Routledge
Taylor & Francis Group

Education 3-13

International Journal of Primary, Elementary and Early Years Education

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rett20

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To cite this article: Ellen Beate Hansen Sandseter, Rune Storli & Ole Johan Sando (2021): The relationship between indoor environments and children's play – confined spaces and materials, Education 3-13, DOI: 10.1080/03004279.2020.1869798

To link to this article: https://doi.org/10.1080/03004279.2020.1869798

Published online: 14 Jan 2021.

EDUCATION 3-13
https://doi.org/10.1080/03004279.2020.1869798

The relationship between indoor environments and children's play – confined spaces and materials

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ABSTRACT

The provision of environments that support and afford play is fundamental for young children's experiences, learning and development. Play environments of Early Childhood Education and Care (ECEC) institutions are therefore of great importance for the opportunities provided children to create and engage in a wide range of play. This study examines the association between Norwegian ECEC institutions' indoor environment (spaces and materials) and children's engagement in different types of play. Children (3–6 years, $N = 86$) were observed in two-minute sequences during periods of the day when they were free to choose what to do. The data consists of 943 randomly recorded two-minute videos, which were coded second-by-second to register the type of play occurring, the space in which it occurred and the materials children used. The results show that the indoor environment in the participating ECEC institutions afforded predictable play types in what could be called confined spaces designed and furnished for certain kinds of play activities. The authors discuss how this helps practitioners maintain predictability and control of children's play, while on the other hand, it restricts children's play and freedom to bring their own initiatives, ideas and creativity into the play in unpredictable ways.

ARTICLE HISTORY
Received 13 October 2020
Accepted 21 December 2020

KEYWORDS
Early childhood; play; indoor environments; affordances; Norway

Introduction

Play is a key aspect in children's lives, including their time spent in Early Childhood Education and Care (ECEC). Article 31 of the United Nations Convention on the Rights of the Child (UN 1989) highlights play as a fundamental right for all children. From children's perspectives, play is voluntary and self-controlled, fun, active, spontaneous, free, unlimited, natural and self-initiated (Wiltz and Fein 2006). Free play is most often defined very broadly as play that is dictated, initiated and controlled by the children themselves (Hewes 2014; Zigler and Bishop-Josef 2006). Santer, Griffiths, and Goodall (2007) elaborate this definition as free play being when children choose what they want to do, how they want to do it and when to stop and try something else. In ECEC settings that are supporting spaces and materials for free play, the children will normally take the lead, with the adults as distance observers of the play, ready to get involved and respond to cues from the children. Children's spontaneous free play is by nature complex; it may exhibit multiple forms, types and stages simultaneously (Hewes 2014). Forms of play are typically described along the locomotor, social and object dimensions (Pellegrini, Dupuis, and Smith 2007). Types of play are classified in a number of ways, but the most traditional is dividing between functional play, constructive play, symbolic/fantasy play and games with rules (Sawyers 1994). A number of studies have shown how the play

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environment is important for children's play, what they prefer to play and the opportunities they have to engage in different kinds of play (see e.g. Acer et al. 2016; Neill 1982; Nykiforuk et al. 2019; Zamani 2016).

The Norwegian ECEC context

The present study is conducted within a Norwegian context. In Norway, the ECEC institution (barnehage) is an early years setting designed to meet and ensure educational and care needs of children from birth to six years of age. Decreed by law, all Norwegian children up to age six years have the right to be educated and cared for in ECEC institutions. The education and care of children is a part of the educational system, but it is seen as separate from mainstream schooling that starts the year a child turns six and begins elementary school. The *Norwegian Framework Plan for the Kindergartens* (NMER 2017) applies to all ECEC institutions in Norway and guides teachers' pedagogical work with children. Children's right to play is regarded as an important element of the content, and ECEC is responsible for making good provisions for play, friendship and children's own culture, and provide opportunities for both indoor and outdoor play (NMER 2017). Play is regarded as a means for learning and developing a complex set of skills. In Norway, there has been an increasing focus on the importance of good learning environments, including good physical environments, which include buildings, rooms and the outdoors in ECEC (NMER 2015–2016). In line with this, the Norwegian Framework plan states that:

> The physical kindergarten environment shall be safe and challenging and give the children opportunities for engaging in varied forms of movement. Staff shall design the physical environment so that all children are given the opportunity to actively participate in play and other activities and so that toys and equipment are accessible to the children. (NMER 2017, 19)

An optimal physical environment will have varied indoor and outdoor play and activity opportunities, provide children with opportunities for exploration, social interactions, and a range of experiences and learning.

Children's play in indoor environments

For those interested in play environment design, looking at the affordances the environment furnishes or affords the child can be helpful. The theory of affordances (Gibson 1979) represents a dynamic framework for considering the utility and flexibility of the physical environment, focusing on the individual's perception of the surrounding environment. The basic assumption in this theory is that the physical environments in which we live afford opportunities to engage in various actions and behaviours. Moreover, the concept of affordances is dynamic and contextual, and Heft (2003) emphasises that affordances are not fixed functional properties of an environment. Rather, they are dynamic entities in the ongoing perception-action process. As such, the concept of affordances in children's play not only provides information about the properties and attributed qualities of environments but also indicates children's abilities to cope with and adapt to the environmental affordances (Aziz and Said 2016).

When complex buildings, such as ECEC institutions, are the focus of professionals planning, furnishing and facilitating children's play and learning activities (e.g. architects, interior architects, ECEC practitioners), knowledge of children's innate playfulness is particularly important to predict and evaluate their play behaviour within such environments. The frames in which play takes place, such as the physical organising of the indoor environment, access to play materials, and cultural and social regulations within the institutions, serve as constraints to secure some predictability of children's play and learning activity. However, children demonstrate their power as agents in their own activities through a dynamic process of play, where both predictability and unpredictability are essential (Fromberg 2006). Thus, unpredictability in play is how the individual child brings his/her own experiences, ideas, perceptions and creativity into the play situation and develops them

in unpredictable directions, both physically and mentally. In examining criteria for child-friendly environments, Kyttä (2004) highlights this positive cyclical interrelationship between children's independent mobility in play and the actualisation of affordances. The more mobility license the children have to explore and play, the more likely they will actualise affordances in their surroundings. In line with this, research has shown that environments with a multitude of accessible play materials and opportunities to use them seem to stimulate creativity and enhance play among children (Acer et al. 2016; Jansson 2015; Nicholson 1972; Nykiforuk et al. 2019; Torrens and Griffin 2013).

There is quite a large amount of research on how children play in outdoor environments, while how children play in ECEC indoor environments is more scarcely studied. Acer et al. (2016) conducted an observational study on how children utilise indoor environments (5-year-old nursery school children's classrooms). The results showed that in an originally designed classroom, children engaged most in dramatic play and manipulative play. Following an intervention of redesigning the space to afford more defined play zones and available play materials, dramatic and manipulative play was still frequent, but also constructive play such as drawing and painting, and more functional movement play such as hopscotch and jumping became more prevalent. The observations also revealed that after the intervention, the number of play materials used in the children's play increased, as did the diversity of their use of those materials. The length of engagement in play among the children also increased. In line with this, Evenstad and Brennhovd (2020) found that for children to engage in symbolic play, they needed a multitude of available materials as well as enough time for the play to appear, develop and continue.

Other studies have focused more on specific indoor spaces such as open floor spaces, tables and play zones. The youngest children's (age 11–48 months) use of open floor spaces, which was the most commonly used space, has been found to afford diverse types of exploration and activities, such as jumping, running, kneeling, riding cars, crawling, sitting, walking and standing (van Liempd et al. 2018). The same study also found that tables were places for more limited affordances, mostly used to sit or stand around while playing in-depth with small toys or doing a focused creative activity. Similarly, tables are found to be places for social interaction between children and staff in ECEC, parallel play or solitary behaviour, and surprisingly little social peer interaction (Torrens and Griffin 2013). These studies have looked at types of play more connected to the social interaction characteristics of the play (solitary play, parallel play, social play) and behaviour (running, crawling, sitting, standing, etc.), rather than focusing on various types of play and how the physical environment affords children with opportunities and invitations to engage in different kinds of play.

To our knowledge, this is the first study to systematically and quantitatively investigate the relationship between spaces and materials in the ECEC indoor environment and children's engagement in different types of play.

Aims and research questions

The aim of this study was to examine how children actualised features in their ECEC indoor environment (spaces and materials) for different types of play in their time for free play. In this study, *free play* implied that children could decide what they wanted to do, where they wanted to be and with whom they wanted to interact.

Methods

The sub-study reported in this article is part of a larger study, Competence for Developing Early Childhood Education and Care (ECEC) Institutions' Indoor and Outdoor Environments (EnCompetence), funded by the Research Council of Norway and approved by the Norwegian Social Science Data Services. EnCompetence was designed as a mixed-methods research approach (Creswell 2015) and included systematic and randomised video observations of children in indoor environments during free play at two data points (fall 2017 and fall 2018).

Participants

The participating ECEC institutions in the study were selected from facilities operated by three partnering ECEC owners. The owners made at least twice as many ECEC institutions available as were required for the study and provided relevant information about each of them, including their size, location, age, spatial qualities, number of departments and number of children in attendance. An important criterion for selected institutions was having at least 20 children aged three to four years old who could be recruited as participants. The researchers selected eight ECEC institutions based on a strategic choice to include different types of institutions in terms of the size, quality and age of the spaces therein. Even though the participating institutions were different, their indoor space had several similarities. They all contain large common rooms for the child group with tables and chairs, and they all had several play zones designated for certain activities such as family play, constructive play and play with toy cars. All of them also had one or more smaller and specialised rooms, such as for math activities, language activities, drama activities or physical activity. Usually, these rooms were shared with the rest of the child groups in the ECEC institution and needed special planning and timing to be used.

The strategy for sampling children to participate was to seek informed consent from all the children's parents, then randomly draw ten children who consented to participate—five boys and five girls—from each institution. As a result, the first period of data collection (T1) included 80 children. Because the second period of data collection (T2) occurred a year after T1, some amendments were made to the sample at T2. In particular, six of the 80 participants no longer attended the institutions at T2, and one child was not included at T2 for ethical reasons. Following the likelihood of dropout anticipated at T1, a list of other children who consented to participate was used to randomly select seven additional children for T2 to replace the dropouts. However, one of the children was sick on the day of observation, which left only six children as replacement participants. Ultimately, the sample consisted of 86 children: 80 at T1 and 79 at T2. The distribution of gender between T1 and T2 was nearly equal, with 51% of the observations being of boys and 49% being of girls. Children's mean age was 3.8 years ($SD = 0.6$) at T1 and 4.7 years ($SD = 0.6$) at T2.

Procedure and data

All observations were video-recorded and performed in accordance with a strict protocol that ensured a random sampling of observational sequences and identical methods of data collection at each institution. Researchers selected two children to be observed on each day of observation, and each child was observed for six two-minute sequences during free play indoors. The protocol instructed the data collector to perform each observation by recording Child 1 for two minutes, followed by a six-minute break to locate the next child in the play area. Next, Child 2 was recorded for two minutes, followed by another six-minute break to find Child 1 for his or her second round of observation, and so forth. If the data collector encountered a child in a situation that could not be filmed (e.g. using the toilet or changing clothes), then the observation was postponed until filming was permitted. If the child was in such a situation for more than ten minutes, then the data collector continued to observe the other child and performed the missing observations at the end of the observation period.

Although a full sample of six observations of 80 children at two data points would have included 960 observations, the final sample included only 943 video observations, meaning that 17 observations were missing (1.8%). Some missing observations occurred because children were sick or picked up early, while others were excluded because the child was hidden from view, the child was preoccupied with the recording equipment, or a technical or human error occurred. The final sample reflected a fairly equal distribution of observations at the two data points, with 479 observations at T1 and 464 at T2.

Ethical considerations

There are special ethical issues in research involving young children (Fine and Sandstrom 1988). One issue is the need to gain informed consent from both parents and children (also from the children in situ before each observation). Informed consent from parents was gathered through their signature after presenting them with written information about the project and how data was to be handled and disseminated. Concerning children's own consent, it is important to ensure that they understand both their own and the researcher's role during the data collection and that they can withdraw from the project at any time (Grieg, Taylor, and MacKay 2007). The researchers in this study, who knew the children well, explained to each child in an understandable way the observations that would be conducted, and informed them of their right to withdraw at any time. The researchers were also very conscientious to refrain from recording children in sensitive situations such as toileting and changing clothes.

The study was approved by the Data Protection Official for Research in Norway, under the premise that the data would not be analysed or published at group level due to the relatively low number of children in each institution.

Measures

The play types utilised in this study were inspired by Dyment and O'Connell's (2013) play categories. For this study, the two last categories (self-focused/looking on, and talking) were merged and renamed 'non-play' since this was not considered to be play activity. This was, for instance, children just looking at other children playing or looking around for something to do, children and practitioners talking about things other than play-related themes. One additional category called 'mixed play' (inspired by Luchs and Fikus 2013) was added to capture sequences where it was difficult to assign one play category because the child engaged in a mix of more than one category. The following play categories were used in the coding process:

- Functional (physical play activities, e.g. running, jumping, climbing, wrestling).
- Constructive (building play activities, e.g. creating forms and constructions with different kinds of materials, drawing, painting).
- Symbolic (creative/imaginative play, e.g. role play, dramatic play, social play).
- Non-play (self-focused/looking on; no interaction with others, not engaged in play, e.g. daydreaming, empty staring, watching activities; or talking, not engaged in active play but talking with another child).
- Mixed play (when children combine several types of play without any type being dominant).

The two latter categories are not in focus in this article. Non-play was not the focus of this article, and mixed play was found to be very limited in the present data material.

Categories for play spaces and play materials were developed to measure the components of the physical environment. The categories of indoor spaces were based on previous research (Acer et al. 2016) as well as discussions within the project group and constant dialogue with the data. The following categories were developed: flex space (spaces between other zones and furniture, places not specifically coded for any activity or purpose), tables (both child-height and adult-height tables), cubbies (cubbies for children's outdoor gear, rain clothes, boots, etc.), Room for physical activity (PA) (spacious rooms – approx. 50 m_2 – designed specifically for PA), tumbling spaces (areas with soft surfaces, large construction materials, pillows and blankets), play zones (zones with materials such as building blocks, outfits, kitchen equipment, play animals), chambers (smaller subspaces such as cubes, dens and hideouts), other (window posts, changing rooms, toilets or bathrooms). Places were coded continuously, and the categories were mutually exclusive. The use or presence of play materials was coded when a child was holding, using or interacting with a material. To

capture the idea that children can use several materials at once, the categories were not mutually exclusive. The categories for materials were pillows, blankets, large construction materials, small construction materials, open-ended materials, outfits, defined toys, art materials, furniture and other materials (books, electronic devices, etc.).

The assessors coded every category of play type, space and material second-by-second in each observation. One assessor coded the categories, and a second assessor reviewed a random sample of 10% of the video observations to ensure consistent coding and interpretation. This procedure resulted in discussions about how specific observations should be interpreted. These discussions resulted in a unified understanding of each category, and some minor revisions to the initial coding. The overall consistency was considered satisfactory.

Analysis

Random intercept models were used in all multilevel analysis. The data were nested at three levels: observation level (level 1; N = 943), child level (level 2; N = 86) and institutional level (level 3) (N = 8). The variance partition coefficient (VPC), with a limit of 5% variance, was used to determine the number of levels in the model (Mehmetoglu and Jakobsen 2017). VPC calculations for functional play indicated a 2% variance at the institutional level and 7% variance at the child level. For constructive play, a 1% variance was found at the institution level and 9% variance at the child level. For symbolic play, there was a 2% variance at the institution level and a 10% variance at the child level. Two-level models were selected for further analysis. Functional play, symbolic play and constructive play were used as dependent variables in the analysis to investigate the association with spaces and materials in the outdoor environment. Stepwise inclusion of variables starting at the lowest level in the model (Hox 2010) was performed, implying that the variable describing spaces and materials used in the observation was added first, before children's age and gender. Only significant variables were included in the next model. An intercept-only model (a model without any explanatory variables) was run first (M0), followed by a model including a variable describing spaces (M1), before the materials were added (M2). Lastly, the second-level variables describing children's age and gender were added to the model (M3). 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 previous models (Hox 2010).

Results

The mean duration of the 943 video observations was 122 s (SD = 6). The average amount of functional play in these observations was 13% (SD = 30). Constructive play was coded in 35% (SD = 43) of the observed time, and the average amount of symbolic play was 20% (SD = 37). Table 1 presents descriptive statistics for the key variables.

Constructive play, places and materials

The final regression model (M3) for constructive play is shown in Table 2. M3 indicates that there is a positive association between the space category tables and constructive play. The amount of constructive play in the observation is estimated to increase 29% when children spend 100% of the observed time at tables. None of the other space categories are associated with constructive play. While the use of blankets, pillows, outfits and furniture has no association with constructive play, all the other materials do. The estimated effect of using small construction materials (65% increase), art materials (48% increase), open-ended materials (17% increase), large construction materials (8% increase) and defined toys (8% increase) are all positively associated with constructive play. There is no significant association between constructive play and the child's age or gender. For constructive play, M1 and M2 are significantly ($p < .001$) improved models compared to the previous model using

Table 1. Descriptive statistics (N = 943 observations).

Variable	Mean	SD	Min	Max
Age	4.2	0.7	2.9	5.8
Functional play	13%	30	0	100
Constructive play	35%	43	0	100
Symbolic play	20%	37	0	100
Places				
Flex space	28%	40	0	100
Tables	20%	38	0	100
Cubbies	7%	23	0	100
Room for PA	5%	21	0	100
Tumbling spaces	13%	33	0	100
Play zones	23%	40	0	100
Chambers	3%	15	0	100
Other (windows and bathrooms)	1%	9	0	100
Materials				
Pillows	2%	13	0	100
Blankets	3%	16	0	100
Large construction materials	12%	30	0	100
Small construction materials	21%	39	0	100
Open-ended materials	4%	18	0	100
Outfits	3%	17	0	100
Defined toys	24%	39	0	100
Art materials	16%	35	0	100
Furniture	21%	34	0	100
Other materials (books and electronic)	2%	12	0	100

a likelihood-ratio test. M3 is not a significantly improved model compared to M2. The substantial reduction in deviance from M0 to M1 and from M1 to M2 demonstrates that the variables describing space and materials in the ECEC indoor environment explain a considerable amount of variation in constructive play.

Table 2. Regression models for constructive play (N = 943 observations).

Model	M0 Empty	M1 Places	M2 Materials	M3 Final model
Fixed part	Coeff.(SD)	Coeff.(SD)	Coeff.(SD)	Coeff.(SD)
Intercept	35 (2)	28 (12)	2 (3)	−3 (7)
Flex space		.02 (.12)		
Tables		.47 (.12)***	.31 (.04)***	.29 (.04)***
Cubbies		−.15 (.13)		
Room for PA		−.15 (.14)		
Tumbling spaces		−.21 (.12)		
Play zones		.05 (.12)		
Chambers		−.10 (.14)		
Pillows			−.09 (.08)	
Blankets			.10 (.07)	
Large construction			.10 (.04)*	.08 (04)
Small construction			.67 (.03)***	.65 (.03)***
Open-ended			.19 (.06)**	.17 (.06)**
Outfits			.05 (.06)	
Defined toys			.08 (.03)*	.08 (.03)*
Art materials			.48 (.04)***	.48 (.04)***
Furniture			.05 (.03)	
Age				1.5 (1.6)
Boy				0.6 (2.8)
Random part				
Level1Var.	1709 (83)	1305 (63)	881 (43)	888 (43)
Level2Var.	168 (50)	134 (39)	80 (25)	79 (25)
Deviance	9758	9505	9130	9136
AIC	9764	9525	9156	9158
BIC	9779	9574	9219	9211

*p < .05: **p < .01: ***p < .001

Symbolic play, places and materials

The final regression model (M3) for symbolic play (Table 3) shows a positive association between the space categories play zones and chambers and children's engagement in symbolic play. The amount of symbolic play is estimated to increase 28% in chambers and 18% in play zones when children spend 100% of the observed time in these spaces. The other space categories (flex space, tables, cubbies, room for PA and tumbling spaces) are not associated with children's symbolic play. Three of the material categories were positively associated with children's symbolic play; using defined toys (29% increase), blankets (27% increase) and outfits (17% increase) all estimated higher engagement in symbolic play. Using small constructive materials was negatively associated with symbolic play, while the other materials (pillows, open-ended materials, art materials and furniture) were not associated with this kind of play. There is no significant association between symbolic play and the child's age or gender. For symbolic play, M1 ($p<.001$) and M2 ($p<.001$) and M3 ($p<.05$) are significantly improved models compared to the previous model using a likelihood-ratio test. The reduction in deviance from M0 to M1 and from M1 to M2 demonstrates that the variables describing space and materials in the ECEC indoor environment explain a reasonable amount of variation in symbolic play.

Functional play, places and materials

The final regression model (M3) for functional play (Table 4) shows a positive association between the space categories room for PA and tumbling spaces and functional play. The amount of functional play in the observation is estimated to be 27% higher when a child spends 100% of the observed time in either of these spaces. There is no association between functional play and the other space categories; flex space, tables, cubbies, play zones or chambers. There is a minor non-significant association between functional play and the use of pillows, while materials such as blankets, small construction materials, outfits, defined toys and art materials are negatively associated with

Table 3. Regression models for symbolic play ($N = 943$ observations).

Model	M0 Empty	M1 Places	M2 Materials	M3 Final model
Fixed part	Coeff.(SD)	Coeff.(SD)	Coeff.(SD)	Coeff.(SD)
Intercept	21 (2)	10 (11)	8 (3)	15 (7)
Flex space		.10 (.11)		
Tables		−.06 (.11)		
Cubbies		−.04 (.12)		
Room for PA		.03 (.12)		
Tumbling spaces		.08 (.11)		
Play zones		.30 (.11)**	.17 (.03)***	.18 (.03)***
Chambers		.36 (.13)**	.28 (.07)***	.28 (.07)***
Pillows			.16 (.08)	
Blankets			.23 (.07)**	.27 (.07)***
Large construction			.04 (.04)	
Small construction			−.08 (.04)*	−.09 (.03)**
Open-ended			.05 (.06)	
Outfits			.18 (.07)**	.17 (.07)**
Defined toys			.29 (.04)***	.29 (.03)***
Art materials			−.04 (.04)	
Furniture			.06 (.03)	
Age				−1.4 (1.6)
Boy				0.2 (2.6)
Random part				
Level1Var.	1244 (60)	1148 (56)	1002 (49)	1014 (49)
Level2Var.	137 (41)	55 (27)	48 (24)	48 (24)
Deviance	9464	9356	9228	9239
AIC	9470	9376	9256	9261
BIC	9484	9425	9324	9314

*$p < .05$: **$p < .01$: ***$p < .001$

Table 4. Regression models for functional play ($N = 943$ observations).

Model	M0 Empty	M1 Places	M2 Materials	M3 Final model
Fixed part	Coeff.(SD)	Coeff.(SD)	Coeff.(SD)	Coeff.(SD)
Intercept	13 (1)	12 (8)	18 (2)	21 (6)
Flex space		−.05 (.08)		
Tables		−.12 (.08)		
Cubbies		.15 (.09)		
Room for PA		.27 (.09)**	.26 (.04)***	.27 (.04)***
Tumbling spaces		.31 (.09)***	.24 (.04)***	.27 (.03)***
Play zones		−.08 (.08)		
Chambers		−.09 (.10)		
Pillows			.13 (.07)*	.12 (.06)
Blankets			−.20 (06)***	−.19 (.06)**
Large construction			.04 (.05)	
Small construction			−.17 (03)***	−.18 (.03)***
Open-ended			−.03 (.05)	
Outfits			−.11 (.05)*	−.12 (.05)*
Defined toys			−.12 (.03)***	−.13 (.03)***
Art materials			−.17 (.03)***	−.18 (.03)***
Furniture			.03 (03)	
Age				−0.7 (1.2)
Boy				1.9 (2.0)
Random part				
Level1Var.	806 (39)	634 (31)	617 (30)	618 (31)
Level2Var.	66 (23)	24 (14)	22 (13)	21 (13)
Deviance	9041	8789	8763	8764
AIC	9047	8811	8791	8790
BIC	9062	8865	8859	8853

*$p < .05$: **$p < .01$: ***$p < .001$

functional play. There is no relationship between functional play and the use of large construction materials, open-ended materials or furniture. The child's age and gender are not associated with the engagement in functional play. Considering the three models, M1 ($p < .001$) and M2 ($p < .05$) are significantly improved models for functional play compared to the previous model using a likelihood-ratio test. M3 is not a significantly improved model compared to M2. In line with this, AIS and BIC measures indicate that M2 is the better model. The considerable reduction in deviance, AIC and BIC from M0 to M1, and the further reduction from M1 to M2 indicates that spaces and materials in the ECEC indoor environment have an impact on the amount of functional play.

Discussion

The descriptive results in this study (Table 1) show that constructive play is the most common type (35%) of play children engage in when being in the ECEC indoor environment. Also, the amount of symbolic play among children is quite high (20%), while children seldom engage in functional play indoors. This would indicate that the indoor physical environments in the ECEC institutions have better opportunities for constructive and symbolic play and less so for functional play. Even though Acer et al. (2016) use other terms for play types, one could assume that what they found as dramatic play and manipulative play being the most prevalent play types in an originally designed classroom are similar to symbolic play and, to some extent, constructive play (also including manipulation) in the present study. Moreover, it could indicate that the physical environments in the ECEC institutions participating in the present study are quite originally designed. Where Acer et al. (2016) did not move into a more detailed analysis of how different spaces and materials in the ECEC environment afforded various kinds of play, this study has aimed to look at such associations to better enable the more successful future design of ECEC institutions.

The most common type of play in the ECEC indoor environment, constructive play (such as building play activities, creating forms and constructions, drawing) was strongly associated with tables,

both child-size and adult-size (Table 2). Also, materials such as small and large construction materials, open-ended materials and art materials and defined toys were positively associated with constructive play. None of these associations are surprising, since tables would afford sitting down and engaging in fine motor activities such as building with Legos or drawing, similar to findings in other studies (Torrens and Griffin 2013; van Liempd et al. 2018). On the other hand, the results that none of the other space categories were associated with constructive play was a bit surprising. One could assume that constructive play could easily appear in other spaces, such as flex spaces, cubbies and play zones. A reason for this could be that materials for construction are not available in these spaces, but confined to the table spaces, and practitioners often seem to prefer such materials being used in a predictable and controlled setting on tables rather than being carried around and spread around in the larger indoor space.

Similar to tables being strongly associated with constructive play, the results (Table 3) showing that play zones and chambers were positively associated with symbolic play (creative/imaginative play, role play, dramatic play) were not surprising. These are small hideouts, dens or more private spaces where children can engage in social interaction and create imaginative and dramatic scenarios without too much interruption. Symbolic play needs space, time and privacy to develop and continue (Evenstad and Brennhovd 2020), and smaller play zones and chambers provide the best opportunity to afford and protect such shielding. The results also show that defined toys, blankets and outfits were positively associated with symbolic play. These are play materials that certainly afford imaginative play, role play and dramatic play, and they are probably more available in play zones and chambers than in other spaces in the ECEC indoor environment. Once again, materials seem to be distributed between spaces in the ECEC in a way that confines them to spaces where the practitioners want certain play types to happen, rather than all materials being available in all spaces or introducing unusual materials in some spaces to see how children utilise them. In line with this interpretation, the results show that small constructive materials, open-ended materials and art materials are not associated with symbolic play (small constructive materials are even negatively associated), which is surprising since are materials could easily be used in symbolic play. Nevertheless, if small arts, open-ended and constructive materials are confined to tables, the opportunity for children to use these to create symbolic play is more difficult when sitting at a table rather passively (van Liempd et al. 2018).

The least common type of play in the ECEC indoor environment, functional play (physical active play activities) was strongly associated with rooms for PA and tumbling spaces. As with the other play types, this is not surprising. These are spaces designed for such play; hence, the children seem to pick up on these affordances (Kyttä 2004) and choose these spaces when they (not so often) choose to engage in functional play. On the other hand, the fact that there is such a low amount of functional play could be explained with these rooms and spaces being less available for children. Especially, rooms for PA in the participating ECEC institutions were all specialised rooms shared with the rest of the child groups in the institution and had to be booked before they could use them. In practice, this was an obstacle for daily use of these rooms for all children, and for some children, it could mean having access for a short period of time every second week. Other studies, though with even younger children, have found that functional play such as jumping, running and crawling was associated with open floor spaces (van Liempd et al. 2018). In the present study, there is no significant association between flex space (similar to open floor space) and functional play. This would indicate that with children ages three to six, one should provide easily available spaces for physical activity and tumbling play within their common ECEC environment, and only providing open floor spaces is not enough to afford opportunities for functional play.

Moreover, the results showing that most materials were negatively associated with functional play is discouraging. The materials available in the ECEC institutions do not seem to afford functional play. On the other hand, this finding is not surprising since most of the materials afford more quiet and sedentary forms of play, such as constructive play and symbolic play as discussed above. A

rather surprising finding, though, is that large constructive materials are not associated with functional play. Many of the rooms for PA and tumbling spaces included large soft and semi-soft constructive materials, and one could assume these would be used for gross motor activities, but the association between these and functional play was not significant. One reason could be that constructive play with these large materials has been coded constructive play in the present study, even though the play also included some degree of physical activity.

The results in the present study show that there are no gender or age differences in any of the play types. This means boys and girls and children of different ages engage in all three play types to the same extent in the ECEC indoor environment. Concerning constructive play, this is a bit surprising. Building and constructing could be assumed to require highly developed fine motor skills and as such, activities that would suit older children with higher skills more. In addition, boys have previously been found to show more interest in building and constructing than girls, but an emphasis on involving girls in constructive play has changed this trend (Edwards, Knoche, and Kumru 2001) and could explain why gender differences were not found in the present study. Another reason the present study did not find gender differences could be that constructive play also included activities like drawing and painting that might be evenly attractive to girls, or it could just be that the girls in this study also like to build and construct. Also, seen in light of knowledge that symbolic play requires somewhat enhanced cognitive skills (Garner and Bergen 2006), the finding of no age difference in symbolic play is somewhat surprising and contrary to what we have found in data from the outdoor environment (Sandseter, Storli, and Sando, forthcoming). This could indicate that the indoor environments have spaces and materials for symbolic play better suited for the younger children than what the outdoor environments have. Finally, no gender differences in functional play is somewhat contradictory to earlier research finding boys to be more physically active than girls (Eaton and Enns 1986; Epstein et al. 2001). However, in a Norwegian equality context where genders are treated rather similarly and given equal opportunities and expectations, this finding is not surprising.

Concluding remarks

Overall, the results in this study show that the children play rather predictively in the ECEC indoor environments. Children's play seems to be confined to certain spaces where materials for a certain kind of play are available. There could be multiple reasons for this, and one of them is the staff trying to have control of where, when and with what play emerges, in order to keep things tidy, predictable and manageable. Another reason could be a trend of designing ECEC institutions with many specialised rooms which also reflects the highlighted subjects (e.g. math, physical education, literacy, nature and science) in the Framework plan (NMER 2017), and further signals that the institutions are covering all learning areas as required. This seems to be a good way to communicate their content clearly to the world outside, but might not be very successful when trying to provide children with opportunities for a broad variety of play activities where they can actualise affordances and bring their individual experiences, ideas, perceptions and creativity into unpredictable directions, alone and with others (Fromberg 2006; Kyttä 2004).

The findings in the present study build on cross-sectional data with observations conducted in a naturalistic context, and there are limitations to this study that must be considered. Only associations between children's play and the investigated spaces and materials are established, and no casual claims are made. The study is also situated in a cultural context where children's free play and participation is highly valued (NMER 2017), something that must be considered when transferring the findings to other circumstances. Moreover, play is an ambiguous concept (Sutton-Smith 2001) that is challenging to measure, since what goes on inside the child's head is an important but unknown entity. The categorisation of children's play relies on the researchers' interpretations of children's behaviours and categories used, and that represents a limitation to this study. The process of reviewing the coding revealed that the boundaries between different play types are quite blurry, and

perhaps even non-existent in some observations. Although the use of mutually exclusive play categories was necessary for the analysis conducted in this study, this may have caused underestimation of less expressive and easy to identify play behaviours. These limitations must be considered when interpreting the results.

The results from the present study contribute with a deeper understanding on how children utilise features in the ECEC indoor environment and would be valuable knowledge for architects and ECEC owners and practitioners when designing and developing physical environments for children. A main finding is that the ECEC indoor environments, to an over-extent, were designed and furnished in a way that confined play to certain spaces and resulted in rather space-dependent opportunities for play. In order to provide children with a multitude of affordances (Kyttä 2004) and possibilities for free, creative play on their own initiative and within their own culture (NMER 2017), it is important to dare to think 'out of the box' and provide more unpredictable, varied and diverse environments. Constructive play could, for instance, just as well emerge in the cubby or flex space by adding and allowing materials for such play there, and affordances for symbolic play could be added in the room for PA or tumbling space. The main take-home message for professionals working with young children is that they should provide children with opportunities for a broad variety of spaces and materials, as well as give them the freedom to bring individual experiences, ideas, perceptions and creativity into the process of developing their play.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Research Council of Norway under Grant 270727.

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