar), the video observation was postponed. The co-researcher was very conscious to refrain from filming in sensitive situations and kept an ongoing dialogue with the children about the filming to ensure assent to participation.

The first data collection (T1) included 80 children. The second data collection (T2) was carried out a year after T1. Six of the 80 participating children no longer attended the institution. Additionally, one child was not included at T2 for ethical reasons. The sample in this article therefore includes 73 children, 36 boys and 37 girls, with a mean age of 4.2 years ($SE = 0.7$). A complete sample of six observations at two data points for 73 children would include 876 2-min video observations. The final sample only included 858 observations (429 observations at each data point, with an average of 11.8 observations per child). Hence, 18 observations are missing. Missing observations occurred because children were sick or picked up early, or they were excluded because the child was hidden from view, was preoccupied with the camera, or a technical or human error occurred.

2.2. Measures

The Leuven Well-Being Scale (Laevers, 2005) was used to measure the well-being of the children on a scale from 1 (extremely low) to 5 (extremely high). A score of 1 on the scale is given when children show clear signs of discomfort, such as whining, screaming, anger or sadness. A score of 5 is given when the child shows signs of appearing happy, expressive, lively or relaxed. A score of 3 indicates a neutral posture with moderate well-being. Score 2 (low) and 4 (high) indicate obvious signs of either discomfort or happiness that are not consistently present. The Observational System for Recording Physical Activity in Children–Preschool (OSRAC-P) (Brown et al., 2006) was used to measure physical activity, which codes PA from 1 (stationary) to 5 (fast movement). A score of 4 indicates moderate movement, and are commonly used as the cut-off point for moderate to vigorous physical activity (MVPA). Training videos and workshops were conducted by the three researchers performing the coding to promote consistency in the coding and interpretation of both scales.

Two independent researchers scored each video observation. Disagreements greater than one point were reviewed again and discussed in the research group until a mutual understanding was reached. For differences of one point, an average of the two scores was used. Using weighted kappa (Cohen, 1968), inter-rater agreement was 90% for well-being, with a kappa value of 0.48. This indicates moderate agreement, and agreements above 80% and with kappa values above 0.40 are often viewed as acceptable agreements (McHugh, 2012). For physical activity, the inter-rater agreement was 92%, with a kappa value of 0.65 indicating good agreement. Based on the scores of well-being and physical activity, a dichotomous variable identifying observations with both well-being and physical activity scores of four or higher was created. These cut off points were chosen since four or above on the physical activity scale represents MVPA, and four on the well-being scale indicates high well-being.

Children's play and the observation's social characteristics were coded continuously, and the categories were mutually exclusive. Children's play was coded using categories for functional play (e.g. running, riding bikes, tumbling, climbing), constructive play (e.g. building sand castles, creating huts and shelters), symbolic play (e.g. role play, dramatic play, social play), mixed play (when children combine several types of play without one being dominant), non-play and talking. These categories were adapted from previous play-categorising studies (Dyment & O'Connell, 2013; Fjørtoft & Sageie, 2000; Luchs & Fikus, 2013). The variables used for play in this article describe the percentage of time for each of the play categories for each observation. Group composition categories in the OSRAC-P (Brown et al., 2006) were used to capture the observation's social characteristics. The

initial categories in the OSRAC-P (Solitary, 1-1 Adult, 1-1 Peer Group Adult, Group) were reduced to two variables describing the percentage of time the child was with other children and the percentage of time an adult was present. Play and social characteristics were coded by one researcher for the entire sample, and a random sample of 10% of the video observations was reviewed by a second researcher to ensure consistent coding.

Categories for places and objects were developed to measure the components of the physical environment. This was done by adjusting categories used in previous research (Cosco et al., 2010; Dyment & O'Connell, 2013; Lerstrup & van den Bosch, 2017) to the context and theoretical framework for this study. The categories for place included sandbox, pathways, nature, open area, fixed functional play equipment (swings, climbing towers, slides, etc.), fixed role-play equipment (playhouses, boats, huts, stores, etc.), fixed equipment other (tables, storage, etc.) and indoor (cubbies, huts and semi-heated outdoor rooms). Places were coded continuously, and the categories were mutually exclusive. Variables describing the use of sandbox, pathways, nature, open area and fixed functional equipment were included in the analysis in this study. Sandbox, open area and fixed functional equipment were present in all of the eight environments, while the presence of nature and pathways varied.

The use of objects was coded when a child was holding, using or interacting with an object. To capture the possibility that children may use several objects at once, the categories of objects were not mutually exclusive. Categories for objects included sand, water, mud, nature materials, toys, open-ended materials and wheeled toys. Sand, toys, and wheeled toys were available in all eight institutions, whereas the availability of water, mud, nature materials and open-ended materials varied across the institutions. The variables for places and objects describe the percentage of time the child is at a place or in which the object was used during each observation. The coding of place and objects was performed by one researcher, and a random sample of 10% of the video observations was reviewed by a second researcher.

2.3. Analysis

The scoring of well-being and physical activity was performed on an Excel spreadsheet. Play, social characteristics, places and objects were coded using Observer XT 12.5 behaviour coding (Noldus), analysis and management software for observation data (Zimmerman, Bolhuis, Willemsen, Meyer, & Noldus, 2009). The Observer XT data were paired with the spreadsheet of scores for well-being and physical activity and imported to Stata MP 15.1 (StataCorp, College Station, TX, USA), which was used for the statistical analysis. Given the hierarchical structure of the data, with several observations of each child and the dichotomous outcome variable, generalized linear latent and mixed models (GLLAMM) (Rabe-Hesketh & Skrondal, 2008) was used to investigate the associations between the observations with high well-being and physical activity and age, gender, play, social context, places and objects.

Following the statistical analysis, the video observations with high well-being and physical activity were identified and analysed qualitatively to search for the affordances children actualised in these observations. This analysis used three of Gibson (2014) categories for affordances as a starting point: *other persons and animals*, *places* and *objects*. The first phase in this analysis was conducted by writing descriptions of how these three groups of affordances were actualised in the observation. Additionally, a general description of the observation was written to describe the context of the observation. This first phase of the analysis was not a detailed description of every affordance the child actualised in the observation. The aim was rather to get a broad overview of how these three categories of affordances were utilised and to identify general trends in how children used the affordances in the environment. In the second phase of the analysis, each written description from the first phase was read, and general comments

regarding how the children utilised the three groups of affordances were written. This analysis was conducted by one researcher, and a second researcher reviewed the analysis and provided comments and adjustments to the initial coding and interpretation. Quotes from the transcribed observations representing ideal types of how different types of affordances commonly utilised are included in the results to provide examples from the material. The quotes are marked with a fictive name of the child, and the age is indicated with numbers; e.g. 4.11 meaning four years and 11 months.

3. Results

The results from the quantitative analysis are presented first, followed by the qualitative analysis. In the discussion, the findings from the two approaches will be combined in an overarching discussion drawing on both analyses.

3.1. Quantitative analysis

The mean duration of the 858 video observations was 122 s (SD = 5). There is an average of 11.8 observations per child, and 49% of the observations were of boys. Descriptive statistics are presented in Table 1.

To examine significant associations between observations with high well-being and physical activity and age, gender, play, social context, places and objects, GLLAMM (Rabe-Hesketh & Skrondal, 2008) was used. Models were fitted separately for background variables, play, social context, places and objects. Age and gender were added to all models to control for these characteristics. Written descriptions of the main findings in these models are provided in the following results. Full models are available from the corresponding author.

Table 1
Descriptive statistics for the full sample, the high well-being and physical activity observations and the remaining sample.

	Full sample	High Well-being and Physical activity	Remaining sample
	N = 858	N = 175	N = 683
	Mean (SD)	Mean (SD)	Mean (SD)
Age	4.2 (0.7)	4.5 (0.7)	4.1 (0.7)
Well-being	3.7 (0.7)	4.4 (0.4)	3.6 (0.6)
Physical activity	3.2 (0.9)	4.4 (0.4)	3.0 (0.7)
Play			
Functional play %	35 (40)	61 (40)	28 (37)
Constructive play %	23 (38)	9 (26)	26 (40)
Symbolic play %	7 (22)	8 (24)	6 (22)
Mixed play %	6 (22)	11 (30)	5 (19)
Social context			
With other children %	77 (37)	86 (29)	75 (38)
With adult %	21 (36)	17 (35)	22 (37)
Places			
Sandbox %	9 (27)	3 (15)	11 (29)
Pathways %	5 (15)	7 (15)	4 (15)
Nature %	5 (21)	7 (24)	5 (20)
Open area %	53 (42)	51 (38)	53 (43)
Fixed functional %	15 (33)	21 (37)	14 (32)
Other places %	13 (28)	11 (22)	13 (30)
Objects			
Sand %	10 (27)	2 (8)	12 (30)
Water %	8 (23)	6 (20)	9 (24)
Mud %	1 (9)	1 (8)	1 (9)
Nature materials %	14 (31)	10 (26)	15 (32)
Toys %	32 (44)	20 (37)	35 (45)
Open materials %	7 (23)	7 (20)	7 (23)
Wheeled toys %	14 (33)	12 (31)	14 (33)

3.1.1. Child characteristics, age, gender and play types

Children experience high well-being and physical activity to a varying degree. Intraclass correlation analysis estimates that 12% of the variance is at the child level, indicating that there are substantial differences among children. The observations with high well-being and physical activity are distributed among 61 children, with an observation range from one to eight among these children. Thirteen children, four boys and nine girls, had no such observations. There is a positive association between observations with high well-being and physical activity and being a boy (b = 0.45, p = .04, 95% CI = 0.02-0.88). Boys represent 59% of the observations. Higher age is also positively associated with high well-being and physical activity observations (b = 0.67, p = .000, 95% CI = 0.40-0.95). The amount of the play types functional play (b = 0.035, p = .000, 95% CI = 0.027-0.043), symbolic play (b = 0.019, p = .000, 95% CI = 0.009-0.030) and mixed play (b = 0.033, p = .000, 95% CI = 0.023-0.043) are all higher in the observations with high well-being and physical activity. Constructive play is not significantly different in these observations.

3.1.2. Other persons and animals, places and objects

Observations with high well-being and physical activity are positively associated with being with other children (b = 0.009, p = .003, 95% CI = 0.003-0.015). The presence of adults is not significantly different in these observations.

Observations with high well-being and physical activity are positively associated with the use of pathways (b = 0.018, p = .005, 95% CI = 0.005-0.030) and fixed functional equipment (b = 0.011, p = .007, 95% CI = 0.003-0.019). The other place categories, sandbox, nature and open area are not significantly different.

Objects are used less in observations with high well-being and physical activity compared to the other observations. More use of sand (b = -0.027, p = .001, 95% CI = -0.043-0.011), nature materials (b = -0.008, p = .028, 95% CI = -0.015-0.001) and toys (b = -0.007, p = .022, 95% CI = -0.012-0.001) is negatively associated with observations with high well-being and physical activity. Variables describing the use of water, mud, open materials and wheeled toys are not significantly different.

3.2. Qualitative analysis

The results from the qualitative analysis are grouped in the three categories of affordances used in the analysis: other persons and animals, places and objects.

3.2.1. Other persons and animals

Other children are highly present in almost all of the observations with high well-being and physical activity. There is often a large group of children playing together in a symbolic context.

Tom 4.11: *A large group of children plays a catch game. The play is based on a TV series called The Labyrinth. The play starts close to a labyrinth built by pallets in one corner of the outdoor area. A boy pretends to be a robot that hunts the other children. The boy we are following runs from the dangerous robot together with several other children. Close to the entrance, a large cable reel functions as a free haven. They express joy and fear of the robot and run back to the labyrinth, where they collapse in the grass.*

Different types of rough-and-tumble play, such as hunting, catching and play fighting are commonly occurring.

Hans 4.10: *Three children stand by the climbing structure. A boy and a girl walk off, and the boy we are following waits for a couple of seconds before he roars loudly and runs after them. They run between small hills and onto a circular pathway, where the girl is captured. The boy comes running to help the girl. Two other children join the fight and free the girl. The chase continues on the pathway and into an open grass field. The girl*

is captured once again and dragged down in the grass. Two children join the pile of children trying to free the girl. They succeed and run off again. Next, one of the boys is chased and captured. The two boys are harsher in their play fighting. They hit and kick each other within a playful context. The children are happy, physically active and deeply involved in the play.

Other children are a necessity to carry out such functional/risky play, as they afford someone to hunt and fight with and have fun with. In other episodes, we also see that other children may heighten the physical challenge by increasing the speed or difficulty or by acting as an obstacle. Although many of the observations involve different types of functional play, such as climbing, cycling, swinging, running or jumping, the functional play episodes commonly also involve a story or fantasy context in which the movements are carried out. This context is commonly constructed with other children. As such, other children are important affordances in the environment for physical activity episodes with high well-being in a multitude of ways.

Adults are, for the most part, not directly involved in the observations with high well-being and physical activity. Adults commonly observe the activity from a distance. There are, however, some observations where adults are playing with children.

Peter 4.5: One adult and several children are building an obstacle course in an area with gravel. The adult initiated the activity and digs in the gravel to place stumps, logs and cable reels in a circular course. The boy in focus collects a large stump in another part of the outdoor space and carries it to where they are building. The stump is heavy. He is clearly proud that he managed to carry the stump and the adult praises him for his strength. He runs off in joy to find more stumps with another boy.

The adult has initiated a constructive play activity that resulted in physical activity and joy through the mastering of different skills. Having the time to fully engage in such activities seems to be a shortage, and sometimes they are distracted when engaged in play.

David 4.1: One adult and several children are playing in the sandbox. The sand represents the sea where the boy we are observing is a shark. The other children and the adult are humans the shark tries to eat. When eaten, they too become sharks. The humans are balancing on the edge around the sandbox and jump onto a wooden podium in the middle of the sandbox. Suddenly, another adult contacts the participating adult to sort out some practicalities. The play continues, but the intensity and involvement in the play drop for many of the children.

The adults' participation helped give different environmental characteristics meaning and supported physically active play and well-being for the group of children. Such observations of adults indicate that adults have a potential to facilitate positive experiences with physical activity for children, but this potential is rarely utilised in the observations in this study. Animals are also included in this category of affordances. There are only a few clips where animals are a focus of the child's attention in the investigated observations. All of these observations involve worms. The high well-being in these episodes is connected to the children's joyful and thrilling encounter with a living creature, and the physical activity is connected to movement in their search for more worms or to show the captured worms to other children or adults.

3.2.2. Places

A variety of places are used in the observations. Some places afford thrills, excitement and physical challenges, other places are resource-rich environments that inspire complex forms of symbolic play, whereas other observations occur in open areas with limited affordances provided by the place. Fixed playground equipment, such as climbing structures and swings, are places that afford functional play types and mastering of motor skills.

Monica 5.2: The girl hangs by her arms from the climbing handles half a meter above the rubber surface. By swinging her body and letting one arm go, she moves forward. She passes with ease a piece of cloth that hangs

from one handle. With full control, she lets go and lands on the ground before she starts over with a different part of the equipment.

Here, the physical environment affords the child possibilities for movements that drive and inspire the play. In other observations, the physical environment is a surrounding where the child's play, imagination and interaction with peers and adults play out. Fixed, functional play equipment may also serve this role.

Noah 4.0: He stands in the middle of the climbing structure. He participates in a catch game with an adult and a large group of children. The adult plays a pirate known from a TV series. The children try to escape. The playground equipment is a frame for the play, and different sub-spaces within the structure are given functions, such as a pot where children are placed to be boiled when captured.

The same equipment that provided the girl with challenging climbing opportunities is here a scene for symbolic play. Different parts of the equipment are given a symbolic meaning in an interaction between the equipment, the participating children and the adult. Places with many and diverse natural elements are also commonly used in the observations with high well-being and physical activity. Also, natural elements afford possibilities for symbolic play.

William 4.8: He plays with a girl below a large old tree with branches hanging over them. They jump across a small gap in the terrain filled with needles from the overhanging tree. They jump across several times, holding a rake in each hand. The gap contains lava, and they collect more needles (lava) to fill the gap. He wants a nearby adult to participate in the play and makes armour and lava shoes for the adult with the rakes at a stump so she can join the play.

Natural elements afford changing affordances in different weather conditions and seasons. Affordances that suddenly appear in the environment due to seasonal variations and weather conditions seem to attract children.

Maria 3.1: Heavy rain and a lack of drainage have resulted in a large pool of water. Several tables have been placed over these pools to prevent children from going into the water. Together with several other children, the girl jumps from the tables into the water. The water splashes, and the children enjoy the activity. They seem to adjust the challenge in their play in accordance with their skills. The girl in the observation jumps off the bench meant for seating, whereas other children jump off the top of the table. Two boys even cover their eyes before jumping off the table to increase the challenge even more.

Places with challenging and varied terrain, such as nature, facilitate physical activity with high well-being, although the main activity is not functional play. To move sand or water from one place to another, children playing in a natural environment have to move through rough terrain, demanding motor skills and physical activity. Similarly, pathways are places in the outdoor environment that facilitate physical activity in many different play episodes. Pathways are used in a continuous flow of activity and are often incorporated into a symbolic play context or used for transportation in different activities. Many of the observations with high well-being and physical activity are also played out in open areas. Here, the affordances provided by other children commonly drive the play, and the open area simply affords a place where they play and interact and have fun with each other.

3.2.3. Objects

Objects provide a wide range of affordances for children in the outdoor environment and are used in many different ways. However, there are also many observations with high well-being and physical activity where objects are not used. In episodes where children engage in running, climbing and rough-and-tumble play, objects are, for the most part, not used. In other play types, such as symbolic play, objects often have a key role.

Patrick 5.3: A group of boys is pretending to drive taxis. Each of the boys has a tricycle that he pretends to be a car. They cycle in a row on pathways and through open areas at high speed. Different places in the outdoor area have different functions. Money is collected at one side of the building, and the airport is on the other side of the building. One of the children holds a board that represents a phone.

Here, tricycles and the board were important elements representing cars and a phone in this symbolic and functional play context (mixed play). Objects may also serve purposes other than representing imaginary items, like affording possibilities for children to create their own places.

Lucas 5.5: Several boys are playing family. Below a slide, they have created a small space using different boxes. Twelve boxes are used to fill openings so there is an intimate subspace below the slide. The boy we are following walks over to a boy who pretends to be a baby. They walk to a box that lies upside down and use the box as a trampoline. The plastic at the bottom of this box is flexible and affords jumping. He climbs back into the subspace below the slide, a place that seems to function as their home.

Although objects are commonly used in symbolic play episodes, objects are also involved in episodes where children engage in challenging functional play. A small piece of wood was used for balancing, resembling a skateboard, in one observation. Thrilling and risky play is also a play where children commonly challenge their physical and motor abilities, and objects are often used to achieve high speed. Objects such as cycles, tricycles, spades and baby buggies are used in play with great speed. Also, equipment from the sandbox is used in play with high speed.

Oliver 4.10: He plays with another boy by the sandbox. They each collect a truck from the sandbox. There is a steep hill and pathway below a large tree close to the sandbox. They carry the trucks up this hill. At the top of the hill, they sit down on top of the trucks and ride down the hill at high speed.

In this observation, equipment from the sandbox was used for purposes other than their intended use and provided these boys with possibilities for exciting high-speed play. This may serve as an example of the overarching finding in the qualitative analysis, namely the complex and relational nature of different sets of affordances in observations with high well-being and physical activity. Other children and adults, places and objects all provide valuable affordances for children in the outdoor environment. These categories of affordances are not isolated entities, but rather elements that interact and strengthen each other.

4. Discussion

The objective of this study was to develop knowledge about episodes where children express high well-being during physical activity and what affordances children utilise in such situations. The results from the quantitative analysis indicate that children experience well-being in physical activity to a varying degree and add to previous evidence suggesting that activity patterns differ between children (Andersen et al., 2017). Boys and older children had more observations with high well-being and physical activity, and as many as 13 children in our sample did not experience high levels of well-being and physical activity simultaneously during the observational period. This highlights the importance of teachers being conscious of how children experience free play in the outdoor environment and systematically observing all children in the outdoor environment to ensure that all children participate in play.

The results from both the quantitative and qualitative analyses highlight the importance of play for simultaneously promoting physical activity and well-being. Observations with high well-being and physical

activity included more functional, symbolic and mixed play compared to the other observations. This finding should be interpreted within a holistic take on children's play, where health is conceptualised broadly, and a diversity of play types should be promoted (Alexander et al., 2014; Herrington & Brussoni, 2015). It is important to underline that play is a voluntary, self-initiated and spontaneous activity that runs out of the child's interests (Fein & Wiltz, 2006), and not something that adults can force children into. Providing children with a physical environment that affords a multitude of play opportunities may be a beneficial strategy, where the fundamental self-initiated nature of play is ensured. The importance of promoting a wide range of play activities is demonstrated by the finding that many episodes happened within a symbolic (e.g. Noah 4.0, William 4.8, Patrick 5.3) and risky play context (e.g. Monica 5.2, Maria 3.1, Oliver 4.10). Sandseter and Kennair (2011) discussed how risky play may be beneficial for children's development, and this study's findings indicate that allowing children to take risks also may be important in facilitating positive experiences with physical activity. Therefore, aiming to facilitate a wide range of play opportunities in the outdoor environment of ECEC institutions is significant from a health perspective.

4.1. Sharing experiences with other children and adults

A supportive environment for play is one that has the social child in focus. The importance of other children was a predominant finding in both analytic approaches. Other children afford someone to play with and someone to share experiences with. Other persons offer the richest and most elaborate affordance as they move around and interact with each other and the individual (Gibson, 2014). They may also inspire movement and increase the challenge and complexity in the activity. Although the presence of adults was not related to observations with high well-being and physical activity in the quantitative analysis, the results from the qualitative analysis indicate that adults in the environment may also serve an important role. However, this potential is not commonly utilised in the present data. Bjørgen (2016) showed the importance of social affordances for physically active play, and how sharing social knowledge and observing others' behaviour may motivate and facilitate physical activity. The episodes of play fighting in the present study show the joy, activity and intense experiences that can flourish in a social and bodily play context. As such, ECEC institutions should seek to facilitate environments that strengthen friendships and children's relationships.

4.2. Having access to various and diverse places

Places are locations in the environment that offer sets of affordances (Gibson, 2014), and different places have been found to afford different activities (Cosco et al., 2010; Smith et al., 2014). The quantitative analysis identified fixed functional equipment and pathways as places that were positively associated with high well-being and physical activity. Children's use of pathways illustrates the dynamic and spontaneous child-environment relationship (Heft, 2003), where affordances in the environment are perceived directly in a flow of activity. The pathways could function as a running track, road for cars or a cycling track, depending on the play context and the child's intentions. Similarly, fixed playground equipment could, although designed for functional play purposes, serve as a scene for symbolic play. The ideal fixed playground equipment perhaps meets both ends, providing physical challenges and having different subspaces that can be used in a variety of play contexts. The overall impression from the qualitative analysis is that episodes of high well-being and physical activity happen in a variety of places. Having access to different places, smaller and bigger, closed and open, natural and built environments seems to be beneficial, a notion in line with previous research (Norodahl & Johannesson, 2016; Zamani & Moore, 2013).

4.3. Interacting with a multitude of objects

In the quantitative analysis, the limited use of objects in the observations with high well-being and physical activity revealed that objects are not a necessity for children to experience well-being in physically active play. Previous analysis of well-being and physical activity independently (Sando, 2019), indicate that more use of objects are mostly negatively linked to physical activity. However, objects were in the present study found to be important elements in episodes where children engaged in symbolic play in the qualitative analysis, a finding in line with a previous study (Larrea et al., 2019). Further, the amount and type of objects available in the outdoor environments in the present study may have influenced the degree to which children utilised objects in physical active play. Having access to an abundance of open-ended objects like wooden planks, tyres, plastic barrels and water containers that afford physical active play, as demonstrated by Bundy et al. (2009), could have influenced the results.

The role of objects should also be considered in relation to what places the outdoor environment holds and the children's interests, so the objects strengthen the affordances of the places and build on the child's interests. Although the results from the quantitative analysis indicate that wheeled toys are not related to observations with high well-being and physical activity, the qualitative analysis showed how tricycles within a social and symbolic play context, where they have access to circular pathways, may facilitate both high levels of well-being and physical activity. This illustrates how different affordances in the environment interact and can collectively support children's play and how social affordances influence the relationship between the physical environment and the child. This highlights the context-dependent nature of the interactions between the child and the environment and the infinite number of factors that influence how a child utilises the environment in a given situation.

4.4. Limitations and conclusion

Although the mixed-methods approach used in this study provided new and valuable knowledge about how the environment can support children's joy of movement, there are some limitations to this study. The qualitative analysis was intended to offer a different perspective than the quantitative analysis. Still, the fact that the results from the quantitative analysis were known when the qualitative analysis were conducted may have influenced the interpretation. Also, the selection of video observations was based on the scorings of well-being and physical activity, making the analysis far from independent. The two analytical approaches are therefore intertwined, as common in mixed-methods research.

Further, may the presence of the co-researcher conducting the filming have influenced children's behaviour, although the person was familiar to the children to minimize the impact. Measuring an ambiguous concept such as well-being is challenging. Although we have tried to interpret children's expressions of well-being through systematic observation, it is a weakness that the children's own voices are not heard. This should be incorporated in future studies. Also, the categorisation of children's play can be questioned, and the qualitative analysis indicates that the boundaries between different play types are quite blurry, and perhaps even non-existent in some observations.

The eight outdoor environments included in the present study are very different and range from small urban environments to extremely large natural environments. The availability of objects is also different across the institutions. The context dependent nature of the child-environment relationship indicate that different associations between the environment and the child may exist in each of the eight institutions. Although the categories and analytical approaches used have aimed to compensate for the range in different environments, this also represents a limitation to the study.

The findings in this study highlight the importance of the physical

environment for promoting children's well-being in physical activity and emphasise how other children and adults, places and objects are important to enhance well-being and physically active play for all children in the outdoor environment of ECEC institutions.

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CRediT authorship contribution statement

Ole Johan Sando: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft. **Ellen Beate H. Sandseter:** Conceptualization, Methodology, Formal analysis, Writing - original draft, Project administration.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvp.2020.101430>.

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