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Risky Play and Children's Well-Being, Involvement and Physical Activity

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Abstract
Children's activities and experiences in Early Childhood Education and Care (ECEC) institutions are essential for children's present and future lives. Playing is a vital activity in childhood, and playing is found to be positively related to a variety of outcomes among children. In this study, we investigated how risky play – a fundamentally voluntary form of play – related to children's well-being, involvement and physical activity. Results from structured video observations (N = 928) during periods of free play in eight Norwegian ECEC institutions indicated that engagement in risky play was positively associated with children's well-being, involvement and physical activity. The findings in this study suggest that one way to support children's everyday experiences and positive outcomes for children in ECEC is to provide children with opportunities for risky play. Restrictions on children's play behaviours following safety concerns must be balanced against the joy and possible future benefits of thrilling play experiences for children.

Keywords Risky play · Well-being · Involvement · Physical activity · ECEC

1 Introduction

There is little consensus regarding what should be the expected outcomes for children in Early Childhood Education and Care (ECEC). Unlike in school, children's outcomes in ECEC are rarely delineated specifically to, for example, subject knowledge (Barnett et al. 2014). Instead, children's outcomes in ECEC are suggested to be foundational aspects of experience and learning (Laevers 2000), like well-being, social competence or emotional and cognitive development. These aspects are considered valuable in themselves and, simultaneously, a necessary basis for later

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learning (Hammer et al. 2017; Gupta and Simonsen 2010). While many researchers, educators, parents and policymakers are concerned with children's outcomes concerning their future (e.g. school readiness) (Schleicher 2019), children themselves would mainly consider the here-and-now value of their ECEC experience (Sandseter and Seland 2016; Koch 2018). This duality challenges researchers, practitioners and policymakers when it comes to establishing consensus around definitions and child outcome measures in ECEC.

In this study, we selected three outcomes on the child level: well-being, involvement and physical activity. We will argue that these outcomes account for essential childhood experiences and are related to future outcomes, and that it is timely to test their relation to the novel concept of risky play.

1.1 Risky Play

The concept of risky play comes from a relatively new line of research (Kvalnes 2017). Risky play comes across as an oxymoron, combining the contradictory connotations of risk and play. Risk refers to the probability of a negative consequence (Rescher 1983), while play refers to a foundational, volunteer, inner-motivated and "purposeless" activity (Sutton-Smith 1997; Carse 1987). Thus, it seems unlikely that anyone voluntarily and with purpose would expose themselves to a possible negative consequence. Notwithstanding, humans engage in such activities throughout life, and even from early childhood (Kleppe 2018; Breivik et al. 2017). Examples of such activities include climbing, balancing, diving and downhill racing with skis or bicycles (Breivik et al. 2017).

One explanation for such seemingly contradictory behaviour is that the reward of a thrilling experience and mastering skills (often increasing difficult challenges) outweigh the potential negative consequences (Zuckerman 2009). When focusing on children, risky play is delineated to activities that entail excitement and uncertainty, and sometimes the possibility of injuries (Little 2010b; Sandseter 2010b). Typical for this type of play is that children willingly seek out situations they subjectively experience as (moderately) dangerous.

Risky play has been categorised into 1) Play with great heights – danger of injury from falling, such as all forms of climbing, jumping, hanging/dangling, or balancing from heights; 2) Play with high speed – uncontrolled speed and pace that can lead to a collision with something (or someone), for instance bicycling at high speeds, sledging (winter), sliding, or running (uncontrollably); 3) Play with dangerous tools – that can lead to injuries, for instance, axe, saw, knife, hammer, or ropes; 4) Play near dangerous elements – where one can fall into or from something, such as water or a fire pit, 5) Rough-and-tumble play – where children can harm each other, for instance, wrestling, fighting, fencing with sticks; 6) Play where children go exploring alone, for instance without supervision and where there are no fences, such as in the woods; 7) Play with impact – children crashing into something repeatedly just for fun; and 8) Vicarious play – children experiencing thrill by watching other children (most often older) engaging in risk (Sandseter and Kleppe 2019).

Characteristically, children will express exhilaration, hesitation, fear or mastery while playing with risk, and numerous repetitions are typical (Sandseter 2009b, 2010a; Kleppe et al. 2017). Risky play thus represents the duality of childhood experience saliently: Children engage in risky play motivated by the thrilling experience itself, not because they want to become good at risk assessment. Regardless, their ability to assess risks will probably be strengthened through experience with risk (Lavrysen et al. 2017).

Children's risk-taking in play appears to be universal, and risky play is observed in various cultures globally (Sandseter et al. 2017; Brussoni et al. 2015). However, different cultures express tolerance for risk differently, and they tolerate different types of risk. In Western societies, there are indications of a growing general risk averseness, both from parents and in ECEC institutions (Spiegal et al. 2014; Sandseter and Sando 2016; Sandseter et al. 2017, 2019; Little 2010a). This risk averseness affects children's possibilities for play and freedom negatively (Sandseter and Sando 2016; Spiegal et al. 2014), including lost potential benefits, both short- and long-term, of risky play (Brussoni et al. 2015; Sandseter and Kennair 2011; Lavrysen et al. 2017).

1.2 Risky Play and Well-Being

In the framework of experiential theory, the main aim is to understand how each child is doing emotionally, socially and developmentally in any given setting (Laevers 2000). The framework relies on two concepts: well-being and involvement. Well-being is in this study defined as to what degree children feel at ease, acts spontaneously and show vitality and self-confidence (Laevers 2000). According to Laevers (2000), such signals indicate how the child's basic physical, emotional and social needs are met. The approach to children's well-being in the present study emphasises children's signals of discomfort or satisfaction and ties such signals to their subjective well-being.

Despite growing attention towards the importance of well-being in childhood, few studies have addressed the impact of ECEC institutions on children's well-being (Holte et al. 2014). The importance of autonomy for children's well-being in ECEC was demonstrated by Sandseter and Seland (2016), who found that having an influence on what to do, where to be, and whom to be with was essential. Koch (2018) found the experience of friendship, challenging activities and engagement in free play to be favourable approaches to well-being in ECEC institutions. The association between play and well-being is also established in other studies (Kennedy-Behr et al. 2015; Giske et al. 2018; Howard and McInnes 2013). As such, risky play can be expected to support children's well-being in ECEC, following the notion that children engage in this form of play of their interest, motivated by the thrilling and exciting experience of challenging activities.

1.3 Risky Play and Involvement

In Laevers' (2000) framework, well-being is seen as a prerequisite for involvement. Involvement is in this study defined as the degree to which children have directed their

attention, are engaged and concentrated in activities (Laevers 2000). If children's basic needs for well-being are not met, and they are not at ease, it is difficult for them to concentrate and experience real involvement. Behavioural indicators of involvement are deep concentration, focus and engagement. Combined, well-being and involvement constitute the concept of 'deep level learning' (Laevers 2000). This concept contrasts superficial learning, in that it describes how challenges must build on children's existing competences, but also that their capabilities must be appropriately challenged. Such learning experiences build a necessary foundation for later learning.

Play is a typical situation where children experience involvement. This idea follows the characteristics of children's play as being grounded in children's interests and intrinsic motivation, attributes that can be expected to relate to engagement and concentration (Liu et al. 2017; Zosh et al. 2017). More so, if there is a risky aspect in the play, aspects of involvement tend to intensify (Sandseter 2010a). Thus, risky play is a typical activity where children can experience involvement.

1.4 Risky Play and Physical Activity

Physical activity is defined in the present study as any bodily movement produced by the skeletal muscles that results in energy expenditure (Caspersen et al. 1985). Being physically active is strongly related to several health outcomes and is commonly considered to be one of the most potent ways to enhance an individual's health across the lifespan (Haskell et al. 2009). Compared to less-active children, physically active children are found to have healthier cardiovascular profiles, to be leaner, and to develop higher peak bone mass (Boreham and Riddoch 2001), characteristics that may influence children's health both in the present and in the future.

A systematic review found general positive relations between risky play and various health indicators, including physical activity (Brussoni et al. 2015). The excitement and rewarding thrill entailed in risky play is seemingly a strong motivation for children to be physically active, e.g. climbing up and jumping down or rough and tumble (Sandseter 2010a; Engelen et al. 2013; Pellegrini and Smith 1998). This thrill is potentially also a motivating factor contributing to the repetitiveness of many types of risky play (Sandseter 2010a; Kleppe et al. 2017). Thereby, risky play seems ideal for facilitating physical activity among children, within an intrinsically motivated context, where children are active because they enjoy the activity. However, Brussoni et al. (2015) revealed that more research was necessary to validate the concept of risky play and potential relations to other child health outcomes.

1.5 Aim of Study

On this background, we hypothesise that risky play is positively associated with well-being, involvement and physical activity. These three outcomes are essential in ECEC, both as a salient expression of children's here-and-now experiences and for their future health and learning. The research question of this article is: *What is the association between engaging in risky play and children's well-being, involvement and physical activity in eight Norwegian ECEC institutions?*

2 Methods

This study was conducted as a sub-study within the project EnCompetence. The study was funded by The Research Council of Norway, and approved by the Norwegian Social Science Data Services. The project is a three-year study using mixed methods (Creswell 2013), placed within a design experiment in education framework (Cobb et al. 2003). The study is conducted in close collaboration with three ECEC owners in Norway, and the data collection involved systematic and randomised video observations of children. The conducted video observations were taken during periods designated for free play, implying that children could decide what they wanted to do, where they wanted to be and with whom they wanted to interact. The analyses in the present study are conducted on cross-sectional data collected in the fall of 2018. Previous studies from this study have demonstrated that children's play were associated with their well-being and involvement (Storli and Sandseter 2019) and that the characteristics of the physical environment were associates with children's well-being, physical activity and involvement (Sando 2019a, b; Storli et al. 2020; Sando and Sandseter 2020), This study differentiates from the previous articles in that here the relationship between children's engagement in risky play and their well-being, involvement and physical activity is explored.

2.1 Procedure and Sample

Eight ECEC institutions were strategically selected among the partner institutions. The participating institutions were located in the south (N = 4), middle (N = 3) and north (N = 1) of Norway, had between 58 and 117 children (Mean = 85) and were built between 1989 and 2016 (Mean = 2007). Five girls and five boys in each institution were randomly selected among the three to five-year-olds, and informed, written consent to participate was obtained from the parents. The data collection was carried out over one week in each of the participating institutions.

With ten children in eight institutions participating, the data collection was supposed to include 80 children. However, one of the children was absent on the day of observation. Therefore, the sample in this study includes 79 children, 40 boys and 39 girls, with a mean age of 4.7 years (SD = 0.6) ranging from 3.8 to 5.8 years.

The researchers in the project developed a strict protocol for the procedure for video observations to ensure a random sample of children's activities. One ECEC teacher from each institution was recruited as a co-researcher and was the one who conducted the filming, to limit the impact on the children's behaviour and to keep an ongoing dialogue with the children about the filming to ensure consent to participate. The researcher participating in the data collection wrote field notes and ensured that the protocol was followed and a participant-as-observer role (Gold 1957) was selected to serve this role. This role was distanced to reduce the impact on the children's and staff's behaviour. If approached by children or staff, the researcher interacted with them but was otherwise conscious of avoiding interacting with staff and children during observation periods. The preschool teacher conducted the actual filming with a GoPro Hero action camera. The co-researcher was asked to regularly

do video observations before the data collection so that the children were familiar with being filmed. Cameras were also used for pedagogical documentation before this study in the participating institutions. Regular use of cameras before the data collection and a familiar person filming with a small wide-angle camera were essential to film children closely enough to be able to capture speech, body language, and facial expression without affecting the children noticeably. Nevertheless, higher participant reactivity is a limitation commonly associated with video observations in behavioural studies (Haidet et al. 2009).

Two children were observed each day. The first child was filmed for two minutes, followed by a six-minute break. Then, the other child was filmed for two minutes, followed by another six-minute break. This alternation was repeated until six video observations were recorded of each child in the indoor and outdoor environment. If a child was in situations in which filming was not an option due to ethical considerations, the video observation was postponed. The co-researcher avoided filming in sensitive situations and kept an ongoing dialogue with the children about the filming to ensure assent to participation.

A complete sample of 12 observations for 79 children would include 948 two-minute video observations. However, the final sample only includes 928 observations. Hence, 20 observations are missing. Missing observations occurred because children were picked up by their parents, or they were excluded because the child was hidden from view, was preoccupied with the camera, or a technical or human error occurred. The number of missing video observations is low and does not represent a methodological challenge for the present study.

2.2 Measures

The Leuven Well-Being Scale (Laevers 2005) was used to measure the well-being of the children. The scale, which is designed for observing children individually for two minutes, scores children's level of well-being on a scale from one to five. Laevers and Declercq (2018) describe the five levels as follows: 1) Outspoken signs of distress, 2) Signs of distress predominate, 3) A mixed picture, no outspoken signs, 4) Signs of enjoyment predominate, and 5) Outspoken signs of enjoyment.

The Leuven Involvement Scale (Laevers 2000) was used to measure the involvement of the children. This scale is developed by the same group of researchers as the well-being scale. It also ranges from one to five and is developed for observing an individual child for two minutes. Laevers and Declercq (2018) describe the five levels as follows: 1) No activity, 2) Interrupted activity, 3) Activity without intensity, 4) Activity with intense moments, and 5) Continuous intense activity.

The Observational System for Recording Physical Activity in Children–Preschool (OSRAC-P) (Brown et al. 2006) was used to measure the physical activity of the children. The classification of physical intensity in OSRAC-P used in this study is based on the Children's Activity Rating Scale (CARS) (Puhl et al. 1990), which has been psychometrically tested and found to demonstrate evidence of reliability (Puhl et al. 1990; Loprinzi and Cardinal 2011; Pate et al. 2010). The physical

activity intensity is classified in five different levels: 1) Stationary or motionless, 2) Stationary with limb or trunk movements, 3) Slow, easy movements, 4) Moderate movements, and 5) Fast movements (Brown et al. 2006).

Two independent researchers scored the well-being, involvement and physical activity of the observed child in each video observation on Excel spreadsheets. The project researchers were trained to use and interpret the Leuven scales and manuals through digital video training. To enhance the consistency in the coding of all three outcome measures, workshops to adjust, recalibrate and identify challenges were held when each researcher had scored 24 observations. These clips were reviewed jointly and discussed to strengthen the internal consistency in the coding. Disagreements higher 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. This choice implies that the scores for the outcome variables in the analysis were a nine-point scale, still ranging from one to five but also with intervening half scores (1.5, 2.5, 3.5, 4.5). In other words, the dependent variables in the analysis were treated as an interval scale, where the distance between scores was considered equal. Using weighted kappa (Cohen 1968), inter-rater agreement was 90% for well-being, with a kappa value of 0.50. A similar agreement was found for involvement, with 90% agreement and a kappa value of 0.58. Kappa values in this range indicate moderate agreement (Viera and Garrett 2005). For physical activity, the inter-rater agreement was 94%, with a kappa value of 0.73, indicating substantial agreement (Viera and Garrett 2005).

Risky play was coded using the Observer XT 12.5 behaviour coding (Noldus), analysis and management software for observation data (Zimmerman et al. 2009). This software allows for the second-by-second coding of videos, meaning that the researchers were able to code instances and duration of the various types of play behaviour. Three assessors independently coded a part of the video material according to recent categories of risky play (Sandseter and Kleppe 2019): 1) Play with great heights, 2) Play with high speed, 3) Play with dangerous tools, 4) Play near dangerous elements, 5) Rough-and-tumble play, 6) Play where children go exploring alone, 7) Play with impact, and 8) Vicarious risk. In the analysis, a merged variable describing the sum of these categories was used to investigate the association between total engagement in risky play and the three outcome variables. The prevalence of the sub-categories describing risky play is previously published (Sandseter et al. 2020).

Workshops and discussions among the researchers were held to ensure similar use and interpretation of the categories. The assessors aimed to evaluate the child's experience of risk in their activities, which may be identified through the child's positive and negative emotion, motor behaviour and verbal and bodily expressions. This implies that no "objective" level of riskiness was set; instead, the child's subjective experiences of risk were interpreted and determined based on observable verbal and bodily expressions and actions. Internal consistency in the coding between assessors was confirmed by cross-checking 80 observations among the 256 observations in which risky play was coded. In 59 of these observations (74%), no comments to the initial coding were made. In 15 of the observations (19%), comments on when to start or stop the coding of a specific category were made. In 6 observations (7%),

comments on what category of risky play that was most appropriate to use were made. The 21 observations with comments were reviewed jointly by all three assessors to discuss the second assessors' comments and to reach a mutual understanding of the use of categories and when to start or stop coding. Only minor adjustments to the full sample were needed following this evaluation of the measure, and the internal consistency was considered to be satisfying.

2.3 Analysis

The risky play codings from Observer XT were exported, paired with the spreadsheet of scores for well-being, involvement 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 nested observations of children within ECEC institutions, multilevel regression analysis (Goldstein 1986) was used to investigate the associations of risky play and children's well-being, involvement and physical activity. Linear mixed models, specifically random intercept models, were used in all multilevel analysis. The multilevel analysis makes it possible to control the nested data structure as well as other variables and increases the accuracy of the predictions (Gelman 2006).

3 Results

The mean duration of the 928 video observations was 122 s (SD = 4). The average amount of risky play in these observations was 12% (SD = 27). The average score for well-being was 3.8 (SD = 0.7), involvement was scored 3.7 (SD = 0.8) on average, whereas physical activity was scored 3.1 (SD = 0.9) on average. The 928 video observations were equally distributed among boys (N = 470) and girls (N = 458) and between the indoor environment (N = 464) and outdoor environment (N = 464). Table 1 presents descriptive statistics for the key variables.

The correlation matrix presented in Table 2 shows that risky play is positively correlated with well-being ($r = 0.27$, $p < 0.001$), involvement ($r = 0.19$ $p < 0.001$), and physical activity ($r = 0.44$, $p < 0.001$).

Multilevel regression analysis was applied to analyse the association between risky play and the outcome variables well-being, physical activity and involvement. This analysis was used to control for the nested data structure and the children's age and gender. Random intercept models were used in all multilevel analysis. The data were nested at three levels: observation level (level 1) (N = 928), child-level (level 2) (N = 79) and institutional level (level 3) (N = 8). The variance partition coefficient (VPC) was used to determine the number of levels in the model (Mehmetoglu and Jakobsen 2017). VPC calculations for well-being indicated that there was a 6% variance at the institutional level and 20% variance at the child level. Similar variances were found in involvement, with a 5% variance at the institution level and 17% variance at the child level. For physical activity, there was a 0% variance at the institution

Table 1 Descriptive statistics (N = 928 observations)

	Mean	SD	Min	Max
Age	4.7	0.6	3.8	5.8
Risky play	12%	27	0	100
Well-being	3.8	0.7	1	5
Involvement	3.7	0.8	1	5
Physical activity	3.1	0.9	1	5

Table 2 Correlation matrix (N = 928 observations)

	1	2	3	4	5	6
1. Age	—					
2. Boy (0 = girl)	0.12***	—				
3. Risky play	0.05	0.03	—			
4. Well-being	0.06	0.07*	0.27***	—		
5. Involvement	0.08*	0.06*	0.19***	0.76***	—	
6. Physical activity	0.07*	0.08*	0.44***	0.38***	0.28***	—

* $p < 0.05$: ** $p < 0.01$: *** $p < 0.001$

level and a 5% variance at the child level. Two-level models were selected for further analysis, following the limited amount of variance at the institutional-level.

Well-being, involvement and physical activity were used as dependent variables in the analysis to investigate the association with risky play. Stepwise inclusion of variables starting at the lowest level in the model (Hox 2010) was performed, implying that the variable describing the amount of risky play in the observation was added first, before children's age and gender. An intercept-only model was run first (M0), followed by a model including a variable describing the amount of risky play in the observation (M1). Lastly, the second-level variables describing children's age and gender were added to the model (M2). Deviance, Akaike's Information Criterion (AIC) and Schwarz's Bayesian Information Criterion (BIC) are presented to indicate how well the model fits the data and to compare the final model to the intercept-only model (Hox 2010). Tables 3, 4 and 5 present M0, M1 and M2 for well-being, involvement and physical activity.

The final models (M2) indicate that there is a positive association between engaging in risky play and children's well-being, involvement and physical activity. The size of the coefficients and the explained variance after including the variable for risky play in the models indicate that risky play is most strongly related to children's physical activity. However, substantial associations were also found with well-being and involvement.

Children's well-being is estimated to be 0.6 higher on the Leuven Well-being Scale when children engage in risky play for the entire observation (100% of the time). There is no significant association between gender, age and well-being. For well-being, M1 are a significantly ($p < 0.001$) improved model compared M0 using a likelihood-ratio test, while M2 is no significant improvement compared to M1.

Table 3 Models for well-being (N = 928 observations)

Model	M0: Well-being	M1: Well-being	M2: Well-being
Fixed part	Coeff. (Robust SD)	Coeff. (Robust SD)	Coeff. (Robust SD)
Intercept	3.84 (0.04)	3.77 (0.05)	3.48 (0.28)
Risky play		0.006 (0.001)***	0.006 (0.001)***
Age			0.05 (0.06)
Boy			0.08 (0.07)
Random part			
Level 1 Var	0.35 (0.02)	0.33 (0.02)	0.33 (0.02)
Level 2 Var	0.09 (0.02)	0.08 (0.03)	0.07 (0.01)
Deviance	1773	1713	1710
AIC	1779	1721	1722
BIC	1793	1740	1751

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 4 Models for involvement (N = 928 observations)

Model	M0: Involvement	M1: Involvement	M2: Involvement
Fixed part	Coeff. (Robust SD)	Coeff. (Robust SD)	Coeff. (Robust SD)
Intercept	3.69 (0.05)	3.63 (0.05)	3.10 (0.31)
Risky play		0.005 (0.001)***	0.005 (0.001)***
Age			0.11 (0.07)
Boy			0.09 (0.09)
Random part			
Level 1 Var	0.57 (0.03)	0.56 (0.03)	0.56 (0.03)
Level 2 Var	0.11 (0.02)	0.10 (0.02)	0.09 (0.02)
Deviance	2200	2177	2174
AIC	2206	2185	2186
BIC	2221	2205	2215

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Involvement is estimated to be 0.5 higher on the Leuven Involvement Scale when children engage in risky play for the entire observation. There is no significant association between gender, age and involvement. M1 are a significant ($p < 0.001$) improvement compared to M0 for involvement model using a likelihood-ratio test. For involvement, M2 is no significant improvement compared to M1.

Physical activity is estimated to be 1.4 higher on the OSRAC-P scale when children engage in risky play for the entire observation. Similar to the child's well-being and involvement, there is no significant association between gender, age and physical activity. For physical activity, M1 are a significantly ($p < 0.001$) improved model compared M0 using a likelihood-ratio test, while M2 is no significant improvement compared to M1.

Table 5 Models for physical activity (N = 928 observations)

Model	M0: Physical activity	M1: Physical activity	M2: Physical activity
Fixed part	Coeff. (Robust SD)	Coeff. (Robust SD)	Coeff. (Robust SD)
Intercept	3.05 (0.04)	2.89 (0.03)	2.54 (0.25)
Risky play		0.014 (0.001)***	0.014 (0.001)***
Age			0.06 (0.05)
Boy			0.10 (0.06)
Random part			
Level 1 Var	0.69 (0.04)	0.56 (0.03)	0.56 (0.03)
Level 2 Var	0.04 (0.01)	0.02 (0.01)	0.02 (0.01)
Deviance	2322	2127	2122
AIC	2328	2135	2134
BIC	2342	2154	2163

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

4 Discussion

The findings in this study demonstrated that children's engagement in risky play was positively associated with well-being, involvement and physical activity during periods for free play among the children in this study. To our knowledge, this is the first time such relations are documented empirically. Despite a growing risk awareness in the society, where children's possibilities for risky play are restricted (Sandseter and Sando 2016; Spiegal et al. 2014), as much as 12% of the observed time was categorised as risky play. This relatively high number indicates that risky play is a popular form of play among the children in this sample.

Among the child outcomes investigated in this study, risky play was most strongly associated with physical activity. Engagement in risky play for the entire observation was estimated to increase physical activity levels with more than one point on the OSRAC-P scale, representing a substantial increase in energy expenditure. The positive effects of physical activity on children's health are well-documented (Boreham and Riddoch 2001). As such, the results in the present study indicate that engagement in risky play may promote children's health through the engagement in physical activity, a finding in line with previous studies (Brussoni et al. 2015). Following this rationale, we will argue that the health benefit of physical activity in risky play outweighs the health threat of injuries associated with risky play. Therefore, facilitating risky play in childhood is health promotion, especially since risky play may improve children's ability to assess risk (Lavrysen et al. 2017; Miller and Byrnes 1997), and thereby also reduce injuries in a long-term perspective.

Another possible positive effect on children's health by engaging in risky play is related to the intrinsic and child-initiated nature of the activity. The motivation for risky play is linked to thrilling experiences (Sandseter 2010a). Positive activity habits may grow in such contexts, where children are physically active because they enjoy the activity in itself. The positive health effect is, thus, an unintended consequence of a fun activity.

Additional support for the notion that risky play is something children enjoy is found, in this study, in the positive association between risky play and well-being. Well-being is estimated to be 0.6 points higher on the Leuven Well-being Scale when children engage in risky play through the entire observation. This increase represents a substantial effect and indicates that children express joy and other signals of well-being when engaging in risky play. Previous research has documented how playing is positively associated with well-being (Kennedy-Behr et al. 2015; Giske et al. 2018; Howard and McInnes 2013), and this study demonstrates that this also is the case for risky play. Koch (2018) found that children in ECEC enjoy taking risks and exploring the limits of their capacities, and the findings in this study support the idea that risky play may promote children's well-being.

The positive association between risky play and well-being in this study may be due to various factors. First, no one tells the children to engage in risky play. It can, therefore, be said to have a salient aspect of autonomy. Autonomy is previously found to be essential to children's well-being in ECEC (Sandseter and Seland 2016). This can also be described as an experience of agency and promoting a positive sense of the self, which both are closely linked to well-being in childhood (Fattore et al. 2009). From a social perspective, mastering challenges together with peers strengthens friendships, which in turn relates positively to well-being (Fattore et al. 2009). Therefore, allowing risky play in ECEC institutions may contribute to various aspects of children's well-being. Additionally, in the experiential framework (Laevers 2000), the experience of well-being is a necessary prerequisite for deep-level learning.

The other key element of deep-level learning, involvement, was also positively associated with engagement in risky play. The association was comparable to the one with well-being, with an estimated increase in 0.5 on the Leuven Involvement Scale when children engaged in risky play for the entire observation. Previous studies have found playing to be an activity that is positively related to involvement (Liu et al. 2017; Zosh et al. 2017). With risky play being an intense play experience (Sandseter 2010a), risky play has the potential to be specifically positively related to involvement. As described by previous research, risky play is typically characterised by a balance between exhilaration and hesitation (Sandseter 2009b, 2010a; Kleppe et al. 2017). Children seek out these situations because the reward of potential exhilaration outweighs the potential negative consequences (Sandseter 2010a), and the ability to assess and master risk requires strong awareness and involvement. Risky play may, therefore, be an activity that may facilitate learning on children's premises. Handling risks requires both the ability to focus and to adapt to different strategies (Miller and Byrnes 1997), and thus represents an example of deep-level learning.

The ECEC years are a period when children "learn to learn", but even if practitioners and policymakers are increasingly aware of this (Barnett et al. 2014), the potential of risky play in these aspects is probably still too controversial to be considered. Child-initiated or child-led pedagogies are seen as optimal for helping children in foundational learning processes (Schleicher 2019), and the self-initiated nature of risky play seems ideal for facilitating learning on children's premises. Obviously, children should not be "forced" into playing risky. Instead, children should choose the play activity themselves,

in physical environments that afford risky play, and, not least, be supported appropriately by knowledgeable and competent ECEC teachers. Including risky play in the pedagogical practises could be one way of facilitating deep-level learning and thereby including a novel strategy for ensuring essential outcomes for children in ECEC.

4.1 Limitations and Future Research

Since this study draws on cross-sectional data that is based on video observations conducted within the children's everyday environment, several limitations to the study exist. No causal relationships can be established based on the results of this study, only associations between the engagement in risky play and the three outcome variables could be established. Also, the results may be highly influenced by the cultural context of the study. Norwegian culture is comparably positive towards children's risk-taking (Sandseter et al. 2019), and the degree to which the same associations exist in other cultural contexts is unknown. Furthermore, previous studies show that contextual factors, including the staff's attitudes and rules towards risky play (van Rooijen and Newstead 2017), parental characteristics (McFarland and Laird 2018) and the physical environment (Sandseter 2009a; Kleppe et al. 2017), are decisive for children's possibilities to engage in risky play but he present study lack control of such decisive aspects. Seasonal variations may also influence the possibilities for risky play in the ECEC institution, and the data in the present study were only collected during the fall. Still, this study's findings are valuable for other contexts since they demonstrate potential benefits of allowing children to take risk in their play, and may therefore be used to push back against institutionalized risk aversion.

The measures in this study aimed to evaluate complex phenomena through video observations, and limitations to these measures exist. In the measurement of well-being and involvement, children's perspectives on how they perceive their well-being or involvement are missing, and the measurement relies on the researcher's interpretation of children's demonstrations of their well-being and involvement. However, children express themselves largely through sounds, facial expressions and body language in actual situations.

The inter-rater reliability tests indicated only moderate agreement for the measures of well-being and involvement, and this represents a limitation to the study. Also, the psychometric properties of these scales have not been tested thoroughly. The physical activity scale was initially developed to score children's physical activity levels in short five-second epochs. The choice to evaluate the physical activity level of the children for two minutes represents a limitation, following the rapidly changing nature of children's physical activity with short bursts of activity (Bailey et al. 1995).

While the measurement of the three outcome variables used previously established scales, the protocol for measuring risky play was developed by the authors of this study. The second-by-second coding of risky play provided possibilities for detailed coding where observations could be reviewed several times. However, this also implied that detailed inter-rater scores could not be calculated in the same manner as for the three outcome variables, which were given a score for the entire video observation. Although as much as 30% of the coding of risky play was reviewed by

a second researcher, and the consistency was considered to be good, challenges and cultural bias exist when determining when children engage in risky play.

Nevertheless, analysing a vast number of video observations from different perspectives has provided new knowledge about how engaging in risky play is positively associated with the essential child outcomes well-being, involvement and physical activity in ECEC institutions. Future research may build on these findings and put the results of this study to test in more rigorous and controlled experiments in different cultural contexts. Future research should also target the role of staff in risky play to facilitate child outcomes, how individual children may benefit differently from risky play, how safety concerns can be balanced to allow risky play, and how the physical environment can be developed to promote risky play within a safe context. Such knowledge may benefit children's everyday experiences in ECEC institutions and their future lives.

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Declarations

Conflict of interest None.

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