

**The Role of Early Educational Experiences in Child Development:  
Evidence from a Context of Universal Access**

Nina Alexandersen

Department of Child Health and Development  
Norwegian Institute of Public Health

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## Summary

Using data from the Norwegian Mother, Father and Child Cohort Study (MoBa), as well as data collected from the children's teachers in ECEC (at 5 years) and school (at 8 years), this thesis seeks to expand the knowledge on the environmental factors that shape child development. Specifically, the thesis focuses on Early Childhood Education and Care (ECEC) as an important environmental context for child development. Children from less advantageous socioeconomic backgrounds are argued to benefit most from attending ECEC. Nevertheless, the benefits of ECEC for child development are critically dependent on quality.

In the first paper, we investigate potential socioeconomic inequalities regarding access to quality in ECEC, in a context where universal policies are expected to ensure equal access for all children. However, limited evidence exists on whether universal policies have succeeded in achieving this goal. We found some indications of socioeconomic inequalities in the access to quality in ECEC, suggesting selection as one of the potential mechanisms. The children of higher-educated parents appeared to access a higher structural quality that together with the parental SES predicted a better relationship quality with their teachers.

In the second paper, we examine some of the mechanisms between different aspects of quality, child functioning and well-being in ECEC. The results suggest that structural quality aspects influence children mainly indirectly via its impact on the relationship quality. Further, we employed a sibling design to address omitted variable bias in the associations between the student-teacher relationship and child outcomes. The associations between the relationship quality (in terms of closeness) and child functioning were relatively strong, even after accounting for relevant child characteristics and unobserved stable family factors.

In the third paper, we extend our investigation to school age children, linking their relational experiences with teachers in ECEC and school to their behavioral outcomes outside the educational context (as observed by their mothers). Specifically, we study the associations between student-teacher closeness and conflict and children's internalizing and externalizing behavior. To strengthen the internal validity of the evidence we used conditional within-person and within-family models (individual and sibling fixed-effects). The overall results provided support for the importance of the student-teacher relationship for child behavioral functioning beyond the ECEC and school context.





## List of Papers

### Paper I

Alexandersen, N., Zachrisson, H. D., Wilhelmsen, T., Wang, M. V., & Brandlistuen, R. E. (2021). Predicting selection into ECEC of higher quality in a universal context: The role of parental education and income. *Early Childhood Research Quarterly*, 55, 336-348.

### Paper II

Alexandersen, N., Zachrisson, H. D., Røysamb, E., Wilhelmsen, T., Wang, M. V., & Brandlistuen, R. E. Preschool Structural Quality and Student-Teacher Closeness are Related to Children's Well-being and Functioning: Sibling-Informed Design. *Submitted to Developmental Psychology*

### Paper III

Alexandersen, N., Zachrisson, H. D., Røysamb, E., Wilhelmsen, T., Wang, M. V., & Brandlistuen, R. E. Student-Teacher Closeness and Conflict and Child Behavioral Functioning During Transition to School: Evidence from Within-Child and Within-Family Analysis. *Under review in Child Development*



# 1 The Role of Early Educational Experiences in Child Development

Child development can be viewed as a process of dynamic interactions or transactions between the child and their proximal environments extending over time and subject to multiple sources of influence (Bronfenbrenner & Morris, 2006; Sameroff, 2009). Children inherit 50% of their DNA from each of their parents and share, on average, the same amount of DNA with their siblings (Gagnon et al., 2005). Throughout their childhood children experience different environmental contexts. One of the first influential contexts children encounter is that of their home and family. Families differ with respect to socioeconomic background, parental values and resources, such as time, knowledge, financial means and health. Accordingly, parents vary in their parental styles and learning opportunities they can provide to their children. Children from the same family are largely exposed to the same home environment, which, via the interplay with their individual traits and characteristics, influences their future experiences and development.

As a growing number of children attend Early Childhood Education and Care (ECEC) (OECD, 2020), in a period foundational for the development of cognitive and socioemotional capacities and highly sensitive to the environmental influences (Knudsen et al., 2006; Shonkoff & Phillips, 2000), the role of ECEC becomes paramount. Across nations, scholars and policy makers increasingly recognize the importance of high quality ECEC for child development (European Commission/EACEA/Eurydice, 2019; Yoshikawa et al., 2013), particularly for children from disadvantaged socioeconomic backgrounds (Duncan & Magnuson, 2013; Heckman, 2006; van Huizen & Plantenga, 2018).

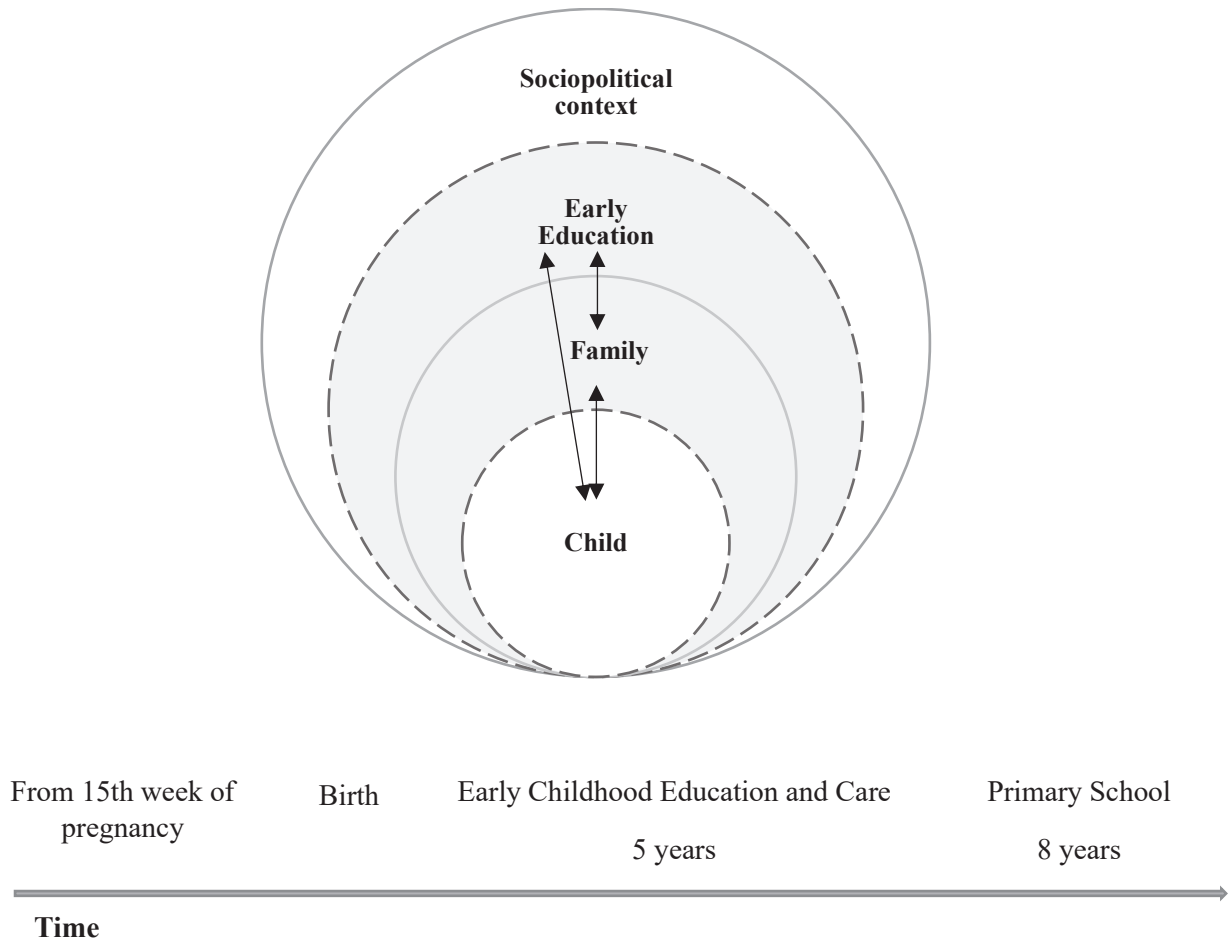
Quality in ECEC is a multidimensional concept where structural dimensions of classrooms and the characteristics of staff are assumed to impact child development, mainly indirectly via its influence on the quality of interactions and relationships between teachers and children (Burchinal, 2018; NICHD Early Child Care Research Network, 2002; Slot, 2018). Researchers have developed different measures to address the multidimensionality of the quality in ECEC and enable comparison across different contexts and children's developmental stages. One central feature across the measures is the recognition of the potentially critical role that teachers have in children's everyday experiences in ECEC.

Prior theoretical and empirical work suggests that close and supportive relationships may provide a secure base for children and facilitate development of essential skills and competencies (Mashburn & Pianta, 2006; Pianta & Stuhlman, 2004; Verschueren & Koomen, 2012). Furthermore, there is evidence that close relationships with teachers may moderate earlier negative relational experiences and improve functioning of children with behavioral and demographic risks (Sabol & Pianta, 2012). The benefits of close relationships with teachers are also evident in adolescence and across different developmental domains (Ansari et al., 2020). The relationships characterized by low closeness or high degrees of conflict appear, on the other hand, to have a detrimental impact on children's development (O'Connor et al., 2012; Sabol & Pianta, 2012). The impact of children's early experiences with teachers in ECEC appears to extend beyond the educational context, impacting their later interactions with parents (Skalická et al., 2015b).

Figure 1 below provides a general conceptual framework for this thesis. In line with the ecological perspectives on child development (Bronfenbrenner, 1977; Bronfenbrenner & Morris, 2006; Sameroff, 2009), children's individual traits and characteristics, family and educational settings are among the central components of the model. These are further embedded within the sociopolitical and cultural context that shapes the characteristics of social and educational institutions such as family, ECEC and school and the experiences of the child. Furthermore, the family and early educational institutions are among the principal contexts for *transactions* (Sameroff, 2009) and '*proximal processes*' - the child's bidirectional interactions over time with people, objects and symbols in the immediate environment (Bronfenbrenner & Morris, 2006). The area of these proximal contexts and processes in the conceptual model is highlighted and denoted with a dashed line.

**Figure 1**

*Conceptual Model*



*Note.* In the ecological or bioecological model of development, both family and educational institutions are in the closest system to the child or immediate environment (*microsystems*), and these interact with each other (*mesosystem*). The original *ecological model* of development (e.g., Bronfenbrenner, 1977) has evolved over the years to become the *bioecological* model with four central elements: *Process*, *Person*, *Context*, and *Time* (Bronfenbrenner & Morris, 2006).

## 1.1 Child Development: Theory and Empirical Evidence

### *The Child: Individual Characteristics*

The importance of individual characteristics in child development is widely acknowledged in both theoretical and empirical work. For example, Bronfenbrenner and Morris (2006) in their discussion of the bioecological model of development underscore the important role of a person's characteristics in "proximal processes" - the primary drivers of development. Similarly, drawing on the developmental systems theory (or an ecologically oriented systems theory (Sabol & Pianta, 2012)), Pianta et al. (2003) identify characteristics of the individuals (e.g., temperament, gender, age) as the central components of relationships between teachers and children. Vygotsky (1978) highlights the role of the child's language as an important mechanism by which experiences from social interactions are internalized or transformed into knowledge. Empirical evidence also points to the important role of individual characteristics in both children's relational experiences and children's development. For example, results from a meta-analysis suggest that girls are more likely to have secure relationships with their child care providers than boys (Ahnert et al., 2006). Gender differences in children's functioning are already evident at the preschool age and across different developmental domains, with girls generally performing better than boys (Brandlistuen et al., 2020). There are, however, different theoretical views and empirical evidence regarding children's individual traits, such as temperament (e.g., vulnerability vs. differential susceptibility), and their interplay with the environment. For example, children with certain temperamental traits have been found to be more *susceptible* to both positive and negative environmental influences, such as parenting (Belsky et al., 2007) and the quality of caregiver-child interactions in child care (Pluess & Belsky, 2009). Examining the mechanisms between individual characteristics, environment, and child development is outside the focus of this thesis. However, this brief discussion illustrates the theoretical and empirical grounds to account for child characteristics when studying associations between the environment or "proximal processes" (e.g., the quality of student-teacher interactions and relationships) and child developmental outcome.

### *The Family: Parents, Siblings and The Home Environment*

Family (together with child care, schools, peers and the neighborhood) is in the nearest system to the child (*microsystem*) (Bronfenbrenner, 1977) and one of the principal contexts for the development of competence and character (Bronfenbrenner & Morris, 2006). Furthermore,

parents are also the first attachment figures, playing a central role in the child's representations of self and others, which is theorized to impact subsequent relational experiences and development (Bowlby, 1969). Given the importance of social interactions for child learning and development (Vygotsky, 1978), parents and siblings also represent a salient social context through which the child can learn and develop. There is empirical evidence supporting the role of parents and the home environment in the child's development. For example, using a random assignment procedure to a Head Start program, Miller et al. (2014) found that parental preacademic stimulation was positively related to children's academic performance and had a protective function for children not assigned to Head Start, promoting resiliency in early literacy and receptive vocabulary. Consistent with the bioecological theory predicting interactions between a person's microsystems, the study also found evidence of moderating effects, which varied by developmental domain. Specifically, the strongest effect of Head Start on early literacy was observed for children with moderate levels of preacademic stimulation, indicating nonlinear relations; for early math the effect was strongest for children with low preacademic stimulation providing support for a compensatory effect. Importantly, both unobservable and observable parental characteristics, such as socioeconomic status (Bradley & Corwyn, 2002; Heckman, 2006; Letourneau et al., 2013) may impact parenting, the quality of the home environment and the child's development. Parental characteristics, including socioeconomic status may also predict access to other social and learning contexts in the child's microsystem, such as ECEC (see, e.g., Petitclerc et al., 2017 for an evidence from different policy contexts). Therefore, there is a need to account for these effects, particularly when using non-experimental data.

### ***Early Education: The Role of Teacher***

As mentioned above, along with the family, ECEC belongs to the closest system of child development and the critical context for acquiring competencies and forming the child's character (Bronfenbrenner & Morris, 2006). Similar to the parental role, the original theoretical insight on the role of the teacher and the importance of positive interactions and relationships for child development can be drawn from attachment (Ainsworth, 1989; Bowlby, 1969) and sociocultural (e.g., Vygotsky, 1978) theories. The primary attachments children form with their parents tend to be more fundamental and different in nature compared to secondary attachments that children, for example, form with their ECEC teachers. Nevertheless, the secondary or supplementary attachments can provide a secure base for the exploration and reassessment of the established working models of self and others and the representational model of this

secondary relationship may endure (Ainsworth, 1989). Drawing on the sociocultural perspective (e.g., Vygotsky, 1978), the teacher's experience and knowledge can advance children's learning and help them realize their developmental potential. Noteworthy, these classical theoretical perspectives have been called into question by later research. Attachment theory, in particular, has been challenged by advances in genetical science recognizing a substantial role of genes (variations in DNA) in explaining an individual's personality (Plomin, 2019) and criticized, among other things, for ignoring cultural diversity and other value systems (Keller, 2018).

Nevertheless, attachment theory, has laid the foundational framework for analyzing the parent-child relationship and by extension the teacher-child relationship (further referred to as *student-teacher relationship*). Specifically, it has provided insight into the central elements and underlying mechanisms involved in forming high quality student-teacher relationships, while the developmental or ecologically-oriented systems framework, which has informed more recent research, addressed the complexity of these relationships (Pianta et al., 2003; Sabol & Pianta, 2012). The contextual nature of both child development (Bronfenbrenner & Morris, 2006), student-teacher relationships (Pianta et al., 2003) and social interactions and learning (Vygotsky, 1978), also points to the importance of the spatial and material environment.

Overall, empirical evidence suggests that high quality early educational experiences, including the quality of student-teacher interactions and relationships, benefit children's development (Sabol & Pianta, 2012; Ulferts et al., 2019; van Huizen & Plantenga, 2018). Moreover, there is evidence that high quality early educational experiences can compensate for some of the negative effects of family environment, such as low-income and changes in income (Dearing et al., 2009; Zachrisson & Dearing, 2015), unfavorable relational experiences and demographic risks (Sabol & Pianta, 2012), as well as a low-quality home environment (Bradley et al., 2011; Miller et al., 2014; Watamura et al., 2011).

### ***The Sociopolitical Context***

Cultural attitudes shape the concept of family, gender roles, parenting and home environment and will likely affect teacher's perceptions, expectations and the nature of the interactions and relationships in ECEC and school. Social values and financial resources influence the institutional and regulatory environment for ECEC and schools, including access policies, structural quality and the content of the curriculum, as well as the principles and objectives of the institutions.



The importance of the sociopolitical and cultural environment is recognized across different theoretical perspectives. This is the *macrosystem* in the ecological model (Bronfenbrenner, 1977) within which the child lives and develops. In the discussion of the transactional model of development, Sameroff (2009) points to cultural differences in the definitions of and reactions to children's developmental stages (e.g., adolescence) and behavior. Further Sameroff (2009) argues that sociocultural factors may affect children's experience, as well as the power of children's influence on their parents. Pianta et al. (2003) refer to these factors as external influences that can shape structural environment and student-teacher relationships, for example, via state policies and regulations.

Empirical evidence also suggests cross-cultural differences in student-teacher relationships (e.g., Chen et al., 2019). Given that most studies are conducted in U.S. settings, more knowledge from other contexts would provide a valuable contribution to the existing research.

## **1.2 Access to Early Childhood Education and Care**

As suggested above, ECEC is a potentially powerful environmental context for child development because during the early years of life children develop fundamental capacities and skills and are highly sensitive to positive and negative experiences (Knudsen et al., 2006). Therefore, it is important that children have access to ECEC and, more specifically, access to ECEC that can provide high quality environment and positive experiences. This appears to be of particular importance for socioeconomically disadvantaged children, which have the largest potential to benefit (Heckman, 2006; van Huizen & Plantenga, 2018).

### ***General Access to ECEC***

The crucial elements of access to ECEC are the availability and affordability of services. In countries with mainly-market driven ECEC systems, the state secures access for low-income families via the provision of targeted programs (e.g., Head Start in the U.S.) or subsidies to purchase ECEC services. In contrast, countries with universal systems ensure access for the entire population of children of certain ages by institutionalizing children's right to ECEC, thereby stimulating supply, regulating fees and subsidizing ECEC services. There are, however, different degrees of universality across nations, with the Nordic countries being known for their particularly comprehensive universal policies (European Commission/EACEA/Eurydice,

2019). In the U.S., which has traditionally had a market driven ECEC system for children under the age of 5 (preschool and pre-kindergarten age), some states are offering universal pre-kindergarten (Pre-K) programs (van Huizen & Plantenga, 2018) (though with a varying degree of universal access). A more fundamental shift to a nationwide universal preschool in the U.S. is now under the consideration (The White House, 2021).

Another element of children's access to ECEC concerns parental preferences, as ECEC is usually not mandatory (at least not for younger children under 3 years of age). Indeed, even in countries with nationwide universal systems and generally high participation rates, such as Norway, there is evidence that children from less advantageous backgrounds (e.g., nonwestern immigrant families, families with a lower socioeconomic status) are less likely to be enrolled in ECEC during early years (prior to 18 months), mainly due to different parental preferences (Zachrisson, Janson, et al., 2013). Therefore, while institutionalizing children's right to ECEC, ensuring sufficient supply and subsidizing ECEC services provide families with the opportunity to enroll children in ECEC, it does not automatically guarantee access for those children that may benefit most. Importantly, even when barriers of availability and affordability are substantially reduced, parental preferences and decisions regarding ECEC might be constrained by access to information and shaped by cultural and social norms (Chaudry et al., 2010; Coley et al., 2014; Meyers & Jordan, 2006).

### *Access to High Quality ECEC*

In mainly market-driven systems, access to high quality ECEC is conditional on the ability to pay, particularly affecting those who are both unable to pay and unqualified for government-funded and quality-regulated programs (such as Head Start in the U.S.). In contrast, countries with universal models of ECEC aim to ensure access to high quality for all children by means of strict national regulations on quality and parental fees. However, ensuring a homogeneously high quality for all is even more challenging than ensuring general access to ECEC. Even in the universal contexts, such as in Norway, there are weaknesses in the regulations (e.g., dispensations from the educational requirements and the lack of regulations of process quality), which allow variations in quality (Engel et al., 2015).

Although variations in quality may give more resourceful parents advantages in accessing high quality ECEC in universal contexts, there is limited knowledge of whether this is the case, particularly in the Nordic context. One study from Norway that used an observational measure of overall classroom quality for toddlers (ITERS-R i.e., one of the ERS

versions) did find some indication of parental selection by education (Eliassen et al., 2018). Another study, which used data from one region in Norway (Rege et al., 2018), found some evidence of socioeconomic selection in centers with “over-performing children” (as an indicator of high quality), but only with regard to father’s education. Both studies relied on relatively small samples, thus larger population-based studies are needed.

Noteworthy, until recently parental choice was quite limited in Norway, as centers were oversubscribed. As a result of oversubscription, in the city of Oslo, for example, child care to 1-2 year-olds children (the cohorts born 2004-2006) was allocated through a lottery (Drange & Havnes, 2019). According to the national statistics, ECEC coverage in Norway has grown considerably over the years, and in the period between 2005-2008 (relevant for the birth cohort 2004-2006) it increased from 54% to 75% among 1-2 year-olds (Statistics Norway, 2017). Although, there still was evidence of supply constraints and unmet demand (i.e., waiting lists) that varied substantially across geographical areas (Asplan Viak, 2007; Engel et al., 2015), by 2010, when the last birth cohort in our study (i.e., 2009), would have a right to a place in ECEC, the coverage was around 79% for 1-2 year-olds (Statistics Norway, 2017).

A study from Denmark argued for some exogeneity in the assignment of child care as a result of long waiting lists and the fact that the final decision is made by the municipality (Bauchmüller et al., 2014). While the same decision-making authority lies with the municipalities in Norway, the Norwegian municipalities are required by law to place considerable value on parental preferences (Ministry of Education and Research, 2005), thereby enabling parental choice. Nevertheless, this points to the important fact that the mechanisms behind advantageous access or selection will be different in universal contexts than in the market driven ones.

Specifically, the mechanisms behind selection would differ because parents would exercise their choice differently (i.e., via a statement of preferences for ECEC centers in their application to the municipality, notably a place guarantee applies to the municipality of residence) and as a result of regulations on fees, which cannot be used as signals of quality. Therefore, parental knowledge, preferences and access to information may play a particularly important role. At the same time there is no easily comparable quality rating for ECEC in Norway, such as the Quality Rating and Improvement System (QRIS) found in the U.S., although some information on practical aspects (e.g., opening hours), structural features (e.g., number of children, child-staff ratio, the percentage of staff with a formal ECEC education,

space per child) and parental satisfaction is available for different centers via the website administered by the Norwegian Directorate for Education and Training.

Related to the above argument, Stahl et al. (2018) found indications of socioeconomic inequalities (particularly with regard to parental education) in Germany, a context of state subsidized ECEC, regulated parental fees and no QRIS. Consistent with the accommodation perspective, which recognizes the complexity and dynamic nature of parental decisions (Chaudry et al., 2010; Meyers & Jordan, 2006), the authors argued for the importance of knowledge, preferences and networks, which are shaped by education and culture. Drawing from this earlier research, the first paper of this thesis explores a socioeconomic selection via knowledge, preferences and information, taking into account the observability of different quality aspects to parents in a context of universal ECEC.

### **1.3 Quality in Early Childhood Education and Care**

#### ***Structural and Process Quality***

There are many different dimensions of quality in ECEC that are commonly categorized into structural and process quality. *Structural quality* is a collective term for given aspects of the spatial and material environment (e.g., the quality and amount of space for children, learning materials and facilities for different activities, group size, child to staff ratio) and characteristics of the staff (e.g., education, competence, experience). The *process quality* combines aspects related to children's direct experiences during pedagogical activities and social interactions with adults and peers. Compared to process quality, structural features are also easier to regulate, and these are more observable to parents when they consider ECEC for their child. Structural quality is assumed to have a more distal relation to child development and is often viewed as a prerequisite for good process quality, which is assumed to have a direct impact on child development and well-being (see, e.g., Burchinal, 2018; NICHD Early Child Care Research Network, 2002; Slot, 2018 for a discussion of structural and process quality and its relation to child outcome).

#### ***The Global Measures of Process Quality***

Commonly used observational measures of process quality for cross-national comparison include e.g., Environmental Rating Scales ERS, such as the Early Childhood Environment Rating Scale (ECERS and ECERS-R) (Harms et al., 1998), Caregiver Interaction

Scales (CIS) (Arnett, 1989) and the Classroom Assessment Scoring System (CLASS) (Pianta et al., 2008) with its age-appropriate versions for infants, toddlers and pre-kindergarten classrooms (see e.g., Slot, 2018; Ulferts et al., 2019 for a more detailed description). ERS is a broader measure of overall classroom quality that also includes some structural aspects, while CLASS and CIS exclusively focus on the interactional aspects of quality between the teacher and children. The CLASS is a more comprehensive measure of interaction quality that encompasses emotional, behavioral and instructional aspects, as well as how the teacher facilitates children's interactions with peers and materials (Slot, 2018).

### ***Teacher-Reported Relationship Quality***

Despite the methodological advantages of observational measures of quality, it is often a time-consuming and expensive method for collecting data. Therefore, *teachers' self-report of quality* and particularly *teachers' perceived relationship quality with children*, using, e.g., the Student-Teacher Relationship Scale (STRS; Pianta, 2001) are commonly used. STRS is a validated and well-established measure (Sabol & Pianta, 2012) consisting of two subscales: *closeness*, which includes aspects of warmth, understanding and emotional connection; and *conflict*, which is characterized by negative emotions, struggle and unpredictability. Student-teacher relationships form in the process of everyday interactions between the teacher and the child in the given classroom settings. At the same time, the established relationships will likely influence the quality of subsequent interactions. The empirical evidence does indicate that teachers' perceptions of their relationships with children are associated with the observed quality of interactions (e.g., Hartz et al., 2017). In addition, teacher-perceived relationships have been linked to children's and teachers' behaviors in the classroom (O'Connor & McCartney, 2006).

## **1.4 Linking the Quality of Early Educational Experiences to Child Development**

### ***Structural Quality in ECEC and Child Development***

Existing literature has devoted a particular attention to structural features, such as *group size*, *child-to-staff* or *child-to-teacher ratio* and *staff's formal qualifications*, reflecting the fact that these features are easier to regulate and therefore are of particular interest to policy makers. Overall evidence from the U.S. points to modest and inconsistent associations between structural features (e.g., teacher's education, group size, child-to-staff ratio) and children's

developmental outcome, with some indications that a higher teachers' education and *larger* group size predict better child outcome (Burchinal, 2018). These inconsistencies are evident both between and within studies, though not only in the results, but also in the definitions or operationalization of structural variables. For example, Mashburn et al. (2008) found that a smaller class size (up to 20) was negatively related to one of the language-related outcomes, and unrelated to other academic, language or social and behavior outcomes. Colwell et al., 2013, on the other hand, reported that group size (the number of children per teacher) was positively related to parental report of children's emotional and behavior regulation, but not to cognitive, social competence or attention-related outcomes. However, in a metaanalysis, Camilli et al. (2010) found a positive effect of individualized instruction on cognitive and school outcomes arguing for advantages of both smaller groups and a lower child-staff ratio for children's learning. Some studies from the U.S., based on data from Head Start (a state-regulated program for low-income families/disadvantaged children), as well as a nationally representative sample, conclude that there is no or little evidence for the importance of structural factors, such as group size, staff-child ratio and teacher education (e.g., Blau, 1999; Walters, 2015).

Evidence from a universal context, regarding the above discussed structural characteristics, is more limited and inconsistent. For example, Bauchmüller et al. (2014) using Danish register data found that a higher staff-child-ratio and a higher share of staff with a formal education were related to a higher test score in Danish language at the end of primary school. Using a sample of children recruited from one region in Norway, Rege et al. (2018) found that teacher-child ratio was a strong predictor of children's school readiness skills, while no relations were observed with other structural features, such as center size. On the other hand, based on Norwegian data from child care assignment lotteries and register data on structural quality, Drange and Rønning (2020) reported that the share of staff with a formal education, center size and child-to-staff ratio were unrelated to the child's academic outcomes early in primary school. Using data from a randomized controlled trial and ECEC teachers' and managers' reports of structural quality, Slot et al. (2018) came to a somewhat similar conclusion. Specifically, the authors found few direct effects of structural quality on preschoolers' language or preliteracy skills; no relation with teachers' formal education was observed, and the same applied to classroom-level factors: group size and child-to-teacher ratio. Noteworthy, differences in methodologies, the operationalization of structural measures, as well as varying timespans across the studies discussed above (both in the U.S. and in universal contexts), may explain



some heterogeneity in the findings. Examining the overall effectiveness of universal ECEC programs based on a meta-analysis of quasi-experimental evaluations, van Huizen and Plantenga (2018) found that a higher quality in terms of a low teacher-child ratio and high teacher qualifications had both short- and long- term beneficial effects on child development, particularly in the cognitive domain. Note that this discussion does not address all the structural quality aspects that, have been linked to child outcome.

Regarding other structural features, which were the focus in this thesis, such as *staff stability*, *staff competence*, and *physical environment*, the evidence is more limited. In Norway, Drange and Rønning (2020) found that a higher level of sick leave predicted lower test scores in language and mathematics in early primary school, thereby suggesting that a lower *staff stability* has a negative impact on children's development. Similarly, Bauchmüller et al. (2014) suggested that a higher staff stability (the share of staff employed compared to the previous year) benefits child language outcome, but this effect was found only for children with non-Danish parents. In contrast to staff's formal education, there is a relatively consistent evidence on the positive effects of additional training and professional development interventions on child outcome (see Slot, 2018 for details). Such interventions may also focus on increasing *staff competence* in the specialized areas, such as behavior problems, shyness, social interactions and language, which can be particularly useful to address diversity in children's individual characteristics and family backgrounds. Finally, concerning the *physical environment*, a cross-national comparison study (Montie et al., 2006) suggested that the number and variety of equipment and materials in preschool settings was a consistent predictor of children's cognitive outcome three years later.

### ***Process Quality in ECEC and Child Development***

As noted earlier, process quality relates to children's direct experiences when interacting with adults and peers during various activities. For preschool-aged children who develop their early cognitive, social and regulatory skills and are, in many respects, dependent on adults, interactions and relationships with their teachers will play a central role. A recent meta-analysis of European studies (Ulferts et al., 2019) that examined the impact of observational measures of process quality (such as CLASS, CIS, ERS and its age- and domain-specific versions) on child academic development, reported overall small but lasting effects. The global measures focusing on the quality of teachers' interactions with children, such as CLASS and CIS, demonstrated a better ability to capture the beneficial aspects of learning environment compared to ERS, which includes structural aspects of quality (Ulferts et al.,

2019). An earlier meta-analysis of four large-scale studies in the U.S. that examined associations between a process quality in preschool and children's school readiness skills at the start of kindergarten also indicated some small main effects on academic outcomes, but no consistent associations were found for social and behavior outcomes. Similarly, the CLASS measure focusing on interaction quality has demonstrated the most consistent main effects on child outcome (Keys et al., 2013). In conclusion, while there is some evidence supporting process quality as a stronger predictor of child development compared to structural quality, these effects also tend to be small. Some of the potential explanations for the small effects or the lack of such effects are the use of more rigorous statistical methods in recent studies, as well as the inadequacy of the current measures to capture important aspects of ECEC quality, content and children's outcomes (Burchinal, 2018).

### ***Teacher-Reported Relationship Quality and Child Development***

As noted, teacher-reported relationship quality (STRS) appears to be consistent with the observed quality of interactions (e.g., Hartz et al., 2017), thereby lending support for the use of this measure as a dimension of process quality. Moreover, teachers' reports may, in fact, be more informative, as these are based on continuous daily interactions with children across different situations in educational settings, as compared to short-time observations (Roorda et al., 2014).

A large body of research, which included children's early relationships with teachers (preschool, kindergarten and early primary school), has provided promising evidence suggesting that high relationship quality may positively contribute to a range of short- and long-term developmental outcomes. Specifically, there is evidence that higher levels of relationship closeness are associated with higher levels of children's engagement and academic performance (e.g., McCormick & O'Connor, 2015; McCormick et al., 2013; Roorda et al., 2017), as well as social and behavioral functioning (e.g., Ansari et al., 2020; Maldonado-Carreño & Votruba-Drzal, 2011; O'Connor et al., 2011; Pianta & Stuhlman, 2004; Silver et al., 2005). High levels of conflict are linked to lower social competence, higher levels of behavioral problems and lower pre-academic skills (e.g., Pakarinen et al., 2021; Skalická et al., 2015b; Varghese et al., 2019).

However, inconsistencies exist within and across studies. For example, some studies do not find significant relations between closeness and any of the examined outcomes (e.g., Varghese et al., 2019), or find only concurrent, but not longitudinal relations (e.g., Pakarinen et



al., 2021), only for some groups of children (e.g., Silver et al., 2005) or under certain classroom conditions (Skalická et al., 2015b). Noteworthy, existing research are characterized by different conceptualization of relationship quality (e.g., the whole STRS scale vs. subscales of closeness and conflict), different raters of child outcome, varying time span, as well as different samples' characteristics and size. Importantly, some of the inconsistencies across studies might be attributed to differences in identification strategies (e.g., not addressing omitted variable bias).

Notably, originally informed by attachment theory and later by ecologically-oriented systems theory (Pianta et al., 2003; Sabol & Pianta, 2012), the empirical research has studied the associations between student-teacher relationship and child outcome from three major perspectives: relationship-driven, child-driven and bidirectional perspectives (see Pakarinen et al., 2021 for a review). Consistent with the theoretical predictions, an overall empirical evidence points to the complexity of children's relationships with teachers and children's developmental outcomes. Both children's characteristics and behavior (Mejia & Hoglund, 2016; Nurmi, 2012), as well as teachers' characteristics and structural context of the classroom where relationships are formed (Mashburn et al., 2006) appear to be important. Most of the empirical research has followed a relationship-driven perspective grounded in attachment theory. Nevertheless, this strand of the research has also incorporated ecological systems elements by conceptualizing student-teacher relationships as "*proximal processes*" and accounting for a wide range of factors related to the child, family, school, family-school-interactions and the neighborhood (e.g., Ansari et al., 2020; O'Connor et al., 2011).

Studies following a bidirectional perspective seek to address the dynamic nature of the associations between relationship quality and child outcome (Pakarinen et al., 2021). Using cross-lagged models some studies provided evidence of reciprocal relations and transactional cycles, particularly regarding externalizing problems and student-teacher conflict (e.g., Doumen et al., 2008; Roorda et al., 2014; Skalická et al., 2015b; Skalická et al., 2015; Zhang & Sun, 2011). However, the validity of this evidence is somewhat questionable. Except for the two studies based on the Norwegian data (Skalická et al., 2015b; Skalická et al., 2015), others used small regional samples, as well as teacher-reported measures of both relationship quality and child behavior. Although, the latter is reasonable when examining reciprocal associations, as the child behavior not observed by the teacher cannot influence their relationship, assuming children exhibit a different behavior outside the classroom context/in contact with other potential informants. Moreover, Doumen et al. (2008); Zhang and Sun (2011) do not appear to

consider potential confounding factors. Interesting, Mejia and Hoglund (2016) found that children's externalizing problems were related to student-teacher conflict, but no evidence of reciprocal relations over time were observed thereby supporting a child-driven model. Moreover, a recent study examining bidirectional links between student-teacher closeness and conflict and children's interest and pre-academic skills in literacy and math, provided support for the relationship-driven perspective (Pakarinen et al., 2021). Notably, there is an important general concern related to the interpretations of cross-lagged models, which may conflate within- and between- person variance (Berry & Willoughby, 2017; Hamaker et al., 2015).

In addition to examining reciprocal and transactional associations, the complexity of the associations between student-teacher relationship and child outcome has been addressed by examining interactions; among other things, between relationship quality and structural context (e.g., Skalická et al., 2015b). This is discussed in the next section.

The quality of the student-teacher relationship is the common theme across the three papers of this thesis. The first paper contributes to the current body of research by exploring the links between parental socioeconomic characteristics, structural quality aspects and children's relationships with teachers. This provides evidence from the universal context on whether more socioeconomically advantaged children have access to higher structural quality, which together with socioeconomic status predicts better relationship quality (in terms of higher closeness and less conflict). The main contributions of papers 2 and 3 are the methodological approaches that allow us to account for omitted variable bias. Except for a few studies from the U.S. (see, e.g., Maldonado-Carreño & Votruba-Drzal, 2011; McCormick & O'Connor, 2015), omitted variable bias was not addressed in the existing research. In paper 2, in addition to child functioning in ECEC (non-academic school readiness), we include a dimension of child well-being to address limited evidence on this important aspect in the ECEC setting. In papers 2 and 3, we follow a relationship-driven perspective. We also use additional mother-reported measures of child outcome to address concern of shared variance in teacher's reporting and a potential reciprocal nature of the associations between teacher-reported relationship quality and child behavior in the classroom. To address complexity regarding student-teacher relationships and children's outcome we explore the role of structural quality characteristics related to the staff and unit/department in the ECEC and account for potential unobserved factors related to the children's and family characteristics.

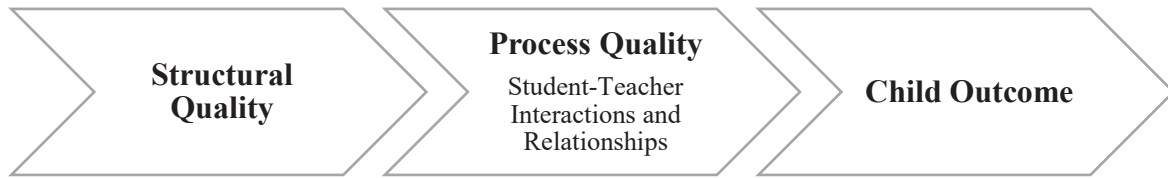
### *From Structure to Process to Outcome*

Following the argument that structural quality serves as a precondition for process quality, research has examined relations between structural features and process quality. The overall evidence on these relations is, however, inconsistent and predominantly comes from the U.S. context (see e.g., Slot et al., 2018 for a relatively recent review). In a Danish universal context, positive correlations were found between teachers' formal education and in-service training and the process quality (CLASS, including the emotional domain). A cross-national comparison of four Western European Countries and the U.S. revealed differences in the relations between structural features and the interaction quality (CIS) across the countries, both in the direction, magnitude and significance of the associations (Cryer et al., 1999). In the most recent study, conducted in a Peruvian context, no relations between structural factors (teacher education and experience, child-to-teacher-ratio) and the process quality (CLASS) were found. Research underscores the complex relations between structural and process quality and suggests that the combination of different structural aspects working together may predict higher process quality (Cryer et al., 1999; Hanno et al., 2020; Slot, 2018).

Empirical evidence on the associations between structural classroom characteristics and teacher-perceived relationship quality appears to be more limited. I will provide a brief review on the links between the structural classroom and staff characteristics explored in this thesis. There is some evidence that *group size* and *child-teacher ratio* are related to teacher-reported relationship quality. Specifically, Mashburn et al. (2006) found that teachers' ratings of positive relationships with children in prekindergarten was associated with a lower child-teacher ratio. Skalická et al. (2015b) reported that the effects of closeness on child behavior problems was moderated by the group size (i.e., children in small preschool groups benefited from more closeness, in terms of reduced externalizing behavior in the first grade). The research has also argued that *staff instability* may negatively impact children's sense of security, their interactions with teachers and their ability to establish safe attachments, as well as reduce staff's resources to provide a stimulating environment and have individual interactions with children (Drange & Rønning, 2020; Skalická et al., 2015b). Finally, there is evidence suggesting that specialized training can enhance caregiver's *competence* and performance, demonstrating a potential for improving the quality of teacher's interactions with children (Fukkink & Lont, 2007) that can be linked to the relationship quality. Somewhat related to this, though not necessarily reflecting a real competence, research finds that higher self-efficacy beliefs are also linked to a higher quality of interactions and relationships with children (Hajovsky et al., 2020).

**Figure 2**

*Assumed Mechanism Between Structural Quality, Process Quality and Child Development*



It has been generally accepted that structural quality impacts child development mainly via its influence on process quality. However, as pointed out in recent review studies (Burchinal, 2018; Slot, 2018), this assumption is based on very limited and inconsistent empirical evidence. More specifically, relatively few studies have tested these indirect mechanisms. Probably the most known of these is the study from the US, using data from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development. The authors (NICHD Early Child Care Research Network, 2002) found small indirect effects of caregiver education and child-staff ratio on children’s cognitive and social outcome via observed quality of caregiver-child interactions. A later study from the U.S. also found that a higher teacher’s education had a small indirect effect on children’s vocabulary scores via observed teacher warmth/responsiveness (Connor et al., 2005). However, the above-mentioned indirect relations have not been supported in the meta-analysis (Burchinal et al., 2016) (as discussed by Burchinal, 2018). Evidence from a universal context in Denmark suggested that teacher qualifications, group size and child-staff ratio had no indirect effects on children’s cognitive outcome (i.e., language and preliteracy skills) via observed process quality (Slot et al., 2018).

Paper 2 contributes to the existing research by investigating the direct and indirect effects of structural quality, including some underexplored factors (such as staff’s stability), on child outcome (functioning and well-being in ECEC). Following suggestions from the earlier research, we consider simultaneous associations between different structural indicators and the student-teacher relationship. Drawing from earlier theoretical and empirical work, we argue that the structural characteristics of the classroom and staff may create necessary preconditions

for the establishment of positive relationships between teachers and children, which in turn may promote better functioning and well-being.

### **1.5 Transition from ECEC to School: Contextual and Developmental Changes**

When children move from ECEC to school they encounter a new educational context with more structured and intensive pedagogical activities. The characteristics of the structural environment also change, e.g., in terms of larger groups and fewer teachers, which may create new challenges for self-regulation and social interactions, while also reducing opportunities for frequent high-quality interactions with teachers (Maldonado-Carreño & Votruba-Drzal, 2011; Skalická et al., 2015b). At the same time, as children start school, they also face new expectations from their teachers' and parents, e.g., in terms of social skills and behavior adjustment (Skalická et al., 2015a). Importantly, children will need to form new relationships with teachers, which can serve as a developmental asset providing support for successful adjustment and functioning in school (Sabol & Pianta, 2012). At this point, children have also acquired experiences and advanced their abilities and skills, which will shape their future interactions, relationships and provide the foundation for a more advanced learning. As children mature, their relationships with peers also gain a more central role (O'Connor et al., 2011). These contextual and developmental changes may shape the nature and function of the student-teacher relationship, although the importance of positive relationships with teachers appears to endure (Maldonado-Carreño & Votruba-Drzal, 2011; O'Connor et al., 2011). Furthermore, while children's relational experiences with ECEC and school teachers may extend beyond the educational context (e.g., affecting their interactions with parents), these experiences can manifest differently in school-aged children (e.g., conflict with the teacher may lead to less cooperative behavior with parents, rather than aggression) (Skalická et al., 2015).



## 2 The Sociopolitical Context: Norway

Considering that social values and cultures shape the characteristics of social and educational institutions and thus children's early experiences and development, it is important to provide an overview of the context where the current study has been conducted. Norway is a social democratic welfare state with universal access to health care and education and a comprehensive social protection system. The Norwegian sociopolitical context has many common features with other Nordic countries. These countries are built on the same principles of universal social rights and equality and characterized by the important role of the state and local government, as well as "consensual governance", this is referred to as the Nordic welfare model (Knutsen, 2017). Norway ranks very high on the Human Development Index (HDI) when considering standard of living, life expectancy and access to learning and knowledge (UNDP, 2020).

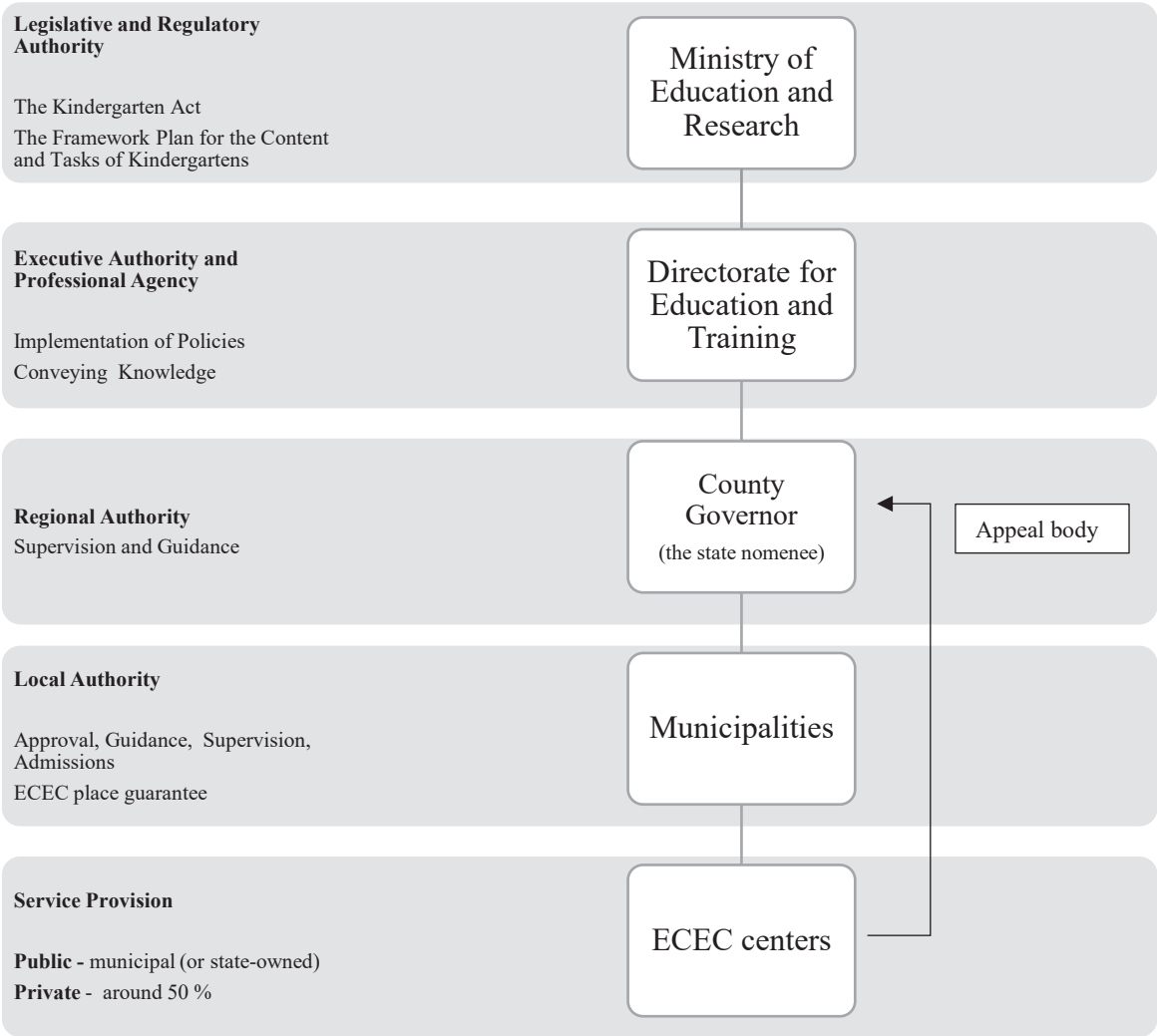
ECEC centers (called kindergartens in Norway) cover children from 0 to 6 years old, providing child care and serving as pedagogical institutions aimed at promoting development, early learning and preparation for school. The participation rates in ECEC are generally high, around 97% for the ages 3-5 years (Statistics Norway, 2021), and were among the highest in OECD countries (OECD, 2020). In the period 2006–2015 (relevant for the birth cohort in this study), the participation rates increased from 62% to 81% for 1–2 years old children, 93% to 97% for 3–5 year-olds and 80% to 90% for 1–5 year-olds (Statistics Norway, 2017).

Furthermore, ECEC centers are expected to collaborate with schools to ensure safe and positive transitional experiences for children; from 2018 this is legally defined as the obligation of both ECEC and schools (Ministry of Education and Research, 2005, 2018). Building on children's individual needs and experiences from ECEC, the schools should develop children's individual learning potential, as well as create a positive and stimulating environment that facilitates social and academic development and well-being (Ministry of Education and Research, 2017d).

Figure 3 below provides an overview of the structure of the ECEC sector in Norway with the roles and responsibilities of the main actors. The Ministry of Education and Research is the governing body responsible for regulations and policies related to ECEC for children from 0 to 6 years. This includes the Framework Plan for the Content and Tasks of Kindergartens (Ministry of Education and Research, 2017b) and the guidance regarding the collaboration

between ECEC and school (Ministry of Education and Research, 2008). This unitary, integrated setting of organization and single governance model, as found in the Nordic countries, facilitates consistent regulations and policies, including requirements regarding staff qualifications and a curriculum with educational content for the entire ECEC period (European Commission/EACEA/Eurydice, 2019).

**Figure 3**  
*Overview of the Norwegian ECEC Sector*



*Note.* The county governor acts as the appeal authority for the municipalities’ decisions.

ECEC place guarantee applied to children who reached one year of age within August in the year in which parents applied for a place. This guarantee was extended in 2017 to include children who reached one year of age in September, October and November.



All children from age 1 and up to the start of primary education at the age of 6 are legally entitled to a place in ECEC (i.e., a place guarantee from 2009) in the municipality they live in (Ministry of Education and Research, 2005). The nationwide regulations on the key structural quality aspects in ECEC and parental fees (Ministry of Education and Research, 2005) aim to ensure that all children irrespective of parental means and geographical location have access to high quality ECEC.

In the period relevant for this study, the pedagogical leaders were required to have a formal *ECEC teacher education*, although dispensations due to a shortage of qualified staff were and are still allowed (Ministry of Children and Families, 2005c; Ministry of Education and Research, 2005). The required *pedagogue-child ratio* was 1:7–9 for small children under 3 years and 1:14–18 for older children (1:7 and 1:14 as per now) (Ministry of Children and Families, 2005b; Ministry of Education and Research, 2017a). The *staff-child ratio* of 1:3 for small and 1:6 for older children was common but was not in force until 2018 (Ministry of Education and Research, 2005, 2018). The *maximum monthly fee* for a place in ECEC constituted NOK 2,250 (approx. USD 350) in 2006 and NOK 2,580 (approx. USD 320) in 2015 (Norges Bank, 2021), with further reductions for siblings and low-income families (note that there has been a substantial depreciation of NOK over the years) (Ministry of Children and Families, 2005a). As per January 2021, the maximum fee is set to NOK 3,230 (approx. USD 379), and from 2015 the fees are also capped at 6% of household income for the first child (Ministry of Education and Research, 2015, 2021; Norges Bank, 2021).

*The Framework Plan for the Content and Tasks of Kindergartens* underscores a holistic approach to children's development, learning, the centrality of play, participation, diversity and well-being (Ministry of Education and Research, 2017c). The plan serves as a guidance for ECEC owners who should adapt it to their own conditions (Ministry of Education and Research, 2005). The national regulations and the Framework Plan apply equally to public (mainly municipality-owned) and private (around 50%; publicly subsidized) ECEC centers.

The Directorate for Education and Training has an executive function ensuring the implementation of policies and interpreting legislation related to ECEC in Norway - the Kindergarten Act (Ministry of Education and Research, 2005). The Directorate is also a professional agency producing relevant statistics and communicating knowledge about ECEC to different user groups, including ECEC professionals and parents.

The county governor is the state representative who is expected to provide guidance to the municipalities and ECEC centers and is responsible for the supervision of the municipalities. The municipalities play the role of the local authorities for ECEC centers, granting approvals, defining operating conditions, providing guidance and conducting the supervision of ECEC centers (Ministry of Education and Research, 2005). A concern has been raised about the dual role of the municipalities as both the owner of and supervisory authority for ECEC centers (Engel et al., 2015). The law now provides the county governors with the right to conduct an additional supervision of ECEC centers and requires that the municipalities organize these conflicting responsibilities separately to ensure impartiality (Ministry of Education and Research, 2005, 2016, 2020).

### 3 Methodological Concerns in ECEC Research

One of the concerns in ECEC research is a reliance on non-experimental data to address causal research questions, such as the effect of ECEC on child development. As children's assignment to an ECEC center is not random, there might be systematic differences between children attending different centers. More specifically, parents with a higher socioeconomic status might select ECEC centers of higher quality or reside in a place where the quality of ECEC centers are higher. At the same time, the children of higher educated parents may also have better prerequisites for positive developmental outcome due to, e.g., genetic factors, a higher quality home environment or a more optimal parenting style. If child and family characteristics are systematically correlated with the ECEC center's quality (i.e., predictor variable or exposure), as well as with child outcome, regression estimates will be biased. A common practice across research fields has been to account for these effects by statistical adjustment (i.e., including these characteristics as covariates in the model). In epidemiological research, it has been argued that when the aim is to estimate *the total causal effect*, it is sufficient to statistically control for those factors that may *affect* both *the exposure* and *the outcome* (i.e., *confounders*) (this is the logic in directed acyclic graphs (DAGs) (Pearl, 2000; Textor et al., 2011). The downside of any statistical adjustment is that it only controls for observed variables included in the model, while unobserved and omitted from the model variables may still bias the associations. Omitted variable bias can undermine our ability to draw causal inference and the validity of the study (Dearing & Zachrisson, 2019; Duncan & Gibson-Davis, 2006). This is a serious concern that may substantially limit the practical implications of the findings and therefore the usefulness of the research for policy makers, ECEC professionals, parents, children and society as a whole.

The use of robust methods that account for omitted variable bias are often required to reduce the number of alternative explanations for the observed associations and strengthen the validity of the inferences. Consequently, ECEC research that uses robust statistical methods to address the non-experimental nature of data, such as the instrumental variable approach, propensity-score matching, and fixed-effects models (including sibling and twin design), has grown (e.g., Araujo et al., 2019; Auger et al., 2014; Dearing et al., 2015; McCormick et al., 2013; Tucker-Drob, 2012; Zachrisson, Dearing, et al., 2013). Nevertheless, a large part of the existing evidence is still based on studies that rely solely on statistical adjustment. More specifically, only few studies examining the associations between student-teacher relationship

and child outcome employed methods that address concerns due to non-experimental data, such as propensity score matching (McCormick et al., 2013) or studying within-child associations over time (Maldonado-Carreño & Votruba-Drzal, 2011). As noted earlier, in papers 2 and 3 we aim to address omitted variable bias and strengthen the validity of the evidence by employing a sibling design (sibling fixed-effects or within-family analysis) and individual fixed-effects (within-child analysis over time). Details are provided in the method section.

## 4 Main Objectives of the Thesis

The overall aim of this thesis is to advance the understanding of the role of ECEC in child development, focusing on the Norwegian sociopolitical context.

### Paper I

Given the crucial role of access to high quality ECEC, particularly for socioeconomically disadvantaged children, *the first paper aims at investigating socioeconomic inequalities and selection mechanisms concerning ECEC of higher quality.*

### Paper II

Partly drawing on the findings from the first paper, *the second paper aims at investigating the mechanisms between different aspects of structural quality and student-teacher relationships and its associations with child functioning and well-being in ECEC by using a sibling design.*

### Paper III

Extending the focus to school functioning, *the third paper aims at studying within-child and within-family associations between student-teacher relationships and children's behavioral functioning.*



## 5 Methods

### 5.1 Data

This thesis is mainly based on data from the Norwegian Mother, Father and Child Cohort Study (MoBa), linked with the Medical Birth Registry of Norway (MBRN), and data collected in the Language and Learning Study (SOL). Additionally, we use data from the Norwegian Directorate of Education and Statistics Norway.

#### *Norwegian Mother, Father and Child Cohort Study (MoBa)*

The Norwegian Mother, Father and Child Cohort Study (MoBa) is a nationwide cohort study conducted by the Norwegian Institute of Public Health (Magnus et al., 2016). MoBa contains data on mothers (n=95 000), fathers (n=75 000) and children (n=114 500) starting from the mother's pregnancy and following the child into adolescence. This includes data on different aspects of children's functioning, parental characteristics and family environment.

#### *Medical Birth Registry of Norway (MBRN)*

The Medical Birth Registry (Irgens, 2000) is a national health registry administered by the Norwegian Institute of Public Health (NIPH). It contains data on all births in Norway, including information about maternal health before and during pregnancy.

#### *Language and Learning Study (SOL): ECEC and School*

The SOL study was conducted at the Norwegian Institute of Public Health in collaboration with the Norwegian Ministry of Education and included a sub-cohort of MoBa participants. The children's teachers in ECEC (at 5 years old) and school (at 8 years old) responded to a questionnaire about different aspects of quality in ECEC, school environment, child functioning and well-being (Wang & Schjølberg, 2014).

#### *Norwegian Directorate for Education and Training*

The Norwegian Directorate for Education and Training prepares and publishes national statistics on Early Childhood Education and Care (also called kindergartens in Norway), as well as on primary and secondary education.

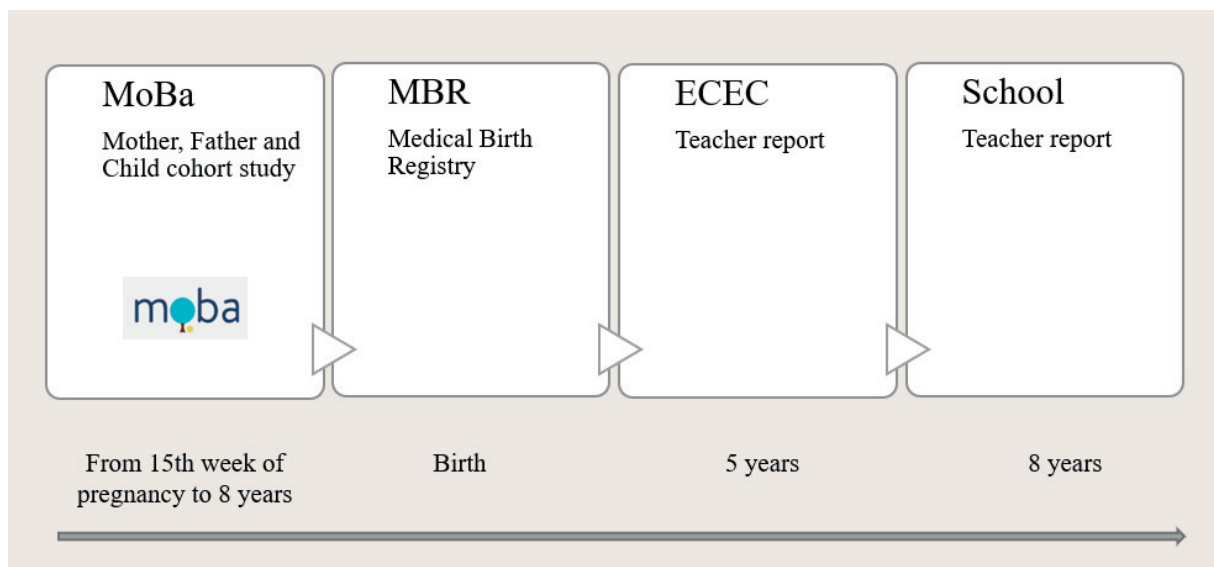
## *Statistics Norway*

Statistics Norway provides official statistics on various aspects of Norwegian society, aggregated at different geographical levels, such as counties, municipalities and boroughs. This includes statistics about Early Childhood Education and Care.

Figure 4 depicts the main data sources used in the current study. The MoBa data (parental report) was linked to MBRN and data received from the children's teachers in ECEC and school.

**Figure 4**

*The Main Data Sources Used in the Study*



*Note.* The data from the Norwegian Directorate for Education and Training (ECEC-level) and Statistics Norway (municipality-level) were used only in the sensitivity analyses in paper 1.

## **5.2 Study Population**

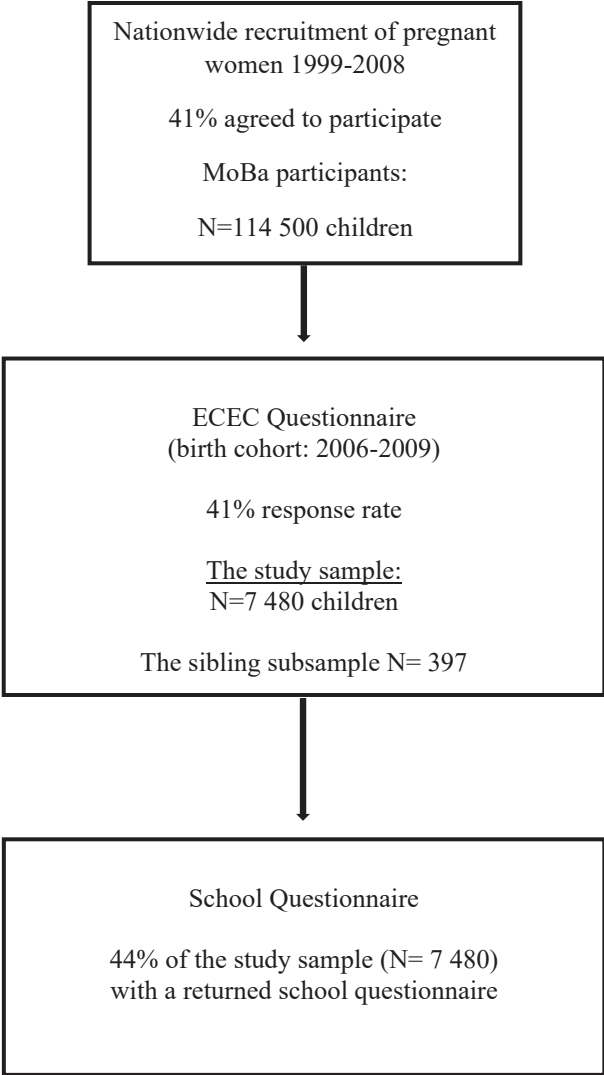
The study population is based on children whose parents participate in MoBa. In a sub-project, the ECEC teachers (mostly pedagogical leaders) of the children born in 2006-2009, were invited to respond to a questionnaire (Q-cc) when the children turned 5 years old. Q-cc covered different aspects of structural quality in the ECEC unit, the teacher's perceived relationship with the child, pedagogical content and different domains of children's functioning.



The children for which ECEC teachers have returned Q-cc became the study participants (n=7 480). When these children turned 8 years old, somewhat similar data were collected from their teachers in school (44% available for the study sample). Figure 5 below provides a simplified illustration of the study population.

**Figure 5**

*The Flow Diagram for the Study Population*



*Note.* N= 7 480 indicates the total study sample (44% of the total sample have returned the school questionnaire; the missing data are addressed in the further analysis). The number of participants in paper 1 and 2 is smaller due to some differences in the approaches to missing data.

Although nationwide recruitment increased the representativeness of MoBa participants of the general Norwegian population, there was evidence of lower health risks, an underrepresentation of the youngest mothers, mothers living without partners and those with more than two previous births (Nilsen et al., 2009). In addition, there were statistically significant differences in the distribution of socio-demographic characteristics between our study sample and the overall MoBa population, with available data on the first questionnaire during pregnancy. Specifically, there were higher proportions of children with parents in the highest educational and income categories and a slightly lower proportion of children with a mother living without a partner. Finally, in the sibling subsample there were higher proportions of children with parents in the highest income categories compared to the overall study sample. Differences between the children with and without a returned school questionnaire were either non-significant or negligible (e.g., Cramer's V for chi-square test  $\leq .04$ ).

### **5.3 Ethical Considerations**

The establishment of MoBa and initial data collection was based on a license from the Norwegian Data Protection Agency and approval from the Regional Committees for Medical and Health Research Ethics (REC). All participants have provided an informed consent to the participation and thereby also consented to the linkage of MoBa with other data sources. All parents have given consent to collect data from their children's teachers. The participants in MoBa are regularly informed about the ongoing research, and when the children reach the age of majority at 18 years they also receive information about the opportunity to withdraw from the participation.

The current study was approved by REC (2018/1918/REK sør-øst). Sensitive information about the participants is securely stored in the deidentified data files on the NIPH server and accessed by the project group via password-protected PCs.

### **5.4 Measures**

#### ***Parental Socioeconomic Status***

We focused on the two main indicators of socioeconomic status: parental education and income. Mothers' reported their own and their child's father's education (ranging from 9 years of secondary school to university college more than 4 years) and income (6 categories in NOK)

in the first MoBa questionnaire during pregnancy. Around the same time, fathers reported their own education and income. We used the father's report, when available. Education was defined as *the highest level of completed education in the family* ('1' up to vocational high school to '4' University, technical college, more than 4 years). This implies that we give an equal weight to mothers' and fathers' education, which seems reasonable considering that in the Nordic countries fathers play an active role in children's upbringing. We also assume a compensatory effect of one parent's higher education for another's lower education. In paper 1, where education and income were used as the main predictor variables, we defined dummy variables to allow for flexible functional forms.

### ***Early Educational Experience: Structural and Relationship Quality***

**Structural Quality.** Data on structural quality in ECEC included characteristics of the physical environment and staff at the unit. ECEC teachers rated three statements about *sufficiency of space* (e.g., "*There is a sufficient space available in your unit to engage in different learning activities*") and six statements about *availability of materials* (e.g., "*There is a lot of material that is easily available to accommodate for the children's interests*") on a scale from '1' completely disagree to '5' completely agree. The teachers also evaluated whether *staff competence* was sufficient (e.g., social competence, behavior problems; '1' completely disagree – '5' completely agree) and whether *staff stability* was good in the unit ('1' not good – '5' very good, reversed from the original scale). Furthermore, the teachers reported the number of girls and boys in the unit (*group size*), *ECEC center organization* (department vs. more flexible groups) and the responding *teacher's experience* of working with children. Schoolteachers have also provided data on the number of girls and boys in the class (*class size*) and their *teaching experience*.

**Relationship Quality.** Children's teachers in ECEC and in school have reported the quality of their relationship with the child by responding to 15 statements from the Student-Teacher Relationship Scale – Short Form (STRS) on a scale from '1' not true at all to '5' very true (Pianta, 2001). STRS consists of two subscales: *closeness* and *conflict*. *Closeness* focuses on positive aspects of the relationship, such as warmth, support and open communication (e.g., "*I share an affectionate, warm relationship with this child*", "*If upset, this child will seek comfort from me*", "*This child openly shares his/her feelings and experiences with me*"). *Conflict* describes challenging and negative aspects of the relationship (e.g., "*This child and I always seem to be struggling with each other*", "*This child easily becomes angry with me*").

### ***Child Developmental Outcome***

Child outcomes were measured in terms of child functioning (non-academic school readiness) and well-being in ECEC, as well as child behavior (internalizing and externalizing problems) at preschool and school age.

**Child Functioning in ECEC.** Child functioning or non-academic school readiness was measured with the School Readiness Questionnaire (SRQ) (Prior et al., 2011) and rated by ECEC teachers on a scale from 1 (considerable difficulty) to 5 (very well) (reversed from the original scale). The 6 selected items included “*settling into the child care center*”, “*co-operation with other children*”, “*use of play materials*”, “*confidence*”, “*speaking in groups of children*” and “*coping with personal needs*”. We have excluded items that could be attributed to the shared variance in teacher’s reporting of their relationship quality and child functioning (i.e., “*relationship with the adults at the unit*”, “*agreeableness*” and “*following instructions*”). In addition, we excluded items that are less likely to be influenced by the quality of student-teacher relationships (i.e., “*concentration*”, “*motor coordination*” and “*fine motor skills*”) and the last summarizing item. The final scale still demonstrated a high reliability (polychoric ordinal  $\alpha = .89$  and Cronbach  $\alpha = .84$ ).

**Child Well-being in ECEC.** Our measure of child well-being focused on children’s positive experience in ECEC. Mothers have responded to a question: “*How does your child enjoy/like being in the current child care?*” on a scale from 1 (not at all) to 5 (very much). The use of this question is supported by the Norwegian Directorate for Education and Training (2018).

**Child Behavior at Preschool and School Age.** Child behavior functioning included internalizing and externalizing behavior rated by mothers in the MoBa questionnaire when the child was 5 and 8 years. At 5 years, internalizing and externalizing behavior were measured with the Child Behavior Checklist (CBCL) (Achenbach & Ruffle, 2000) on a scale from 1 (rarely/never) to 3 (often/typical). Internalizing problems included 5 statements from the anxiety subscale, e.g., “*Gets too upset when separated from parents*”, “*Too fearful or anxious*” and externalizing problems included 5 statements from the aggression subscale e.g., “*Defiant*”, “*Gets in many fights*”. At 8 years, the MoBa questionnaire included the Parent/Teacher Rating Scale for Disruptive Behavior Disorders (RS-DBD) (Silva et al., 2005) and the Screen for Child Anxiety Related Disorders (SCARED) (Birmaher et al., 1997). For externalizing problems we used 8 statements from the RS-DBD, Oppositional Defiant (OD) behavior, rated by mothers on

a scale from 1 (never/rarely) to 4 (very often), e.g., “*Loses temper (tantrums)*”, “*Actively defies or refuses to comply with adults’ requests or rules*”, for externalizing problems. For internalizing problems we used all 5 statements from the Screen for Child Anxiety Related Disorders (SCARED) (Birmaher et al., 1997), which mothers’ rated on a scale from 1 (not true) to 3 (true), e.g., “*My child gets really frightened for no reason at all*”, “*People tell my child that he/she worries too much*”.

### ***Control Variables***

Control variables were mainly related to children’s and parents’ characteristics. Below I provide a brief description of the control variables included in the main models in papers 1-3. Note that we originally considered a broader spectrum of covariates for the associations between student-teacher relationship and child outcome. Additional control variables were also included in the sensitivity analyses in paper 1 (see subsection *Statistical Adjustment for Covariates* for details and the rationale for adjustment).

**Child Characteristics.** Child characteristics included *temperament at 6 months*, *early behavioral problems*, *behavioral problems in ECEC*, *language difficulties* and *gender*. Mothers responded to 10 statements about the child *temperament at 6 months* (i.e., before the start of ECEC), 7 items from the fuzzy/difficult subscale in the Infant Characteristics Questionnaire (ICQ) (Bates et al., 1979) and 3 additional questions added by MoBa. We reversed positively loaded questions, and a higher overall score indicated a more difficult temperament. *Early behavioral problems* were based on the mother’s report when the child was 3 years old. For externalizing behavior, we used 5 items, identical to the items from the CBCL at 5 years. For internalizing problems only 3 items in the questionnaire were identical to the items from the CBCL at 5 years. We included one additional item from the Infant-Toddler Social and Emotional Assessment (ITSEA) (Carter et al., 2003), which was nearly identical to an item from the CBCL at 5 years. *Child behavioral problems in ECEC* were rated by teachers in Q-cc. We used 5 statements from the CBCL and 7 statements from the Conners’ Parent Rating Scale-Revised: Short Form (CPRS-R (S)) (Conners et al., 1998) related to *externalizing difficulties*. Mothers reported child *language difficulties* using the Semantic subscale of 8 items from the checklist of 20 Statements about Language-Related Difficulties (Språk 20) (Ottem, 2009). Mothers also indicated the child’s *gender*; when this information was missing we relied on data from MBRN.

**Parental Characteristics.** Parental characteristics included *mother's civil status* (single vs. living with a partner), *one of the child's parents being a non-Norwegian speaker* (mother's report), *mother's age at the child's birth* (MBRN), *the highest completed education in the family*.

All scales have demonstrated an adequate reliability in our sample, in terms of Cronbach or polychoric ordinal alpha (Gadermann et al., 2012). Polychoric ordinal alpha was estimated for variables with less than four categories, as earlier evidence has shown that ordinal alpha provides more accurate estimates of reliability for items with few response categories (Gadermann et al., 2012). The alphas ranged from .71 for internalizing behavior at 3 years to .85 for language difficulties, student-teacher conflict at 8 years, and staff competence in ECEC.

## 5.5 Statistical Approaches

### *Structural Equation Modelling (SEM)*

The main analyses in this thesis were conducted within a SEM framework using Mplus version 8 (8.2.- 8.5.) (Muthén & Muthén, 1998-2017). Some of the advantages of SEM include the possibility of modelling latent constructs and complex simultaneous relations between variables, accounting for the measurement error, as well as the availability of software allowing application of more flexible and accurate approaches to missing data (Bollen & Noble, 2011; Tomarken & Waller, 2005). Data preparation and preliminary analyses were done in Stata versions 15 and 16 (StataCorp., 2017, 2019).

### *Missing Data*

Missing data due to non-response on some questions or the whole questionnaire (i.e., attrition) is a common concern in studies using a survey design. Not addressing missing data (i.e., deleting cases) may result in biased estimates when data are not *missing completely at random* (MCAR) (Schafer & Graham, 2002). Following the best practice (Schafer & Graham, 2002), we handled missing data by using multiple imputation (MI) (papers 1 and 2) and full information maximum likelihood (FIML) (papers 2 and 3). MI was performed using a Bayesian analysis (Rubin, 1987; Schafer, 1997) of the unrestricted (H1) variance covariance model (Asparouhov & Muthén, 2010; Muthén & Muthén, 1998-2017). All variables relevant for the subsequent analyses were included in the imputation model. In paper 2 we imputed 5 datasets, as it was demonstrated to be sufficient with Weighted Least Squares Estimator

(WLSMV) estimator (Asparouhov & Muthén, 2010). As missing data for covariates ( $x$  variables) are not addressed (Muthén & Muthén, 1998-2017), these variables were introduced in the model by mentioning their variances (multilevel models in papers 2 and 3).

### ***Clustering and Hierarchical Data Structure***

Clustering of data means that there are multiple observations embedded within entities (i.e., clusters), such as siblings within the same family or children attending the same ECEC center. A hierarchical data structure implies that smaller entities are embedded within larger entities, such as children within the ECEC center and ECEC centers within the municipality.

The non-independence of the observations within clusters can be addressed by using estimators that produce cluster-robust standard errors. Alternatively, this can be modelled by allowing intercepts to vary across the clusters (i.e., random-intercept models). Clustering and hierarchical data structure can be addressed using multilevel modelling. The methods of data collection used in this study has reduced clustering. Specifically, as the MoBa participants were recruited from the whole country, children in this study were spread across different geographical locations, ECEC centers, schools and teachers. Nevertheless, we have explored standard errors when accounting for the clustering of children within ECEC centers in the subsample with valid ECEC IDs (papers 1 and 2). The results remained almost identical suggesting that the effect of clustering in the study sample is quite limited.

### ***Individual- and Sibling Fixed-Effects Models***

As discussed, there are some methodological concerns in the ECEC research and particularly in the research on student-teacher relationship and child outcome. Panel data facilitates the use of fixed-effects models addressing unobserved heterogeneity in the individuals and families that may otherwise bias the observed associations (*omitted variable bias*). In other words, these models isolate the effect of predictor ( $x$ ) on outcome ( $y$ ) from other unobserved characteristics of individuals or family, which may provide an alternative explanation for the observed associations. There are different ways to estimate the parameters of fixed-effects models. A common approach is to apply OLS and include dummy for individuals.

We estimate the fixed-effects models within a SEM framework using the MLR estimator (maximum likelihood with standard errors robust to non-normality) that handles missing data with FIML. In paper 2 we employ sibling fixed-effects models, which exploit



variation within the family (i.e., comparison of siblings to each other) and therefore do not require longitudinal data. The sibling analysis accounts for all parental and family characteristics shared by the siblings, but it relies on statistical adjustment for differences between the siblings, when these may influence the predictor and the outcome (i.e., confound the associations). As a result, the associations might be biased due to unobserved or unaccounted differences, such as child-specific characteristics or unshared family environment. In paper 3, we also estimate individual fixed-effects models examining variation within the child over time (i.e., comparing two time points: 5 and 8 years). The individual fixed-effects account for child-related factors (including individual, parental and family characteristics) that do not vary over time, thereby eliminating bias due to all *constant* child-related factors.

In both papers we use a latent centering approach (Hamaker & Muthén, 2019), which allows us to separate between and within slope, where the last one is equivalent to a fixed-effects model or within-child association. The sibling or within-family analysis was conducted with data in a long format using a multilevel SEM; this approach is also referred to as a latent decomposition (Muthén & Muthén, 1998-2017). The individual fixed-effects or within-child analysis was performed using SEM with data in a wide format (Hamaker & Muthén, 2019).

### ***Statistical Adjustment for Covariates***

Statistical adjustment for covariates was employed to account for potential confounding variables either as the primary method (paper 1) or in addition to the factors accounted for by the sibling and individual fixed-effects models (paper 2 and 3). The rationale for including relevant covariates in the model were based on the hypothesized relations of these variables with the predictor ( $x$ ) and the outcome ( $y$ ). Specifically, based on the modeling of DAGs (Pearl, 2000; Textor et al., 2011), the estimation (of the total effect) required statistical adjustment when a variable could be hypothesized to correlate with the predictor (referred to as exposure) and affect the outcome. In paper 1, we also adjusted for child characteristics, which were primarily hypothesized to affect the quality of the student-teacher relationship (i.e., gender, temperament prior to starting ECEC, the period of time the teacher has known the child, and teacher-reported child behavior). Controlling for factors which only affect the outcome are not necessary but may improve the precision of the estimates. We also accounted for the change of child care and addressed some of the potential mediating mechanisms in the relations between socioeconomic status and ECEC quality (i.e., factors at the ECEC center- and municipality-level, which could be the link between a higher SES and teacher-reported quality at the unit). In paper 3, we took a more conservative approach to the inclusion of covariates due to the



additional complexity of the statistical models with data in a wide format. Specifically, we explored these hypothesized relations in bivariate and multivariate analyses. The relevant covariates that showed only weak associations with the main study variables and had a very limited impact on the explained variance ( $< .01$  change in  $R^2$  when excluded) were not included in the final model.



## **6 Main Findings**

### **Paper 1**

Access to high quality ECEC is particularly critical for children from less advantageous socioeconomic backgrounds. Although the universal policies should ensure that all children, irrespective of socioeconomic status, have equal access to high quality ECEC, a limited empirical evidence exists on whether this is achieved in countries with universal ECEC systems. In the first paper we aim at investigating the potential socioeconomic selection into ECEC of higher structural quality and explore the impact of SES and structural quality characteristics on student-teacher relationship quality. We have considered an observability of different aspects of quality to parents and used structural equation modeling (SEM) to estimate the total, direct and indirect effects of parental education and income on different aspects of quality. We found that higher parental education (and less consistently income) predicted child attendance of higher quality ECEC on some structural dimensions. Higher parental SES and mostly the same dimensions of structural quality (i.e., developmental material, staff competence and stability) predicted a better relationship quality in terms of higher levels of closeness and lower levels of conflict.

### **Paper 2**

Despite the wide consensus that benefits of ECEC for child development are critically dependent on quality, our understanding of the mechanisms between different aspects of quality in ECEC and its impact on child development is limited. Moreover, the majority of ECEC research is based on observational data and statistical adjustment for observed factors, thereby questioning the validity of the interpretations due to omitted variable bias. We explored potential indirect mechanisms between different structural quality dimensions, student-teacher closeness and child outcome using SEM. Further, we exploited a quasi-experimental sibling design (Lahey & D'Onofrio, 2010) accounting for unobserved stable family factors in the associations between the student-teacher closeness and children's non-academic functioning and well-being. The results suggested that structural quality dimensions mainly affected children indirectly via impacting relationship quality. Student-teacher closeness was related to teacher-reported child functioning and mother-reported well-being, even after accounting for all stable family-level confounders via a sibling analysis with a multilevel SEM.

### **Paper 3**

Children's internalizing and externalizing problems relate to social and academic functioning and well-being and therefore constitute a considerable burden for the individual and society. We aim to strengthen the evidence on the associations between student-teacher closeness and conflict, and children's internalizing and externalizing problems outside the educational settings (as observed by mothers). To address concern of bias due to unobserved child and family factors, we studied within-child and within-family associations by using individual- and sibling fixed- effects models. Additionally, we have accounted for factors that could vary over time and/or between the siblings. The results from the within-child analysis (comparing two occasions at 5 and 8 years) indicated that student-teacher conflict was positively associated with externalizing and internalizing problems. The within-family analysis (comparing siblings) suggested that closeness at 5 years was negatively related to externalizing problems, while conflict was positively associated with internalizing problems at 8 years. Overall, we find evidence supporting the importance of student-teacher relationships for children's behavioral functioning.

## **7 Discussion**

### **7.1 Contribution to the Field**

This thesis seeks to advance the understanding of the importance of ECEC as an environmental context where an increasing number of children spend their early years (OECD, 2020), a period foundational for the development of cognitive and socioemotional capacities (Knudsen et al., 2006; Shonkoff & Phillips, 2000).

The first paper of this thesis contributes to the limited knowledge on the access to quality in universal ECEC settings, where national policies are expected to ensure equal access to high quality ECEC for all children irrespective of their socioeconomic background. Our results show that even in these settings with regulated and subsidized ECEC, there are indications that children from less advantageous backgrounds experience a lower quality, at least in some dimensions.

The second paper adds to the scarce empirical evidence regarding the assumption of indirect mechanisms between structural quality and child development via process quality. Our results are consistent with the hypothesis that structural quality affects children mainly indirectly by providing preconditions for positive interactions and relationships between teachers and students (Burchinal, 2018; NICHD Early Child Care Research Network, 2002; Slot, 2018). Both the second and third paper contribute to the field by employing robust statistical approaches, which address omitted variable bias and thereby strengthen the evidence concerning the importance of the relationship quality for child functioning and well-being. All three papers contribute to the relatively limited knowledge regarding the sociopolitical context with a universal model of ECEC.

### **7.2 Methodological Considerations**

#### ***Measures***

Whenever possible, we used internationally recognized measures with well-established psychometric properties, e.g., CBCL and STRS (Achenbach & Ruffle, 2000; Pianta, 2001). As indicated in the method section, our measures demonstrated satisfactory or good reliability in our data, in terms of Cronbach or polychoric ordinal alpha. Reliability also reflects the

accurateness of the measure and is inversely related to the measurement error or unexplained variance. The measurement errors were accounted for in the SEM analysis with latent variables.

However, some of our measures, such as *staff competence* and *child well-being* are not firmly grounded in the prior research. When discussing *staff competence*, we also mention self-efficacy, therefore acknowledging that it may reflect subjective perceptions of one's own and others' abilities. Nevertheless, we believe that this measure serves its purpose in our study as both an objective level of competence and belief in one's own and others' competence may affect the classroom climate and the ability to establish positive relationships with students. The fact that this measure may reflect both perceptions and a real competence may, however, limit our ability to give specific recommendations to policymakers. Child well-being is a complex, multidimensional and highly debated concept (Alexandrova, 2014; Amerijckx & Humblet, 2014). In this study, we referred to child well-being when using a question "*How does your child enjoy/like being in the current child care?*", which is almost identical to the question used by the Norwegian Directorate for Education and Training (2018) in their annual ECEC monitoring. The purpose of using this item was twofold. First, we aimed at addressing the limited knowledge on young children's experiences in ECEC (Sandseter & Seland, 2018). Second, we aimed to strengthen the validity of the inferences, which can be drawn from the association between teacher-reported measures of the relationship quality ( $x$ ) and child functioning ( $y1$ ). The rationale for the latter is that the association between teacher-reported relationship ( $x$ ) and mother-reported child well-being ( $y2$ ) is free from a shared rater variance (common method bias). As a result, the unexplained residual variances are independent of each other. While we fully acknowledge that this measure is not able to capture the complex concept of child well-being, we believe that the use of this item was adequate for the purpose in question.

### ***Internal and External Validity of the Study***

The *internal validity* of the study concerns the ability to eliminate *alternative explanations* and draw *causal inferences* from the findings. The method used to collect or generate data, (observational or experimental, such as from a randomized controlled experiment), can influence the internal validity of the study. Omitted variable bias, for example, may arise when using observational data. As noted, this occurs when factors unobserved or unaccounted for by the model affect both the predictor ( $x$ ) and the outcome ( $y$ ). As a consequence,  $x$  becomes correlated with the error term. In other words, when  $x$  and  $y$  share a common cause or a third variable, such as child characteristics that predict both better student-teacher relationship and child outcome, it is crucial to use appropriate methods to account for

such unobservable heterogeneity. Methods, such as fixed-effects models applied in papers 2 and 3, control for unobserved heterogeneity, thereby reducing the number of alternative explanations and strengthening the internal validity of the study.

*External validity* refers to the extent to which the study findings are *generalizable* to other contexts and populations, such as the entire population of children in Norway. A related concept when dealing with non-experimental data is the *representativeness* of the study sample (e.g., in terms of the distribution of socio-demographic characteristics) as compared to the whole or general population. In observational studies, self-selection and attrition may lead to a problem when the study participants are systematically different from non-participants, i.e., not representative of the general population. The representativeness of the sample affects the ability to generalize the findings and thus the external validity of the study. Below we discuss some important concerns due to the use of observational data, how we have addressed it and the implications for our findings.

### **7.3 Strengths and Limitations**

The most prominent strengths of this study are extensive data on mothers, fathers and children recruited from all over the country and robust statistical methods to account for omitted variable bias when examining student-teacher relationship and child outcome. The majority of this study's limitations are related to the observational nature of our data. Observational data are particularly susceptible to self-selection, non-response and rater bias, which may pose threats to the internal and external validity of the study. Nevertheless, most of the research in the field extensively relies on observational data, as randomized controlled experiments are often not feasible or unethical to implement. Despite the nationwide recruitment, MoBa has a relatively low participation rate (41%) and there is evidence that families with more advantaged sociodemographic characteristics and lower health risks are overrepresented. In addition, there was a low response rate on the ECEC questionnaire (41%) with some indication of self-selection in terms of socioeconomic status. Finally, we had a low data coverage for school-reported measures, such as student-teacher relationship (around 44% for the ECEC study sample). We have addressed missing data with MI and FIML, considered to be the state-of-the-art methods (Schafer & Graham, 2002), but we cannot eliminate the possibility that this had an impact on the estimates. Importantly, even when the assumption that data are missing at random

(MAR) is violated, these methods perform substantially better compared to deletion and mean substitution approaches to missing data (Baraldi & Enders, 2010).

Noteworthy, these differences between the study participants and the general population do not necessarily affect the estimates of the associations (Nilsen et al., 2009). Even though selection and attrition will influence means and prevalence estimates, the associations between the variables appear to be much more robust against this type of bias (Gustavson et al., 2019; Gustavson et al., 2012), particularly when individuals with extreme scores are included (Gustavson et al., 2019). Nevertheless, another study has shown that the associations might be biased due to selection and loss to follow-up (Biele et al., 2019). If this is the case in our study, we would expect the estimates to be biased downwards due to the lower-risk study population.

Regarding more specific limitations, the major concern in paper 1 is related to the endogenous nature of the relation between socioeconomic status and ECEC quality. Furthermore, data limitations precluded us from studying parental choice (e.g., with a discrete choice analysis) and account for multiple constraints on parental preferences and decisions. Nevertheless, we have addressed some of the important concerns, such as differences in wealth between municipalities, as well as in the availability and quality of ECEC (i.e., statistical adjustment in the sensitivity analyses). We have also controlled for how long the teacher has known the child and the child's characteristics to increase the precision of the estimates and address concern that teacher-reported relationship quality is affected by, e.g., teacher-observed child behavior.

Another important concern in paper 1 and 2 is related to common method bias due to a potential shared variance in teachers' reporting. In paper 1, we have attempted to address it by acquiring register data on some structural characteristics, but there were no comparable measures to verify relations between those structural dimensions, which indirectly related to relationship quality. Similarly, we were not able to rule out that indirect effects in paper 2 were the result of shared variance in teachers' reporting. However, when we examined associations between student-teacher relationship quality and child outcome in ECEC, we used a mother-reported measure of child well-being that provided some validation of teacher-reported child functioning. The sibling design accounted for potential omitted variables related to stable family characteristics, thereby reducing the number of alternative explanations and strengthening the internal validity of the study. The statistical adjustment for additional child-specific factors also accounted for possible confounding factors not addressed by the sibling design. Nevertheless, we cannot rule out alternative explanations due to potential reverse



causality and unobserved child-specific characteristics or unshared family environment. Noteworthy, twin studies suggest that the shared environment contributes substantially to explaining children's short- and long- term outcome (such as, cognitive school readiness (Lemelin et al., 2007) and university enrollment (Smith-Woolley et al., 2018)).

One potential limitation in paper 3 relates to short longitudinal data on student-teacher relationships. An increased number of repeated measurements could improve the precision of the estimates. Moreover, a longer period of investigation could provide a more nuanced picture of the associations between student-teacher relationship and child behavior. Nevertheless, as discussed, children experience many contextual and developmental changes during the transition to school and over the school years, which may influence the nature of their relationship with teachers and how these relational experiences reflect on their interactions outside the educational context. Therefore, our focus on a relatively short, but important, period between the last year of ECEC and the early years of school, has its merits. Another aspect that deserves attention is the use of different instruments over time to measure child behavior, which may raise questions as to whether our findings can be attributed to differences in the instruments. Considering the developmental changes between 5 and 8 years, one can argue that the use of different instruments is appropriate. Furthermore, we accounted for some of these differences in the statistical models by relaxing the constraints over time. In the third paper we have substantially reduced the number of alternative explanations. Specifically, we addressed potential bias due to shared rater variance by using three sources of reporting (ECEC teacher, schoolteacher and mother) and accounted for all constant child characteristics and additional observed time-varying covariates not accounted for by the within-child models. We cannot, however, eliminate alternative explanations due to the possibility of reverse causality and omitted variable bias as a result of unobserved time-varying factors. Noteworthy, both in non-experimental and experimental data eliminating all potential sources of alternative explanations is an unattainable goal.

#### **7.4 Interpretation of the Main Findings**

In paper 1, we found that parental socioeconomic background was related to the quality of the ECEC the child attended. Specifically, higher parental education (and less consistently income) was related to higher structural quality and higher relationship quality. Given that these structural features should be possible to observe for parents, e.g., by attending the center and

talking to staff or through social networks, this suggests a possible selection as a result of better information and preferences. Nevertheless, these effects were only evident for some structural dimensions. One potential explanation is that the parents may place a greater value on aspects, such as material environment, staff qualifications and stability than, e.g., group size and child-staff ratio. Furthermore, our finding that those structural dimensions related to parental SES also predicted a higher relationship quality may suggest that parents select ECEC based on the structural quality that they believe may promote a higher relationship quality. Alternatively, it may reflect that parents look for the best ECEC center for their children and this is correlated with the quality of relationships between children and teachers.

However, considering the limitations discussed above, we cannot rule out that the observed relations are the result of shared variance in teachers' reporting and omitted variable bias. The evidence of more consistent and somewhat stronger relations between ECEC quality and parental education compared to income is in line with prior research and points to the importance of knowledge, preferences and networks in universal systems (Eliassen et al., 2018; Stahl et al., 2018).

In paper 2, we found that structural quality was related to child outcome mainly indirectly via the link with the quality of student-teacher relationships. This suggests that structural features of the unit or classroom (i.e., access to various materials and facilities to accommodate for children's interests, overall competence or self-efficacy and staff stability) contribute to a more favorable environment for positive student-teacher interactions and relationships. These findings are consistent with prior research and the assumption that structural quality mainly provides preconditions for process quality (Burchinal, 2018; NICHD Early Child Care Research Network, 2002; Slot, 2018). Our finding that student-teacher closeness was consistently related to teacher-reported children's functioning and mother-reported child well-being, even when accounting for unobserved stable family-level confounders, points to a potentially central role of the teacher for child development. This finding is supported by earlier research and in accordance with the argument that teachers may serve as a secure base facilitating children's development of the skills and abilities needed for successful functioning in school (Mashburn & Pianta, 2006; Pianta & Stuhlman, 2004; Verschueren & Koomen, 2012). However, despite the strengths of the sibling design, we are not able to eliminate alternative explanations due to shared variance in teachers' reporting, reverse causality and omitted variable bias attributed to unobserved child-specific characteristics or an unshared, time-varying family environment.

In paper 3, we found evidence that the student-teacher relationship is related to child behavioral functioning as reported by mothers. Student-teacher conflict appeared to be a stronger and more robust predictor of child behavior than closeness. This is in accordance with earlier research finding consistent negative relations between conflict and externalizing problems (e.g., Silver et al., 2005; Skalická et al., 2015b; Skalická et al., 2015). One potential explanation is that negative relational experiences have a stronger impact on the child and the subsequent interactions with parents. Overall, results suggest that the student-teacher relationship is important for child behavioral development, and this importance extends beyond the educational settings. Although we are not able to rule the possibility of some reverse causality and omitted variable bias due to unobserved time-varying child or family characteristics, we were able to substantially reduce the number of alternative explanations.

## **7.5 Policy Implications**

This thesis has several findings that can be of interest for policy makers. First, the findings of socioeconomic inequalities in the use of higher quality ECEC suggests that existing universal policies have not fully achieved their goal of equal access to high quality ECEC. The evidence that disadvantaged children, who may benefit the most, access a somewhat lower quality, raises concerns that there might be a suboptimal return on the societal investment in ECEC. Considering that we have found some evidence of parental selection based on observable quality characteristics, some of the potential ways to target inequalities might be to enhance parental access to information and knowledge about the importance of different aspects of quality for child development. However, it might be difficult to avoid that parents of higher socioeconomic status take advantage of their resources, such as knowledge and social networks in access to information. Therefore, a more effective strategy might be to address the weaknesses in the existing regulations of quality and strive to ensure a homogeneously high structural and relationship quality across the centers. There is, for example, potential to raise the quality of the relationships for all children via professional development interventions, particularly targeting staff working in centers with socioeconomically heterogeneous groups of children. Given that this study is one of the first to examine potential selection in a large population-based sample and the cost associated with launching new policies, our findings should first stimulate further research to confirm the results across different samples and methods.

Next, our finding that structural quality is related to child development, mainly indirectly via the association with student-teacher relationship quality, does suggest that raising the quality of relevant structural features in ECEC may result in a more favorable environment. This may, in turn, enhance the quality of interactions and relationships between teachers and children. Specifically, policies aimed at improving staff stability, staff competence and self-efficacy, as well as increasing the variety of stimulating materials and facilities to accommodate for different interest among children, can be a potentially effective way to improve the quality of social interactions and relationships in ECEC.

Importantly, the results from papers 2 and 3 indicate that the associations between the quality of student-teacher relationships and children's functioning are not the product of bias due to unobserved stable child and family factors that have been rarely addressed in the prior research. Furthermore, the evidence that the impact of student-teacher relationships extends beyond the educational context as observed by mothers underscores the importance of enhancing the quality of student-teacher interactions and relationships.

Given the international acknowledgement of the universal model of ECEC (European Commission/EACEA/Eurydice, 2019; van Huizen et al., 2019; van Huizen & Plantenga, 2018) and the interest in adapting similar models among policy makers in other countries, including in the U.S. (The White House, 2021), the findings from this thesis should have an international policy relevance.

## **7.6 Directions for Future Research**

In this study we have attempted to address some important gaps in the existing literature regarding the access to quality in ECEC in universal settings, as well as the underlying mechanisms between quality and child developmental outcome. We also strengthened the validity of the existing evidence regarding the associations between student-teacher relationship and child outcome. Below, I outline some important aspects, which deserve further attention.

### ***Access to or Selection into High Quality ECEC***

We found some evidence that parental socioeconomic background is related to the quality of the ECEC children attend, which is consistent with a socioeconomic selection due to better knowledge, preferences and information. Future studies should further advance our understanding of the mechanisms behind the observed inequalities. Given that our study used

a limited set of structural quality indicators based on register data, further studies should examine these associations with a wider range of register-based structural indicators, as well as observational measures of process quality.

Furthermore, the field would benefit from robust analyses of parental preferences and choice of ECEC centers, e.g., a discrete choice analysis, while also addressing complexity and the dynamic nature of parental decisions (Chaudry et al., 2010). In addition to parental, family and child characteristics and a place of residence, this would require data on all ECEC centers available to parents in the area, distances to different centers, ECEC characteristics and parental ranking of ECEC centers from the applications to the municipalities. Such analysis would advance our understanding of relations between parental socioeconomic status and preferences within given opportunities and constraints (e.g., availability of centers in the area). It could also shed light on whether parents with higher socioeconomic status are better informed about the characteristics of ECEC centers.

Examining data on parental preferences and the actual ECEC centers that the children attend would provide knowledge as to what degree parental preferences are met and thus parental ability to choose. Furthermore, data on the child's history of attendance of ECEC centers, together with the family's residential history and longitudinal data on the quality of ECEC centers, could provide a more nuanced picture of parental behavior. For example, a parental response to changes in quality, both in general, and as the child approaches school age.

### ***ECEC Quality and Child Developmental Outcomes***

We also found evidence of indirect relations between structural quality, student-teacher relationship and child outcome, suggesting that structural quality relates to child outcome mainly indirectly via the link with the student-teacher relationship. Again, considering that all our measures were teacher-reported, it would be important to confirm that the observed relations are not the result of the shared variance in teachers' reporting. This could be done by using register data or different raters of structural quality. Moreover, given the complexity of the relations between structural and process quality and child outcome, future studies should also examine interaction effects between different quality aspects. Finally, a broader spectrum of structural characteristics should be considered.

Furthermore, our findings suggest that student-teacher closeness and conflict relate to better child behavioral functioning, even when accounting for all stable family and child characteristics. However, it would be interesting to examine within-child associations using

more extensive longitudinal data and including both socioemotional and cognitive outcomes. Given that sociopolitical context may shape the structural environment and the nature of student-teacher relationships, the current research would also benefit from studies representing different policy contexts.

## **7.7 Conclusion**

Using a subsample of Norwegian children whose parents are participating in the nationwide population-based cohort study (MoBa), we investigated whether a parental socioeconomic background predicted the quality of the ECEC that children attend. Further, we examined the associations between different aspects of structural quality in ECEC, student-teacher relationships in ECEC and school and children's developmental outcomes.

The study has been conducted in the universal context, where nationwide regulations on quality and subsidized ECEC should ensure equal access to high quality ECEC independent of socioeconomic status. In this context, we found some indications of inequalities in the use of quality in ECEC, which is in line with the advantageous socioeconomic selection based on knowledge, preferences and information. Given that children from less advantageous socioeconomic backgrounds may benefit most from high quality ECEC, the current evidence raises concerns of a suboptimal return on public investment in ECEC and calls for further research.

Moreover, we found some evidence supporting the argument that structural characteristics mainly serve as preconditions for process quality, such as the quality of interactions and relationships between children and teachers. Furthermore, employing rigorous statistical approaches, we found evidence supporting the importance of children's relationships with teachers for their development, which extends beyond the educational settings. By addressing potential omitted variable bias attributed to stable child and family characteristics we were able to substantially reduce the number of alternative explanations and therefore strengthen the prior research.

Despite the above-mentioned methodological strengths, it is important to acknowledge that our measures reflect teachers' and mothers' perceptions, and our understanding of the young children's views and perspectives on their relationships and well-being is still limited. As a final note, all data generation processes, even controlled experiments, can be subject to bias, and all theoretical and statistical models are only an approximation of the complex reality.

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## Predicting selection into ECEC of higher quality in a universal context: The role of parental education and income



Nina Alexandersen<sup>a,b,\*</sup>, Henrik Daae Zachrisson<sup>c</sup>, Tiril Wilhelmsen<sup>a,b</sup>,  
Mari Vaage Wang<sup>a</sup>, Ragnhild Eek Brandlistuen<sup>a</sup>

<sup>a</sup> Norwegian Institute of Public Health, Department of Child Health and Development, P.B. 222 Skøyen, 0213 Oslo, Norway

<sup>b</sup> University of Oslo, Department of Psychology, P.B. 1094 Blindern, 0317 Oslo, Norway

<sup>c</sup> University of Oslo, Department of Special Needs Education, P.B. 1140 Blindern, 0318 Oslo, Norway

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### ABSTRACT

There is consensus about the positive effects of high quality Early Childhood Education and Care (ECEC) on children's development, particularly for children from lower socioeconomic backgrounds. However, limited knowledge exists on the access to quality in ECEC in a universal context. This study investigates potential socioeconomic selection into ECEC of higher structural quality in the context of a universal, heavily subsidized, and regulated system in Norway, intended to provide equal access to high quality ECEC. Furthermore, we explore the impact of SES and structural quality in ECEC on student–teacher relationship quality. Our conceptual model takes into account how readily accessible information on different quality aspects is for parents. We use data from the Norwegian Mother, Father and Child Cohort Study linked with teacher–reported ECEC quality for children born in 2006–2009 (N 7,226), supplemented by registry data at ECEC and municipality level. We find that higher parental education, and to a lesser degree income, predict child attendance of ECEC with higher structural quality as rated by ECEC teachers. Further, higher parental SES and structural quality (i.e., developmental material, staff competence and stability) predict better student–teacher relationship quality in terms of higher level of closeness and less conflict. These findings suggest that ambitions of universal equal access to high quality ECEC are not entirely realized and more efforts are needed to ensure higher structural quality in ECEC and enhance relationship quality for children from less advantageous socioeconomic backgrounds.

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### 1. Introduction

It is widely recognized that high quality Early Childhood Education and Care plays an important role in child development, particularly for children from lower socioeconomic backgrounds (Dearing, McCartney, & Taylor, 2009; OECD, 2012; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2011; Ulferts, Wolf, & Anders, 2019; van Huizen & Plantenga, 2018; Vandell et al., 2010). Yet, disadvantaged children are more likely to experience lower ECEC quality, drawing attention to the importance of improving overall ECEC quality and ensure equity in the access to high quality ECEC (Stewart, Gambaro, Waldfogel, & Rutter, 2014; OECD, 2012). The affordability of high quality ECEC is particularly crucial in market-driven systems where prices for high quality school or center-based care are high, such as in the US (Magnuson &

Waldfogel, 2014). This is also the case in some European countries with primarily market-driven ECEC systems for the youngest children (Ireland, the Netherlands, the UK, Switzerland), while availability concern due to unmet demand of formal center care for younger children remains even in countries with mainly publicly subsidized ECEC such as France and Germany (European Commission/EACEA/Eurydice, 2019).

Countries with progressive universal access policies (e.g., Norway along with other Nordic countries) strive to provide access to high quality ECEC for all children irrespective of their parents' financial means, by mandating children's right to a place in ECEC, expanding supply, extensively subsidizing ECEC services, and introducing nationwide regulations on quality. Nordic countries are cited as an example of countries with high quality ECEC, this is reflected in requirements for staff qualifications, educational focus and consistent policies for the entire ECEC period (European Commission/EACEA/Eurydice, 2019). In Norway, ECEC is seen as a mean to reduce social inequalities, increase women workforce participation and promote positive child development. Despite the efforts, socioeconomic inequalities in utilization of

\* Corresponding author at: Norwegian Institute of Public Health, Department of Child Health and Development, P.O. Box 222 Skøyen, 0213 Oslo, Norway.  
E-mail address: [Nina.Alexandersen@fhi.no](mailto:Nina.Alexandersen@fhi.no) (N. Alexandersen).

ECEC are evident across different policy contexts, even in countries with progressive universal policies (Petitclerc et al., 2017). The question remains whether socioeconomic inequalities also persist in access to quality in ECEC in universal contexts. In Norway, children of parents with higher education (but not income) were found to attend centers with somewhat higher quality (ITERS-R) (Eliassen, Zachrisson, & Melhuish, 2018). Yet, the evidence from such contexts is limited and larger population-based studies are lacking.

Socioeconomically disadvantaged children evidently benefit most from attending ECEC across early childhood in Norway (Dearing, Zachrisson, Mykletun, & Toppelberg, 2018; Zachrisson, Dearing, Blömeke, & Moser, 2017). Even though Norway is considered to represent a high quality ECEC context, there are a number of weaknesses regarding existing regulations and current practices including a shortage of educated staff, exemptions on staff qualifications and no specific regulations for monitoring, maintaining and improving process quality (OECD, 2015) that allows variations in quality. In fact, a recent study has found that quality (ITERS-R Infant Toddler Environment Rating Scale-Revised) in Norwegian ECEC centers was much lower than expected (Bjørnstad & Os, 2018). As policy makers strive to reduce social inequalities and specifically achievement gaps in education, it is crucial to understand if there are systematic socioeconomic differences in the use of ECEC of higher quality. If disadvantaged children are less likely to attend high quality ECEC, it may be an indication that the current universal policies are insufficient for ensuring equal access. If this is the case, potential implications are reduced opportunities for disadvantaged children, economic inefficiencies and increased socioeconomic inequalities in the society. This study aims at investigating socioeconomic selection into ECEC of higher quality in the context of a universal, heavily subsidized, regulated system, thereby contributing to the limited evidence on this subject and informing policy makers about the adequacy of existing universal policies.

### 1.1. The context of universal access: the Norwegian model of ECEC

Norway represents a setting with a nationwide universal, integrated, unitary setting ECEC system (European Commission/EACEA/Eurydice, 2019). The aim is to provide an equal access to high quality ECEC for all children from the age of 1 (legal right to a place in ECEC linked to the end of generous parental leave benefits) to 5 years old (up to start of primary education), irrespective of their socioeconomic background and geographic location. Over the years relevant for this study (2006–2015), the national coverage has expanded from 80% to 90% for 1–5 year olds, from 62% to 81% for 1–2 year olds and from 93% to 97% for 3–5 year olds (Statistics Norway, 2017). As per 2019, 92% of all children in the age of 1–5 years attended ECEC (Statistics Norway, 2020).

ECEC is heavily subsidized with capped monthly fees, which were NOK 2,250 in 2006 (app. USD 350) and NOK 2,580 (app. USD 320) in 2015, and fee reductions for siblings and low-income families (Ministry of Children and Families, 2005a; Norges Bank, 2020). As per now, the maximum monthly fee is NOK 3,135 (app. USD 350 exchange rate January 2020, there has been a substantial depreciation of NOK over the years) and should not exceed 6% of a household income per ECEC place for the first child (Ministry of Education & Research, 2020; Norges Bank, 2020). Fees are the same for public and private institutions. All centres, both public and private, are subsidized by the government and obliged to follow the nationally regulated quality standards (Ministry of Education & Research, 2005), concerning staff education, staff:child ratio and content of curriculum. The national regulations on staff:child ratio were not legally enforced during the study period, but 1:3 for small

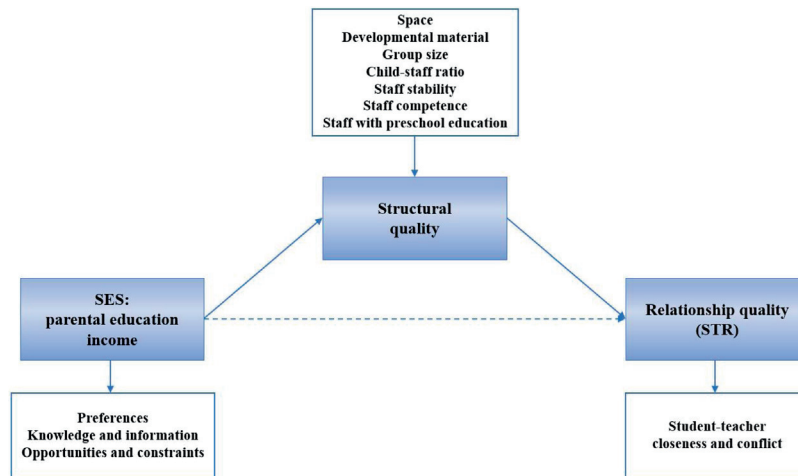
children (under 3 years old) and 1:6 for older children (over 3 years old) was a common practice. Staff education was primarily regulated through requiring preschool education (now called Kindergarten teacher education) for the pedagogical leader (though exemptions were allowed) and the pedagogue to child norm, which was 1:7–9 for small and 1:14–18 for older children (now 1:7 and 1:14) (Ministry of Children & Families, 2005b; Ministry of Education & Research, 2017).

Parents in Norway are not able to directly choose the ECEC center, but must rank the centers they prefer in their application to the municipality. The municipality makes the ultimate decision based on the availability and parental preferences, prioritizing children according to their date of birth and children with older siblings in the same center. Municipalities are required to facilitate a coordinated admission into ECEC and ensure equal treatment of children as well as public and private ECEC (Ministry of Education & Research, 2005) that constitute around 50% of ECEC in Norway. The ECEC centers are usually divided into departments for younger and older children, and children normally attend the same center except when the family moves or parents are dissatisfied with the center.

In contrast to the U.S. for example, where Quality Rating and Improvement System (QRIS) provides an easily comparable quality rating for different preschools, there is limited information for evaluation of quality in Norway. Parents in Norway can compare different ECEC centers by accessing publicly available online information on some structural quality characteristics (e.g., type of ECEC, ownership, opening hours, number of children, child-staff ratio, share of staff with preschool education, parental satisfaction, space for play and activities per child). Alternatively or additionally, parents can obtain information about ECEC characteristics by contacting ECEC centers of interest.

### 1.2. ECEC quality

ECEC quality is a complex and multifaceted concept that is usually defined in terms of structural and process quality indicators. Structural quality includes factors such as group size, child-staff ratio, space, materials and staff qualifications. These factors are more distal to child development and expected to primarily work indirectly through influencing process quality. Process quality is more proximal to the child and concerns different aspects of everyday interactions between staff and children and among children (see e.g., Slot, 2018). Process quality, including global and domain-specific measures, has been demonstrated to have small, but positive and lasting effects for children's academic development (e.g., Ulferts et al., 2019). One particularly important dimension of process quality is student-teacher interactions and relationships. Student-teacher relationships (also referred to as teacher-child relationships in the literature) are gaining a central role in enhancing educational quality and promoting positive child development (Sabol & Pianta, 2012). Close relationships have a potential to improve both academic and socioemotional functioning among children with behavior and demographic risks, while conflict seems to worsen negative outcomes for children with behavior problems (Sabol & Pianta, 2012). A commonly used measure of student-teacher relationship in research involving preschool and school children is the Student-Teacher Relationship Scale (STRS) (Pianta, 2001) that has been shown to correlate with observed student-teacher interactions and relationships (Hartz, Williford, & Koomen, 2017; Howes & Ritchie, 1999). Research has demonstrated that STRS (including subscales of closeness and conflict) relates to children's academic and socioemotional development with evidence of long-term effects extending into adolescence (e.g., Ansari, Hofkens, & Pianta, 2020; Pianta & Stuhlman, 2004; Valiente, Parker, Swanson, Bradley, & Groh, 2019).



**Fig. 1.** Conceptual model: relation between parental SES, structural quality in ECEC and STR. *Note.* The dashed line denotes the total effect of parental SES on student-teacher relationship (STR) quality. This effect includes both potential indirect effects via structural quality and other effects from SES to STR (e.g., certain parental and child characteristics associated with SES, such as stronger social skills that can influence STR). Control variables are not included in the figure to simplify the illustration.

### 1.3. Conceptual model: SES and ECEC quality

In this section, we present a conceptual model (Fig. 1) exploring potential mechanisms for how SES can be linked to higher structural quality in ECEC, and how SES and structural quality may predict student-teacher relationship (STR) quality. One potential mechanism linking SES and ECEC quality is that higher SES parents may have higher preferences for quality including educational and developmental aspects of ECEC, compared to lower SES parents (Johansen, Leibowitz, & Waite, 1996; Peyton, Jacobs, O'Brien, & Roy, 2001; Stahl, Schober, & Spiess, 2018; Vandenbroeck, De Visscher, Van Nuffel, & Ferla, 2008). Yet, observed parental child care choices and perceived differences in preferences may, in fact, reflect preexisting opportunities and constraints (Chaudry, Henly, & Meyers, 2010; Coley, Votruba-Drzal, Collins, & Miller, 2014; Meyers & Jordan, 2006; Vandenbroeck et al., 2008; Weber, 2011). In the context of universal systems, where barriers associated with affordability are mainly removed, parental choices and preferences might still be constrained by varying availability of high quality ECEC (Becker & Schober, 2017; Vandenbroeck et al., 2008, e.g., as a result of residential segregation and parental preferences for ECEC proximity Becker & Schober, 2017).

In line with the earlier literature (e.g., Becker & Schober, 2017; Stahl et al., 2018) we argue that higher SES parents may have better knowledge and information. Specifically, higher SES parents might be more informed about quality in ECEC, including different dimensions of quality and their significance for child development, and thus be better equipped to evaluate classroom quality, compared to lower SES parents (Cryer, Tietze, & Wessels, 2002; Mocan, 2007). As social networks are stratified by location and sociodemographic characteristics (Chaudry, 2004), parents of higher SES may access more accurate information about different ECEC alternatives through their more competent and better-informed social networks. Parents of higher SES may also employ more effective search strategies (Vandenbroeck et al., 2008), possibly reflecting better information or knowledge on when and how to look for ECEC.

In a potential evaluation of the ECEC center's quality, parents will likely base their decisions on more easily observable quality characteristics (Becker & Schober, 2017; Mocan, 2007; Stahl et al., 2018). Further, we suggest that parents may partly rely on observable structural quality characteristics in their expectation of unobservable prior to selection STR quality. This is somewhat in

line with an earlier study in the U.S. (Mocan, 2007) arguing that under condition of information asymmetry between the parents and the centers, the parents are forced to extract quality information, though often unsuccessfully, from observable center and classroom characteristics. This is particularly the case for difficult to observe quality characteristics. Since larger information asymmetries have been found for difficult to observe quality aspects and parental characteristics were more strongly related to information gaps for highly observable characteristics (Camehl, Schober, & Spiess, 2018), we may discover larger socioeconomic differences for more easily observable structural quality attributes.

However, Mocan (2007) also showed that parents are weakly rational not using all information available when assessing ECEC quality. Moreover, as a result of limited and imperfect information, little experience, limited time frame for finding child care and costs associated with searching and evaluating different care alternatives, parents rely extensively on their social network as a source of information that also limits and filters this information through cultural and social norms (Meyers & Jordan, 2006). Thus, because of weak rationality, time and resource constraints, inexperience, limited information, and not always clear link between structural quality characteristics and STR quality, parents may instead use shortcuts to assess quality relying on information from their social network.

Due to a relatively compressed income distribution and relatively small wage differences between high- and low-skilled workers, the correlation between education level by year and income after tax among cohabiting couples with children under school age is 0.37 (authors own calculation in administrative records for the Norwegian population). In addition, maternal and paternal income have been shown to have a differential effect on the amount of nonmaternal care received (NICHD Early Child Care Research Network, 1997) and concern for educational aspects (Johansen et al., 1996). Therefore, both education and income, as well as maternal and paternal sources of income, can be interesting and meaningful independent predictors. In sum, we build on previous research in proposing a model for parents' selection of their child into higher quality ECEC based on how readily available and interpretable they find information about different aspects of quality. We hypothesize that higher SES parents are more likely to select ECEC of higher structural quality that may also predict STR quality.



#### 1.4. Addressing alternative explanations of SES selection

With all studies on selection into ECEC being non-experimental, statistical control for alternative explanations is crucial for strengthening the internal validity of any inference (Duncan & Gibson-Davis, 2006). Previous studies in this area have highlighted multiple domains of potentially important variables. Besides the SES variables, these include variables related to family cultural background, parental beliefs and involvement, household composition, maternal characteristics and various child-level factors, as well as center and regional characteristics (e.g., Becker & Schober, 2017; Coley et al., 2014; Eliassen et al., 2018; Grogan, 2012; Petitclerc et al., 2017; Stahl et al., 2018; Zachrisson, Janson, & Nærde, 2013). While all the above-mentioned factors can affect ECEC choices and are relevant predictors of selection into ECEC, not all these factors will confound the association between SES and ECEC quality jeopardizing the internal validity of the study. We employed causal directed acyclic graphs (DAGs) (Pearl, 2000; Textor, Hardt, & Knüppel, 2011) to identify appropriate variables that require statistical adjustment. Assuming that SES affects structural ECEC quality through influencing *unobserved preferences, knowledge, information and opportunities* and that structural quality can then predict STR along with parental SES, we estimate the total effect of SES on structural quality and STR. The minimal sufficient adjustment required inclusion of variables conceptualized to affect both SES, *unobserved parental preferences, knowledge, information and opportunities* and STR (i.e., parent non-native speaker, single mother and mother's age). Having a non-native speaking parent may affect family educational level and income, shape parental preferences, knowledge, information and opportunities to evaluate and access ECEC quality and may influence STR (e.g., through parental and children's language competence and cultural differences in social behavior). Being a single mother will affect measures of family SES as well as influence preferences, information and opportunities (e.g., available time and financial resources). Mother's age may predict educational level and income (i.e., older mothers are more likely to complete higher education and/or have a higher level of income) as well as affect preferences and knowledge. Additionally, we control for child-level characteristics (child's temperament, behavior, gender) and for how long the teacher has known the child that can influence STR. Including these variables can improve precision of the estimates and reduce the unexplained variation in STR. Finally, we control for whether parents reported that they have changed child care, as they may have sought centers with higher structural quality. We include additional control variables related to ECEC and municipality characteristics in the sensitivity analyses to account for some of the potential mediating mechanisms (e.g. regional-level opportunities and constraints) in the relation between SES and structural quality.

#### 1.5. The present study

The purpose of this study is to explore potential socioeconomic selection into ECEC of higher structural quality, and to examine if structural quality along with SES predicts STR, taking into account accessibility of information on different quality aspects to parents. The current study expands, in several ways, the existing research literature in the context of universal ECEC system where parents have a limited information for prior evaluation of ECEC quality. First, this study contributes to filling the gap in research on access to ECEC quality in the Nordic universal, integrated, unitary setting, utilizing rich data from a nationwide prospective cohort study. Second, in addition to different structural features, this study includes the student-teacher relationship quality that appears to play an important role in enhancing educational quality and improving children's functioning (Sabol & Pianta, 2012).

Finally, we explore individual contribution of parental education, maternal and paternal income, while accounting for alternative explanations of associations between SES, structural quality and STR.

## 2. Methods

### 2.1. Data and study population

The study is based on the sub-cohort of children, participating in the Norwegian Mother, Father and Child Cohort Study (MoBa), for which questionnaire data from ECEC teachers were collected when they were 5 years old N 7,436 (in the main analyses 7,226). ECEC teachers of the children born between 2006 and 2009 were invited to evaluate the ECEC quality and the children's functioning in an ECEC questionnaire (Q-Cc). The teacher response rate was around 41%. These data were further linked to the Medical Birth Registry of Norway (MBRN) (Irgens, 2000), that is a national health registry containing information about all births in Norway. Finally, these data were merged with ECEC-level registry data from The Norwegian Directorate for Education and Training and municipality-level registry data from the Statistics Norway.

MoBa is a prospective population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health (Magnus et al., 2016). Participants were recruited from all over Norway in 1999–2008. The women consented to participation in 41% of the eligible pregnancies. The MoBa cohort now includes 114,500 children, 95,200 mothers and 75,200 fathers. The current study is based on 12th version of quality-assured data files released for research in 2020 that included only the sub-cohort of children with Q-Cc data.

### 2.2. Ethical consideration

MoBa has been approved by The Regional Committees for Medical and Health Research Ethics (REC) and The Norwegian Data Protection Authority (DPA). The current study has a separate approval from REC (2018/1918/REK sør-øst). Informed written consent was obtained from all participants in MoBa.

### 2.3. Measures

#### 2.3.1. Structural quality

Measured at the department or base (i.e., more flexible/open group organization) level. Space and developmental materials were measured by asking ECEC teachers to rate its sufficiency and availability on a scale from 1 (“completely disagree”) to 5 (“completely agree”). Group size was based on teachers' reported total number of girls and boys. Child-staff ratio was estimated by dividing the total number of girls and boys by the total number of male and female employees. Staff education was defined as a share of all employees (including the head of the department) with a preschool education of the total number of male and female employees. Staff stability was rated by ECEC teachers on a scale from 1 (“very good stability”) to 5 (“not good stability”). The measure was reversed in the subsequent analysis where 5 indicated “very good stability”. Staff competence was measured by asking ECEC teachers to indicate their agreement on a scale from 1 (“completely disagree”) to 5 (“completely agree”) that employees in the department have sufficiently good competence with regard to social competence, bullying among children, behavior problems, language competence and shy children.

#### 2.3.2. Student-teacher relationship

Closeness and conflict were measured by 15 questions from the short form of the Student-Teacher Relationship Scale (STRS-SF)

(Pianta, 2001) and rated by ECEC teachers on a scale from 1 (“not true at all”) to 5 (“very true”).

### 2.3.3. Registry data at ECEC and municipality level

Additionally, we have acquired registry data on ECEC quality: the share (%) of staff with a preschool education, and approved play and rest area (m<sup>2</sup>) per child at ECEC and municipality level, as well as data on ECEC coverage and spending in the municipalities. These data were used in the sensitivity analyses.

### 2.3.4. Socioeconomic status

Parental education and income were reported by mothers in the MoBa 15th weeks of pregnancy questionnaire and fathers in the period 2000–2009. Mothers and fathers were asked to indicate the highest level of education they have completed and their yearly gross income (including child support, unemployment benefits and other allowances). Education included six categories ranging from 9-year secondary school to college/university more than 4 years (Master’s degree, medical doctor, PhD). We operationalized education as the highest attained education in the family (e.g., if the mother’s educational level was higher than the father’s, we used the mother’s education and vice versa) assuming a compensating effect of one parent’s higher education for another’s lower education. Education was then combined into three categories (due to a small number of participants in the lowest educational categories): i) up to high school education ii) higher education college/university up to 4 years and iii) higher education college/university more than 4 years. Income originally included 7 categories ranging from 1 (no income) to 7 (over NOK 500,000 in gross income) that were analyzed as three categories indicating i) low (up to NOK 299,999) ii) middle (NOK 300,000–499,999) and iii) high income (NOK 500,000 and higher).

### 2.3.5. Control variables

The main control variables included parent non-native Norwegian speaker and single mother. Both variables were reported in the MoBa 15th weeks of pregnancy questionnaire where mothers were asked to indicate civil status and whether the child’s mother or father had a mother tongue other than Norwegian. An additional control variable for structural quality included mother’s age (MBRN). Additional control variables for STR included child’s gender and temperament reported by parents in the MoBa child’s 6th months questionnaire, teacher-reported child’s behavior and time (in years) the teacher has known the child (Q-Cc). Child’s temperament was measured by 10 questions based on the Infant Characteristics Questionnaire (ICQ) (Bates, Freeland, & Lounsbury, 1979) and children’s behavior was measured by 5 questions from the Child Behavior Checklist (CBCL) (Achenbach & Ruffle, 2000) and 7 questions from The Conners’ Parent Rating Scale-Revised: Short Form (CPRS-R) (Conners, Sitarenios, Parker, & Epstein, 1998).

## 2.4. Statistical methods

### 2.4.1. Structural equation modelling

We modelled selection into ECEC of higher structural quality and the effects of SES and structural quality on STR by means of structural equation modelling (SEM) in Mplus version 8.2. The four main SEM models were estimated with a robust Weighted Least Squares estimator (WLSMV) and parameterization ‘theta’. In the first model, we estimated the total effect of SES on all structural quality indicators and STR quality to see if higher SES predicted higher structural quality and better STR (all quality indicators were included in the same SEM model and assumed to correlate). In the second model, we estimated the effects of different structural quality characteristics on STR to see if higher structural quality in ECEC had an impact on STR (closeness and conflict were included in the

same SEM model and assumed to correlate). In the last two models, we explored potential indirect effects of SES on closeness and SES on conflict via structural quality indicators (that are assumed to exist prior to forming of STR). We included those structural indicators that were shown to relate to SES and predict STR (examining individual models for closeness and conflict, structural quality indicators and SES with and without adjustment for covariates). To explore the indirect effects of SES we regressed relevant structural quality indicators on SES variables, and STR on both the structural quality indicators and SES variables, in combination with the MODEL INDIRECT command. This produced total, direct and indirect effects separately for closeness and conflict. In all models, we controlled for potential family-level confounders and the change of care, as well as child-level characteristics in the regressions for STR.

Dummy variables for middle and high category of income and higher educational levels were included as predictors in the SEM models with the lowest categories of education and income serving as reference (i.e., up to high school education and income up to NOK 299,999). We chose not to analyze SES as a composite measure, education and income were not highly correlated (polychoric correlation with a casewise deletion for education and mother’s income  $r = 0.45$ ; education and father’s income  $r = 0.30$ ; mother’s and father’s income  $r = 0.35$ ) thereby providing an opportunity to explore their individual effects. Space, developmental material, staff competence, STR (closeness and conflict), as well as child’s temperament and behavior were analyzed as latent variables. All items used to measure the latent variables were defined as categorical variables in the analysis to account for their ordered response nature. Separate confirmatory factor analyses (CFA) were performed for latent measures prior to inclusion of these measures in the final analysis, meaningful residual covariances were added based on the modification indices.

### 2.4.2. Missing data

Missing data were handled by multiple imputation in Mplus using Bayesian analysis of unrestricted (H1) variance covariance model (Asparouhov & Muthén, 2010; Muthén & Muthén, 2017; Rubin, 1987; Schafer, 1997). Data were imputed for all variables that we planned to use in the main analyses (with the exception of a dummy variable change of child care that was used as a condition for inclusion in some of the sensitivity analyses), all these variables were used to create 50 imputed datasets. The datasets were saved and used in the further analyses.

## 3. Results

Descriptive statistics for all variables included in the main analyses are presented in Table 1 (detailed descriptive statistics with all indicators of the latent variables can be found in the supplementary material). All scales in the current study have shown good reliability, with polychoric ordinal alpha (Gadermann, Guhn, & Zumbo, 2012) ranging from  $\alpha = 0.83$  to  $\alpha = 0.91$ . The results from the four SEM models are provided in Tables 2 and 3 and Figs. 2 and 3. These are the average results over the 50 imputed datasets with standardized (STDY and STDYX) estimates (regression coefficients) for latent and observed continuous variables and probit regression coefficients for an ordered categorical dependent variable staff stability. The effects of the control variables are not presented due to MoBa’s restrictive policies to prevent infringement on other research projects.

### 3.1. Total effects of SES on structural quality and STR

#### 3.1.1. SES and structural quality

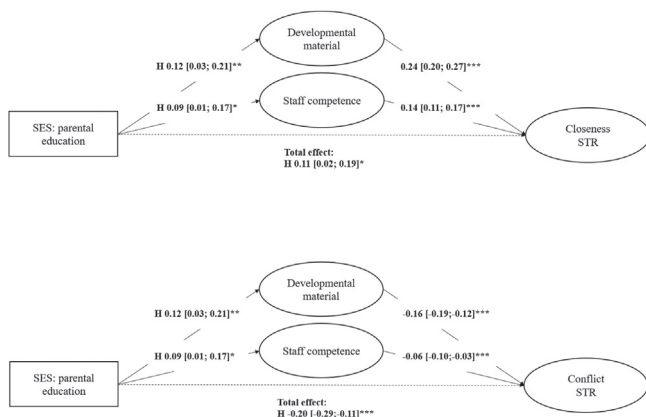
The results (Table 2) indicate that a higher level of parental education (more than 4 years) is positively associated with devel-

**Table 1**  
Descriptive statistics: quality indicators, predictors and covariates.

Variables	Missing/ imputed data %	Mean (SD) %	Polychoric ordinal alpha
Space: play and rest area (sufficiency)	0.3	3.66 (0.86)	0.83
Developmental material (availability and accessibility)	0.3	4.20 (0.52)	0.80
Staff competence	0.7	3.84 (0.65)	0.89
Staff stability	1.8	4.22 (0.94)	
Group size	4.3	20.51 (5.62)	
Child-staff ratio	5.9	4.98 (1.30)	
Staff (%) with preschool education	5.0	34.03 (19.07)	
Closeness (STR)	0.2	4.35 (0.48)	0.85
Conflict (STR)	0.2	1.45 (0.54)	0.91
<i>Parental education</i>			
Lower education: up to high school education	1.4	16	
Higher education: up to 4 years	1.4	38	
Higher education: more than 4 years	1.4	46	
<i>Income mother</i>			
Low (up to NOK 299,999)	3.6	44	
Middle (NOK 300,000–499,999)	3.6	49	
High (NOK 500,000 and higher)	3.6	8	
<i>Income father</i>			
Low (up to NOK 299,999)	2.3	21	
Middle (NOK 300,000–499,999)	2.3	54	
High (NOK 500,000 and higher)	2.3	25	
<i>Family- and child-level control variables</i>			
Parent non-native Norwegian speaker	2.7	11	
Single mother	1.4	2	
Mother's age	0.2	31.18 (4.36)	
Changed child care <sup>a</sup>	2.8	47	
Teacher has known the child (years)	2.4	2.50 (1.38)	
Child's gender (girl)	0.0	50	
Child's temperament (ICQ)	3.2	2.18 (0.72)	0.86
Child's behavior (CPRS)	0.7	1.42 (0.50)	0.93
Child's behavior (CBCL)	0.7	1.26 (0.36)	0.85

Note: N = 7,436 (average results over 50 imputed datasets). ICQ-Infant Characteristics Questionnaire; CBCL - Child Behaviour Checklist; CPRS - Conners Parent Rating Scale; STR - Student-Teacher Relationshipship.

<sup>a</sup> Missing values for changed child care were not imputed (N = 7,226) this variable was used as a condition for inclusion in some of the analyses.



**Figs. 2 and 3.** Regressions: total (SES to STR) and indirect effects (SES to structural quality × structural quality to STR) of parental education on STR.

Note: N 7,226 (average results based on 50 imputed datasets). Standardized estimates with [95% CI]. Controlling for other SES variables, family- and child-level covariates (STR regression) and child care change. Education: the highest education in the family more than 4 years (H), reference: up to high school education.

All potential indirect effects (developmental material, staff competence and stability) are included in the same SEM model. Staff competence and stability are assumed to correlate.

The model fit for closeness and conflict: RMSEA = 0.03 CFI = 0.97 TLI = 0.97 SRMR = 0.04.

\* p < .05 \*\* p < .01 \*\*\* p < .001

opmental material at the ECEC department that the child attended (0.12 of a standard deviation SD), similar in magnitude, but non-significant effect was observed for high mother's income. Higher parental education (more than 4 years) and high mother's income were also significantly related to higher staff competence (0.09 and

0.12 of SD), while higher father's income predicted higher staff stability. However, we found only small and non-significant effects of SES on group size and child-staff ratio. Interestingly, the share of employees with preschool education was positively related to higher parental education (0.09 and 0.11 of SD), but negatively to high mother's income (-0.12 of SD). In other words, children with highly educated parents seem to attend ECEC with a higher share of employees with preschool education, while children with high-income mothers appear to access lower quality in terms of share of employees with preschool education.

### 3.1.2. SES and STR

Regarding socioeconomic status and relationship quality (Table 2). Having parents with higher education (0.13 and 0.11 of SD) and a father with a higher income (0.08 of SD) were significantly related to higher level of student-teacher closeness and lower level of conflict (-0.15, -0.20 and -0.10 of SD). Having a mother with higher income was also, though non-significantly, related to higher level of closeness (0.11 of SD).

### 3.2. Effects of structural quality on STR

Our results (Table 3) also reveal adjusted associations between structural quality attributes and relationship quality. Higher teacher rating on developmental material, staff stability and staff competence were associated with higher rating on student-teacher closeness (0.24, 0.09 and 0.13 of a SD) and lower rating on student-teacher conflict (-0.08, -0.09 and -0.04 of SD). Furthermore, space (play and rest area) and group size were both negatively related to student-teacher closeness (-0.05 and -0.05 of SD).

**Table 2**  
Regressions: total effects of SES on structural quality and student-teacher relationship (STR), regression coefficients  $\beta$  with standard errors (SE).

	Structural quality (ECEC department/base)					Relationship quality (STR)			
	Space: play and rest area	Develop. material	Group size	Child-staff ratio	Staff stability	Staff competence	Staff with preschool education	Closeness	Conflict
<i>Hypothesized observability</i>									
	<i>Easily observable</i>					<i>Potentially observable</i>		<i>Not observable</i>	
Higher education up to 4 years	0.01 (0.04)	0.07 (0.04)	0.01 (0.04)	-0.01 (0.04)	0.05 (0.04)	0.03 (0.04)	0.09 (0.04)*	0.13 (0.04)**	-0.15 (0.04)**
Higher education more than 4 years	0.09 (0.04)	0.12 (0.05)**	-0.02 (0.04)	0.07 (0.04)	0.02 (0.04)	0.09 (0.04)*	0.11 (0.04)**	0.11 (0.04)*	-0.20 (0.05)**
Middle income mother	-0.02 (0.03)	-0.01 (0.03)	0.04 (0.03)	0.04 (0.03)	-0.004 (0.03)	0.03 (0.03)	-0.03 (0.03)	0.02 (0.03)	0.01 (0.03)
High income mother	0.05 (0.06)	0.11 (0.06)	0.02 (0.05)	0.05 (0.05)	0.02 (0.06)	0.12 (0.05)*	-0.12 (0.05)*	0.11 (0.06)	0.01 (0.06)
Middle income father	-0.03 (0.04)	0.01 (0.04)	0.03 (0.03)	0.04 (0.03)	0.10 (0.04)**	-0.03 (0.04)	0.04 (0.03)	0.08 (0.04)*	-0.07 (0.04)
High income father	0.002 (0.04)	0.08 (0.05)	-0.03 (0.04)	0.05 (0.04)	0.13 (0.04)**	-0.08 (0.04)	-0.02 (0.04)	0.05 (0.04)	-0.10 (0.05)*

Note: N = 7,226 (average results over 50 imputed datasets). All quality characteristics are included in the same SEM model and are assumed to correlate. Education: the highest education in the family, reference category: up to high school education. Income: reference category low income: up to NOK 299,999. We account for whether parents reported that they have changed child care in all analyses (dummy variable). Family-level control variables for estimating the total effect of SES: parent non-native speaker, single mother and mother's age (structural quality). Child-level control variables in the models for STR: child's temperament prior to starting ECEC, teacher-reported child's behavior in ECEC (CBCL-Child Behaviour Checklist for conflict and CPRS - Connors Parent Rating Scale for closeness), teacher has known child (years), and child's gender. Model fit indices: RMSEA = 0.03 CFI = 0.96 TLI = 0.96 SRMR = 0.04.

\* p < .05.  
\*\* p < .01.  
\*\*\* p < .001.

**Table 3**

Regression: effects of structural quality (ECEC department/base) on student-teacher relationship (STR), regression coefficients  $\beta$  with standard errors (SE).

	Relationship quality (STR)	
	Closeness	Conflict
Space: play and rest area	-0.05 (0.02)*	0.001 (0.02)
Developmental material	0.24 (0.02)***	-0.08 (0.02)***
Group size	-0.05 (0.01)***	-0.02 (0.02)
Child-staff ratio	0.01 (0.01)	-0.03 (0.02)
Staff stability	0.09 (0.01)***	-0.09 (0.01)***
Staff competence	0.13 (0.02)***	-0.04 (0.01)**
Staff with preschool education	-0.01 (0.01)	0.03 (0.02)

Note: N 7,226 (average results over 50 imputed datasets). Family-level control variables for estimating the effect of structural quality characteristics on STR: closeness and conflict: SES, parent non-native speaker and single mother. Child-level control variables: child's temperament prior to starting ECEC, teacher-reported child's behavior in ECEC, teacher has known child (years), child's gender. We account for whether parents reported that they have changed child care. Both closeness and conflict are included in the same SEM model and are assumed to correlate. Model fit indices: RMSEA 0.03 CFI 0.96 TLI 0.96 SRMR 0.05.

\* p < .05.  
\*\* p < .01.  
\*\*\* p < .001.

### 3.3. Indirect effects of SES on STR via structural quality

Further, we explored potential indirect effects of SES on STR (separately for closeness and conflict) via structural quality indicators that were related to SES and STR. Due to space limitations, we present our results for indirect effects (path *SES to structural quality* × *structural quality to STR*) in figures only for parental education (see Figs. 2 and 3). The figures represent the effects of the highest level of education - college/university more than 4 years compared to the reference category - up to high school education) on STR: closeness and conflict with [95% CI], while controlling for other SES variables, potential family-level confounders and child-level characteristics that may affect STR.

#### 3.3.1. Indirect effects: SES and closeness

We found very small, significant indirect effects from the highest level of parental education to closeness via developmental material 0.03 [0.01; 0.05] and staff competence 0.01 [0.001; 0.02], accounting for 0.03 and 0.01 of SD of the total effect of the highest level of parental education on closeness 0.11 [0.02; 0.19]. Both the total effect from the highest category of mother's income to closeness 0.11 [-0.01; 0.22] and indirect effect via developmental material 0.03 [-0.003; 0.06] were non-significant, while significant indirect effect via staff competence amounted to 0.02 [0.001; 0.03] (of SD) of the total effect. The indirect effects from the middle and high father's income via staff stability constituted 0.01 [0.003; 0.02] and 0.02 [0.01; 0.03] (of SD) of the total effects 0.08 [0.01; 0.15] and 0.05 [-0.03; 0.13] with the last one not being statistically significant.

#### 3.3.2. Indirect effects: SES and conflict

There were also weak negative indirect effects from the highest level of parental education (more than 4 years) to conflict via developmental material -0.02 [CI -0.03; -0.004] (of SD) of the total effect -0.20 [-0.29; -0.11]. The indirect effects from the middle and high father's income via staff stability accounted for -0.01 [-0.02; -0.003] and -0.02 [-0.03; -0.004] (of SD respectively) of the total non-significant -0.07 [-0.14; 0.01] and significant effect -0.10 [-0.18; -0.01].

### 3.4. Sensitivity analyses

We have conducted different sensitivity analyses to explore mechanisms behind the observed associations and test the robust-



ness of the results. We have adjusted standard errors for clustering at the ECEC level to allow for non-independence of observations (multiple children in the same ECEC) in the subsample with valid ECEC IDs (see appendix Table A1). Around 78% of the total sample had valid ECEC IDs. In general, the effects in the subgroup analysis were similar (somewhat stronger) and still suggesting that higher SES were associated with higher structural quality. Additional effects became significant (for space, developmental material, and mother's middle income predicted higher child-staff ratio), some few effects became non-significant.

In addition, we addressed concerns regarding potential differences in ECEC availability across the municipalities and that higher SES families live in more affluent municipalities and might be more likely to attend higher quality ECEC by controlling for ECEC coverage and spending within municipality. Moreover, we controlled for potential quality differences between the municipalities by including the share (%) of staff with preschool education and play and rest area per child (m<sup>2</sup>) in the municipality. These analyses allowed us to account for some of the important mediating mechanisms in the observed relations between SES and structural quality in the subsample with valid ECEC IDs that have not changed child care.

We also adjusted standard errors for clustering to allow for non-independence of observations at the municipality level. Even after controlling for ECEC and municipality characteristics, higher parental SES predicted higher structural quality in terms of developmental material and stability (see appendix Table A2).

Furthermore, we explored if higher SES predicted higher quality at the ECEC level with registry data on the share of staff with a preschool education, and play and rest area (m<sup>2</sup>) total in ECEC and per child. This was done in the subgroup analysis for those with valid ECEC ID (this allowed us to link the registry data) and those that did not change care (as ECEC ID were collected when children were 5 years old and the registry data were used from the earlier years). Though there was a positive relation between a higher education and the share of employees with a preschool education (unadjusted analyses), the effect sizes were very small and non-significant, while a negative relation with mothers income remained.

#### 4. Discussion

In this study, we investigated socioeconomic selection into ECEC of higher structural quality in the context of universal access, and explored effects of parental SES and structural quality on STR quality. In line with earlier research we argued that one of the mechanisms for how SES can be linked to a higher structural quality in ECEC is through preferences, knowledge and access to information affecting parental ability to evaluate quality and that parents will likely base their decision on more easily observable quality characteristics. Finally, we suggested that parents may partly rely on observable structural quality in their expectation of unobservable prior to selection STR quality (i.e., there are potential indirect effects between SES and STR).

Results (Table 2) suggested that children from families with higher SES are more likely to attend ECEC of higher structural quality (particularly with regard to developmental material, staff competence and stability) and appear to have a better relationship quality, though the effect sizes were quite small. Results also indicated that the same aspects of structural quality predicted higher relationship quality (Table 3), but indirect effects were weak.

Overall, we did not observe a consistent pattern suggesting greater socioeconomic differences for easily observable compared to more difficult to observe quality indicators. Recent studies from a similar context also did not provide consistent evidence to support this argument. While Stahl et al. (2018) reported that lower educated parents and parents with migration background experi-

enced lower quality mainly for easily observable quality aspects, Becker and Schober (2017) found no significant social and ethnic differences for the most easily observable quality indicators (group size, child-teacher ratio).

The observed associations between SES and STR may reflect that higher SES parents are able to select ECEC with certain characteristics that may predict higher relationship quality (including recommendations from their social network and other ECEC characteristics that we do not observe), or that relationship quality is influenced by parental SES. In the last case, one potential mechanism can be that children of higher educated parents have stronger social and communication skills that make it easier to establish a more positive relationship with the teacher or higher educated parents have a better collaboration with the teachers that facilitates a more positive relationship with the child.

Our findings are in alignment with the earlier Norwegian studies that found SES selection into ECEC in Norway. Indications of socioeconomic selection have been found both with regard to participation in ECEC centers (Petitclerc et al., 2017; Sibley, Dearing, Toppelberg, Mykletun, & Zachrisson, 2015; Zachrisson et al., 2013) and attendance of ECEC centers of higher quality (Eliassen et al., 2018).

We observed somewhat more consistent patterns between parental education and ECEC quality compared to income. In addition, the effect of education was, in most cases, stronger when not controlled for income. The effects of mother's and father's income varied, both in terms of statistical significance and direction of associations. More specifically, a combined measure of parental education was significantly positively related to staff qualifications, in terms of both teacher-reported competence at the unit and a formal preschool education, as well as consistently related to higher relationship quality. Moreover, significant positive patterns of parental education were evident across quality indicators with a different degree of observability. Mother's and father's income, on the other hand, were not consistently related to teacher's qualifications and the effects were not found for quality indicators hypothesized to be easily observable to parents in the main analysis (though some significant effects appeared in the subsample analyses Tables A1 and A2). Parental income was also less consistently associated with the relationship quality. One of the potential explanations for these variations can be that income plays a less significant role in Norway, where access is universal and center care is heavily subsidized, and thus may be a less consistent predictor of quality. Parental education is also more closely related to knowledge and information, or as suggested above, might predict parental and children's social and communication skills needed to establish good relationships. These arguments are in accordance with the recent study by Stahl et al. (2018) that argued that knowledge, preferences and network might be more important than financial means in the process of ECEC selection in Germany.

Similarly to Becker and Schober (2017), we found no effects of socioeconomic status on other structural attributes such as group size and child-staff ratio in the main analysis. Becker and Schober (2017) interpreted the lack of significant results for group size and child-staff ratio (assumed to be the most easily observable quality aspects) as evidence for limited support for the family investment model and parental choice of ECEC. Our significant results for developmental materials (that should be easily observable to parents when they come to the ECEC center) do not quite support this conclusion. A possible explanation is that higher SES parents select ECEC based on structural quality aspects that are expected to vary more and more predictive of child well-being. Parents with higher SES may, in general, value these quality aspects (developmental material, staff competence, stability and education) higher than group size and child-staff ratio when considering ECEC for their children. We also cannot rule out that an alternative explanation for



the lack of associations between socioeconomic status, group size and child-staff ratio as well as a negative effect of mother's income on staff education can be incorrect reporting on the number of staff, number of children and staff education that were subsequently used to define these variables. Although, a negative association between high maternal income and staff with preschool education was confirmed with the registry data.

We also found that some of the potentially observable structural quality attributes that were related to higher SES, particularly developmental material, staff competence and staff stability, predicted higher relationship quality. This appears to provide some support to our earlier argument that parents of higher SES may select ECEC based on the structural quality indicators that are expected to promote higher relationship quality.

Larger groups were associated with a lower degree of student-teacher closeness. Associations between structural quality at classroom (e.g., group size, child-staff ratio) and staff level (e.g., pre-service qualifications) and process quality are generally supported in the literature, though with some inconsistencies. This might be attributed to limited variation within countries due to regulation of structural features, differences in methodologies and statistical techniques (Slot, 2018). More specifically regarding STR, group size has been found to moderate the effects of student-teacher closeness on children's behavior problems suggesting a beneficial effect of smaller groups (Skalická, Belsky, Stenseng, & Wichstrøm, 2015).

#### 4.1. Limitations

Some of the limitations of this study are related to general limitations of survey designs that tend to suffer from selection and non-response bias, recall bias and measurement errors. There was some degree of selection into MoBa that seemed to be exacerbated by non-response on the ECEC questionnaire. Some authors (Gustavson, von Soest, Karevold, & Røysamb, 2012; Nilsen et al., 2009) argued that the estimates of associations are not affected by self-selection and attrition rates and that there is high potential to prevent bias by including individuals with extreme scores (Gustavson, Røysamb, & Borren, 2019). However, a recent study by Biele et al. (2019) concluded that self-selection and loss to follow-up may still result in biased estimates of the associations. The consequences for our selective sample are that we probably underestimate the effects of SES on selection into ECEC quality, as higher educated, non-single, native speaking parents were overrepresented. Our reported measures of quality and parental SES may also contain measurement errors as these rely on ECEC teachers' memory (recalling of information) and judgment when reporting quality. While the error term should account for potential errors in the dependent variable (ECEC quality), the independent variables (education and income) could introduce bias in the estimations in the way that we do not find effects of income/education on ECEC quality. Moreover, the analysis of DAGs and the minimal sufficient adjustment for confounders still relies on the researchers' judgment and availability of data and therefore doesn't eliminate the possibility of omitted variables bias.

Even though we account for clustering of children within ECEC in the subgroup analysis thereby allowing for the intracluster correlation or non-independence, we were not able to account for potential clustering within a classroom due to the lack of information on which classrooms children attended. However, this should not be a substantial concern as many children participating in MoBa are dispersed across different ECEC centers.

In addition, the observed associations between the structural and relationship quality may reflect a shared variance in teachers' reporting. There were no corresponding registry data for ECEC to provide additional support for these associations. Therefore, one should be careful about interpreting the results as strong evidence

that parents can successfully use observable structural quality attributes to expect higher relationship quality or as an indication that targeting structural quality aspects, where we found significant associations, will improve relationship quality.

It should also be mentioned that our measures of quality and modeling of potential parental selection takes a researcher perspective. This might be an oversimplification of the complex reality where parents face numerous trade-offs and constraints. We do not have an opportunity to get insight into the real parental decision-making processes when looking for ECEC, perception of quality and values parents attach to different aspects. Even though parents seem to agree on the importance of quality attributes in the professionally recognized ECEC quality measures (Cryer et al., 2002; Mocan, 2007), there is evidence of substantial information gaps between professionals and parents (Camehl et al., 2018). In addition, it would be interesting to know if parents in the study received their first choice ECEC center, as this would say something more about parental ability to choose, but this information was not available. Moreover, while we argue that some quality is difficult to observe for parents prior to selection of ECEC, both structural and relationship quality, would, at least to some degree, be observable to parents once their child is enrolled in a center. This means that parents could change the center after observing a lower quality. We account for change in the analysis, but as we do not have comparable longitudinal data on quality before and after the change of child care, we are not able to examine whether the change of ECEC centers in our study sample could be the result of children's experience of poor structural or relationship quality. Furthermore, it can be argued that student-teacher relationship from the teacher's point of view is a problematic way to conceptualize relationship quality, as this measure is child-specific. We have controlled for child-level characteristics that may affect the relationship quality to address this concern. It is also possible that teachers report less closeness and more conflict with children from lower SES backgrounds compared to those from high. While one could potentially strengthen the measurement by looking at the aggregated report for all children by teacher, we are not able to examine it as we do not have information on teachers that answered the questionnaire. Moreover, considering that children are dispersed across different ECEC, it is likely that in many cases there is only one child per reporting teacher.

Observed socioeconomic differences in ECEC quality may also reflect other preferences (e.g., ECEC proximity) and regional differences defining parental opportunities and constraints (e.g., supply and quality of ECEC, social network as the source of information that can be stratified by location). A high concentration of families with high/low SES in some areas may also affect ECEC quality. Yet, even after controlling for municipality-level factors in the sensitivity analyses we found indications that higher SES predicted higher structural quality in terms of developmental material and staff stability. Similarly, in an earlier Norwegian study (Eliassen et al., 2018) high parental education was associated with higher quality in ECEC even after controlling for municipality. Alternatively, the observed socioeconomic differences may reflect preferences for other unobservable factors, that correlate with the analyzed quality characteristics, such as socioeconomic and ethnical composition of children in the group (e.g., Becker and Schober, 2017; Stahl et al., 2018; Torquati, Raikes, Huddleston-Casas, Bovaird, & Harris, 2011) or practical considerations such as transportation, that might be more important to lower SES parents due to more limited resources. These above discussed aspects can be important mediating mechanisms of the observed associations. Finally, even in the context where parental applications for a place in ECEC are administered by the municipalities, thereby limiting potential selection by providers and parental influences, we cannot completely rule out the possibility that parents of higher SES may have some influence on the

process. One potential loophole is that private providers have their own regulations regarding admission priorities, in addition to those defined by the law for all ECEC centers.

#### 4.2. Policy implications and directions for future research

In spite of the above-mentioned limitations, this study provides an important insight on the equity in the access to high quality ECEC in the universal context, and in particularly cast light on the access by children from less advantageous socioeconomic backgrounds. The evidence that children from less advantageous backgrounds, that could benefit most from high quality ECEC, appear to experience ECEC of lower quality, at least on some dimensions, is alarming. As discussed, high quality ECEC provides an important foundation for child development with positive short- and long-term effects for children's cognitive, language and socioemotional development. Potential consequences of the observed socioeconomic inequalities in the access to high quality ECEC are reduced opportunities for disadvantaged children, increased socioeconomic inequalities in the society and economic inefficiencies because of suboptimal return on public investment in ECEC. Variations in ECEC quality and evidence of possible selection may pose challenges for the universal system that is intended to provide homogeneous high quality ECEC services for all children. While one potential effective way to reduce inequities in the use of higher quality ECEC might be improving parental knowledge and information, more research is needed to confirm our findings across different samples and methodological approaches as well as to improve the understanding of parental preferences, information and selection process of ECEC. In future research, it would be important to study how these quality characteristics for which we observed socioeconomic disparities influence different aspects of children's development and well-being. Furthermore, future studies exploring selection into ECEC of higher quality should include a broader range of structural quality indicators based on registry data as well as different aspects of process quality.

#### 5. Conclusion

We found indications of advantageous socioeconomic selection into ECEC of higher quality in the context of universal access in Norway. Higher parental education, and to a lesser degree income, predicted child attendance of ECEC with higher structural quality as

rated by ECEC teachers. Further, higher parental SES and structural quality (i.e., developmental material, higher staff competence and stability) predicted better student-teacher relationship quality in terms of higher level of closeness and less conflict. These findings suggest that ambitions of universal equal access to high quality ECEC are not entirely realized and more efforts are needed to ensure higher structural quality in ECEC and enhance relationship quality for children from less advantageous socioeconomic backgrounds.

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#### Declarations of interest

None.

#### CRediT authorship contribution statement

**Nina Alexandersen:** Conceptualization, Methodology, Formal analysis, Writing - original draft, Visualization. **Henrik Daae Zachrisson:** Conceptualization, Methodology, Writing - review & editing. **Tiril Wilhelmsen:** Writing - review & editing. **Mari Vaage Wang:** Funding acquisition, Project administration, Writing - review & editing. **Ragnhild Eek Brandlistuen:** Conceptualization, Methodology, Writing - review & editing, Supervision, Funding acquisition.

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#### Appendix A. Sensitivity analyses

**Table A1**  
 Regressions: total effects of SES on structural quality and student-teacher relationship (STR), regression coefficients  $\beta$  with standard errors (SE) clustered by ECEC.

	Structural quality (ECEC department/base)										Relationship quality (STR)	
	Easily observable					Potentially observable					Not observable	
	Space: play and rest area	Develop. material	Group size	Child-staff ratio	Staff stability	Staff competence	Staff with preschool education	Closeness	Conflict			
Higher education up to 4 years	0.03 (0.05)	0.10 (0.05)*	0.02 (0.04)	-0.02 (0.04)	0.08 (0.05)	0.02 (0.05)	0.11 (0.05)*	0.12 (0.05)*	0.09 (0.05)	-0.17 (0.05)**		
Higher education more than 4 years	0.10 (0.05)*	0.15 (0.05)**	-0.003 (0.04)	0.05 (0.05)	0.06 (0.05)	0.11 (0.05)*	0.12 (0.05)*	0.09 (0.05)	-0.21 (0.05)***			
Middle income mother	-0.02 (0.04)	-0.01 (0.04)	0.05 (0.03)	0.07 (0.03)*	0.001 (0.04)	0.03 (0.03)	-0.03 (0.03)	0.03 (0.04)	0.01 (0.04)			
High income mother	0.02 (0.07)	0.11 (0.07)	-0.01 (0.06)	0.04 (0.06)	0.04 (0.06)	0.12 (0.06)	-0.14 (0.06)*	0.12 (0.07)	0.02 (0.07)			
Middle income father	-0.05 (0.04)	-0.01 (0.04)	0.004 (0.04)	0.03 (0.04)	0.10 (0.04)*	-0.04 (0.04)	0.03 (0.04)	0.10 (0.04)**	-0.08 (0.04)			
High income father	0.01 (0.05)	0.06 (0.05)	-0.04 (0.04)	0.07 (0.05)	0.12 (0.05)*	-0.09 (0.05)	-0.02 (0.05)	0.08 (0.05)	-0.11 (0.05)*			

Note: N 5,611 (average results over 50 imputed datasets). The analyses included those with valid ECEC ID, we account for whether parents reported that they have changed child care. All quality characteristics are included in the same SEM model and are assumed to correlate. Education: the highest education in the family, reference category: up to high school education. Income: reference category low income: up to NOK 299,999. Family-level control variables for estimating the total effect of SES: parent non-native speaker and single mother, mother's age (structural quality). Child-level control variables in the models for STR: child's temperament prior to starting ECEC, teacher-reported child's behavior in ECEC, teacher has known child (years), child's gender. Model fit indices: RMSEA = 0.02 CFI = 0.96 TLI = 0.96 SRMR = 0.04.

\* p < .05.  
 \*\* p < .01.  
 \*\*\* p < .001.

**Table A2**  
 Regressions: effects of SES on structural quality, adjusted for ECEC and municipality characteristics factors, regression coefficients  $\beta$  with standard errors (SE) clustered by municipality.

	Structural quality (ECEC department/base)									
	Easily observable					Potentially observable				
	Space: play and rest area <sup>a</sup>	Develop. material	Group size	Child-staff ratio	Staff stability	Staff competence	Staff with preschool education <sup>b</sup>			
Higher education up to 4 years	0.000 (0.07)	0.09 (0.07)	0.01 (0.05)	-0.03 (0.06)	0.08 (0.07)	0.001 (0.06)	0.03 (0.06)			
Higher education more than 4 years	0.05 (0.07)	0.15 (0.08)*	0.01 (0.06)	0.03 (0.06)	0.08 (0.06)	0.07 (0.07)	0.08 (0.06)			
Middle income mother	-0.01 (0.05)	0.01 (0.05)	0.08 (0.04)*	0.08 (0.04)	-0.04 (0.05)	0.06 (0.05)	-0.05 (0.05)			
High income mother	0.05 (0.10)	0.07 (0.08)	-0.04 (0.11)	0.05 (0.08)	0.05 (0.08)	0.11 (0.10)	-0.05 (0.07)			
Middle income father	-0.02 (0.05)	0.03 (0.05)	-0.01 (0.05)	-0.003 (0.05)	0.10 (0.06)	-0.02 (0.05)	0.004 (0.05)			
High income father	0.03 (0.07)	0.14 (0.06)*	-0.08 (0.05)	0.09 (0.06)	0.15 (0.06)*	-0.09 (0.07)	0.03 (0.06)			

Note: N 3,003 (average results over 50 imputed datasets). The analyses included those with valid ECEC ID (allowed us to link the registry data) and those that reported that they have not changed child care (as ECEC ID were collected when children were 5 years old and the registry data were used from the earlier years). All quality characteristics are included in the same SEM model and are assumed to correlate. Family-level control variables: parent non-native speaker, single mother and mother's age. ECEC-level control variables: ownership (private/not private) and organization (department vs base or zone with more flexible/open groups). Municipality-level control variables: ECEC coverage (share (%) of children 1–5 years with a place in ECEC) and spending on ECEC (net operating expenses per capita 1–5 years in NOK 1000). Additionally controlled for: play and rest area per child in ECEC (m<sup>2</sup>) and share (%) of staff with a preschool education in the municipality (avg. 2009–2010). Model fit indices: RMSEA = 0.02 CFI = 0.98 TLI = 0.97 SRMR = 0.05.

\*p < .05 \*\*p < .01 \*\*\*p < .001.

## Appendix B. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ecresq.2021.01.001>.

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## Errata

Name of candidate: Nina Alexandersen

Title of thesis: The Role of Early Educational Experiences in Child Development: Evidence from a Context of Universal Access

Abbreviations for different types of corrections:

Cor – correction of language

Cpltf – change of page layout or text format

Page <sup>a</sup>	Line	Original text	Type of correction	Corrected text
IV-X			Cpltf	Added blank pages
V	10	open-mind	Cor	open mind
V	19	Eliassen.	Cor	Eliassen,
2	14	ecologically-perspectives	Cor	ecological perspectives
20, 28, 40			Cpltf	Added blank pages
29	22	(Mari Vaage & Schjølberg, 2014)	Cpltf	(Wang & Schjølberg, 2014)
67	1	Mari Vaage, W., & Schjølberg, S. (2014).	Cpltf	Wang, M.V., & Schjølberg, S. (2014).
Paper I-III			Cpltf	Added blank pages

*Note.* The table of contents has been updated accordingly.

<sup>a</sup> Refers to the updated page numbers.