Curriculum and Quality Analysis and Impact Review of European Early Childhood Education and Care

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Executive summary

This report addresses wide-spread concerns regarding the quality of ECEC provisions and reports the results of secondary data analyses of the relations between structural quality characteristics and process quality in European ECEC provisions. The report also addresses the issue of social selection mechanisms in ECEC by reporting findings on the quality of ECEC services specifically for socioeconomically disadvantaged children and by identifying combined effects of structural and contextual factors disfavoring disadavantaged children. Using data from longitudinal datasets of ongoing studies in five European countries, comparative analyses were conducted on a comprehensive set of structural variables, measured in a similar way across these countries, to investigate their associations with observational measures of process quality. In addition to the commonly investigated *main* effects, the current study also specifically explored *interaction* effects for different combinations of teacher, classroom and system characteristics. Finally, we investigated whether children from socioeconomically disadvantaged background involved in these studies experienced equal process quality as non-disadvantaged children.

In the secondary analyses reported here we followed the common distinction between *structural* quality aspects, such as group size or teacher's qualifications, and *process* quality, which refers to the physical, social, emotional, and instructional aspects of children's interactions with teachers, peers, and materials. Structural quality aspects are major factors in the costs of ECEC, however research sofar has revealed inconsistent relations with process quality, while the latter is most strongly related to children's developmental and educational outcomes. Therefore, the secondary data analyses included a wide range of structural, organizational and contextual characteristics as predictors of process quality. Regarding the process quality three commonly used observation measures were included to evaluate the emotional and educational process and curriculum quality: the Early Childhood Environment Rating Scale revised (ECERS-R) and its extension (ECERS-E) and the Classroom Assessment Scoring System (CLASS).

The main analyses were carried out in two steps using hierarchical regression analyses. In the first step, the main effects were investigated by entering all predictors and in the next step the interaction term was added. All possible combinations of interaction effects were explored and tested separately. In case of a significant interaction effect, the significance and relevance of the interaction was determined.

For England the results revealed main effects of teachers' qualifications and type of provision. Quality was highest in provisions with an educational orientation compared to more care oriented provision, with a large effect size. In addition, higher qualified teachers provided higher process and curriculum quality showing small effects. Finally, an interaction effect appeared of type of provision and teacher's education level. The interaction revealed that low educated teachers working in educationally oriented provision provided higher

process and curriculum quality compared to their counterparts working in care oriented provisions, with medium to large effects.

In Finland, main effects were found for teacher's qualifications and work experience and to a lesser extent group size. Higher teacher qualifications and more work experience were associated with better classroom organization, showing small to medium effects. Larger group size was related to lower emotional support and poorer classroom organization. An interaction effect appeared between the location of the classroom (in a day care center or in a school) with group size for all three domains of process quality. When classrooms were located in schools a larger group size was related to higher process quality, whereas for classrooms located in day care centers a smaller group size was associated with higher quality.

The data from Germany showed a significant main effect of the proportion of children with migration background in a classroom. Having more children with a migration background in a classroom was negatively associated with both process and curriculum quality. The interaction analyses revealed an interaction between teacher's work experience and the proportion of children with migration background. More work experience appeared to migitate the negative effects of having more children with a migration background in the classroom.

In the Netherlands, several main effects appeared for group size, children-to-staff ratio, work experience and professional development opportunities with small-to-medium effect sizes. Smaller group size and, at the same time, more unfavourable children-to-staff ratios was related to higher emotional and behavioural support. More work experience was related to higher quality on all domains of process quality and curriculum quality. In addition, the provision of more professional development actitivites at the center was related to higher curriculum quality. Three interaction effects were found: Having more opportunities for professional development in combination with more unfavourable children-to-staff ratios was related to higher educational quality, which seems to point to a compensating effect of professional development. Teachers with more work experience and more opportunities for professional development showed higher educational quality. Finally, more experienced teachers provided higher curriculum quality while having more unfavourable children-to staff ratios.

For Portugal the type of sector, favouring the public sector, was related to process and curriculum quality and the provision of additional in-service training, as indicator of professional development, was also associated with higher process quality. An interaction effect between type of sector with children-to-staff ratio revealed that staff working in the public sector and having a less favourable children-to-staff ratio showed higher process and curriculum quality.

Overall, the findings revealed several structural characteristics to be related to process and curriculum quality. Teachers' qualifications, professional development opportunities, work experience and to a less extent group size and children-to-staff ratio have shown associations with process and curriculum quality. Moreover, work experience and professional development opportunities, appeared important moderators in several

countries. More importantly, country specific moderators were evident in all countries, pointing to a complex interplay of factors, mostly related to country specific aspects of the ECEC system.

Following the interaction plots, cross-tabulations were explored to investigate the number of classrooms falling above and below the interaction effects. The findings pointed out that a relatively high number of classrooms was characterized by the most unfavourable combination of structural aspects leading to the lowest process and curriculum quality. Generally, this applied to 20% to 50% of the classrooms in the five studies. These findings are reason for concern, because the potential benefits for children depend critically on the quality. This holds especially for the most vulnerable children for whom quality matters the most.

We also investigated whether children from different family backgrounds experience different process quality. Children were defined as socieconomically disadavantaged if their mother's education level was at or below the ISCED 2 level (lower secondary education) and as linguistically disadvantaged if their family's home language was different than the country's majority language. The results revealed different patterns across countries with both *negative* and *positive* selection effects. In Finland and Germany disadvantaged children received lower quality care compared to their more affluent peers, whereas in the Netherlands and Portugal disadvantaged children experienced higher process and curriculum quality. In England, children with low educated mothers using educare experienced lower process and curriculum quality than their peers with higher educated mothers. In the education oriented provisions non-English speaking children experienced *lower* process quality, but *higher* curriculum quality than their native peers.

These mixed findings should be interpreted while considering the ECEC systems and policy contexts in the respective countries. Finland and Germany both provide universal ECEC for children, but Finland only has a small disadvantaged population, whereas Germany has a much larger population of at-risk children, particularly children with a migration background. Although, generally, ECEC quality in Finland can be considered high, non-Finnish speaking children appeared to be enrolled in classrooms with lower educational quality. Quality in the German study was considered low and even lower for children with a migration background who tended to be clustered together in ECEC centers. The present findings suggest that the policies aiming at equal outcomes in Finland and Germany may fall short. In England there is a patchwork of ECEC provisions with a mix of publicly and privately funded organizations, with overall higher quality than in the other countries in this study, but this holds particularly for the education-oriented provisions. Disadavantaged children were about equally enrolled in educare-oriented and education-oriented provisions, thus only part of the disadvantaged children were able to profit from higher quality. Despite a targeted policy for narrowing the education gap by providing disadvantaged children with free ECEC at an earlier age than children from more affluent families, there appeared to be selection tendencies making lower educated and non-English parents choose ECEC provisions of poorer quality. Portugal has a similar ECEC system with a division between public and private provisions in combination with a targeted policy for disadvantaged families. Quality was higher in public provisions where most disadvantaged children were enrolled, pointing to a positive selection

tendency. Similarly, in the Netherlands an even stronger targeted approach was adopted to combat early disadvantages by implementing education programs focused on broad development and language skills together with the appointment of extra staff and the provision of extra professional development. Within the boundaries of the overall lower quality in the Netherlands, as observed, the targeted policy seems to be beneficial for disadvantaged children as they experience higher educational and curriculum quality compared to their more affluent peers.

Altogether, the findings from the secondary data analyses showed less than optimal structural and process quality, which may limit the potential benefits for children and society, particularly for disadvantaged children. The results also revealed that relations between structural and process quality are complex, interactive and seldom straightforward. The current findings may provide starting points for both policymakers and center management to deal with these complexities.

Recommendations

1) Creating a balanced team of teachers with varying educational qualifications and work experience can be an effective approach to increase quality.

2) Work experience was an important moderator in a number of countries, which supports the idea of creating teams of teachers varying in work experience. Embedding this in a context of continuous professional development in the center, including time for observation, reflection and feedback on practices or coaching on the job could strengthen the knowledge and skills of teachers, and result in higher quality.

3) Continuous professional development turned out as a common denominator of several approaches of in-service training and guidance activities at ECEC centers that contributed to higher quality in several countries.

4) Working with a disadvantaged population is challenging and it is essential to attract sufficiently qualified staff that can provide higher process and curriculum quality, which may require additional (financial) incentives to attract staff.

5) In order to increase process and curriculum quality, policy makers should not focus on regulating single structural aspects, but rather take into account the combined, interactive and systemic effects of several other structural characteristics, while also bearing in mind the specific aspects of the ECEC system in their countries.

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Introduction

This report addresses widespread concerns regarding the quality of ECEC provisions and reports the results of secondary data analyses of the relations between structural quality characteristics and process quality in European ECEC provisions. The report also addresses the issue of social selection mechanisms in ECEC by reporting findings on the quality of ECEC services specifically for socioeconomically disadvantaged children and by identifying combined effects of structural and contextual factors disfavoring disadavantaged children. The report is part of the project *Curriculum Quality Analysis and Impact Review of European Early Childhood Education and Care (CARE)*, funded by the European Union's 7th Framework program (THEME [SSH.2013.3.2-2] Early childhood education and care: promoting quality for individual, social and economic benefits). The task reported on here is part of WP2, entitled *Curriculum, pedagogy, and classroom quality: promoting effectiveness of ECEC.*

The objectives of the task are directly related to the overall aim of WP6 and the CARE-project as a whole, namely to develop a comprehensive, culture-sensitive European framework for evaluating and monitoring ECEC quality and child wellbeing, and to propose indicators of ECEC quality and child wellbeing that can be used for educational policy making at the European level. Within the CARE-project, WP 2 specifically focuses on micro- and meso-level characteristics of ECEC that constitute quality *in practice* and that affect children's wellbeing, learning and development directly. To the tasks of WP 2 belongs the following already completed study: (1) a comparative analysis of European curricula (Sylva et al., 2014; deliverable D2.1). Other completed studies of the CARE-project are: (2) a comparative review of approaches to ECEC staff professionalization in Europe (Jensen et al., 2015; D3.1), (3) an updated review of research into the impact of ECEC on child development (Melhuish et al., 2015; D4.1), (4) a literature review on the effectiveness of different types of funding and governance of ECEC (Akgündüz et al., 2015; D5.1), and (5) a first report on the views of parents as important stakeholders of ECEC regarding quality and wellbeing (Broekhuizen et al., 2015; D6.2).

Other, still ongoing studies within CARE address (6) the cultural interpretations of quality and the cultural factors that shape the implemented curriculum in ECEC as observed in different countries, and provide (7) a meta-analytical review of effects on child outcomes, including recent European studies, (8) an in-depth analysis of innovative approaches to continuous in-service professionalization, (9) an analysis of factors determining the accessibility and inclusiveness of ECEC, and (10) an economic analysis of the costs and benefits of ECEC. Finally, to provide a general framework of shared concepts and a basic model of ECEC services as embedded in wider local, regional and national contexts, in order to guide and integrate all separate studies within CARE, a starting document was developed with the main goals of the project and definitions of core concepts in ECEC that is also the basis of the current study (Moser, Melhuish, Petrogiannis, & Leseman, 2014; D6.1).

A central issue for most European countries is not whether to invest in early childhood education and care, but how much, in which aspects, and at what level (OECD, 2006). Investments in ECEC concern the supply of provisions for ECEC and, within these provisions, structural quality aspects, such as group size, children-to-staff ratio, required staff education level and paid salaries. These are considered the regulatable aspects of ECEC quality and the subject of statutory quality regulations in most countries. They are also major factors in the macro-economic costs of ECEC (Mashburn et al., 2008), but, as will be detailed below, they are found to be inconsistently related to the quality of the daily care and education

processes in ECEC centers and also to childrens's wellbeing and developmental outcomes. Related to that, it can be expected that also long term social and economic benefits of ECEC are less clearly related to the input in ECEC. Put differently, the relation between investment and return in ECEC is far from clear and this fact is disquieting from a policy point of view. Clarifying the relations between structural quality characteristics and the processes within ECEC centers that determine outcomes and returns, therefore, has high priority. To this end, the CARE-project has examined the complex relationships and interactions between structural features of ECEC, staff characteristics, contextual factors and process quality using data from recently completed and still on-going European studies. Comparing European countries with different quality regulations and ECEC systems can bring new evidence on these issues to support educational policymaking. High quality ECEC is considered one of the most effectives means to compensate for early socioeconomic and cultural disadvantages (Heckman, 2006; Leseman, 2009; Melhuish et al., 2015). Therefore, an important question is whether children most in need do indeed receive comparatively high quality ECEC. Several studies found evidence for negative selection effects, as will be detailed below, and a core question is if disadvantaged children in Europe do receive services of lower quality than non-disadvantaged children.

Aims and research questions of the study

The original objectives of the study reported here, as stated in the Description of Work (DOW) were the following:

> 2.4 To compare direct and indirect (mediated) effects of teacher characteristics (e.g. efficacy beliefs, stress, curriculum goals, educational level, experience, cultural background), structural characteristics (e.g., settings, play and learning materials, group size, children-to-staff ratio) and context characteristics (salaries, opportunities for professional development, career opportunities, parental involvement) on curriculum implementation, pedagogical approach and process quality in different European ECEC systems.
>
> 2.5 To compare direct and indirect (mediated) effects of curriculum implementation (e.g., provision of activities that promote social, emotional, academic, moral and citizenship development), pedagogical approaches (e.g., child-centered, program-centered, academic vs. 'whole child' emphasis), and process quality (emotional, organizational, and instructional support) on children's social-emotional, cognitive and academic development, and children's wellbeing in different European ECEC systems.

Several data sets were available for these purposes. We started with inspection of the data of the following studies: (1) from the Netherlands: Pre-COOL (age 2-6) and the Utrecht Mixed Preschool Groups (age 3-6); (2) from Finland: First Steps (age 5-13) and the Jyväskylä Longitudinal Study of Dyslexia (age 0-15); (3) from Germany: BiKS (age 3-8) NEPS (age 0-4), Early Chances (age 2-4), and NUBBEK (age 2-4); (4) from England: EPP(S)E (age 3-16); (5) from Denmark: VIDA (age 0-6); and (6) from Portugal: Context and Transition Study (age 4-7). The Principal Investigators of these studies were also key-persons involved in WP 2.

First, we identified and compared the measures used in these studies in order to select the largest possible set of variables across the studies that were operationalised in the same or in highy similar way (an overview of all the measures considered of all studies is available upon request from the authors). Second, we selected only those data sets that had observational measures of process quality assessed by either the Early Childhood Environment Rating Scales Revised and Extended (ECERS-R/E; BiKS, EPP(S)E, pre-COOL and Context and Transition Study) or by the Classroom Assessment Scoring System (CLASS; pre-COOL, First Steps). The Danish study Vida had relevant measures too, but due to privacy regulations we could not access the data for the purposes of our study. This left us with five data sets from five countries. The details of these data sets are described below.

Next, we started the process of recoding and reconstructing the study variables to make them comparable across studies. With regard to the structural quality measures and the observational measures of process quality (T2.4), this work was successful, leading to new datasets for each of the five countries with a relevant set of (highly) comparable variables. The details of this process and the remaining set of variables on which the country comparisons were based are described in detail are below in the section on the research method.

With regard to the child outcome measures (T2.5) the same approach was followed by selecting outcome measures that were based on the same (but adapted to the respective countries) tests, such as the Peabody Picture Vocabulary Test, by selecting tests with similar conceptual background, especially in the area of mathematics, and by selecting tests within similar domains of development, especially regarding social-emotional development. The degree of similarity and comparability of the outcome measures used in the five studies varied strongly, both conceptually and expecially regarding the metrics of the measurement scales. For most measurement instruments item-based overlap was entirely absent. Even with regard to the PPVT, the testitems only partly overlapped. In the domain of social-emotional development even the conceptual overlap was rather low, with studies using quite different measures addressing quite different aspects of personal and social-emotional functioning (e.g. from externalizing problem behavior to self-esteem, from work attitude to self-regulation). In view of the scaling problems resulting from this diversity and lack of overlap, we had to decide to change the analysis plan for T2.5. Instead of creating a large single data pool of all countries, a plan was made for analyzing relations between quality and outcomes per country, and to create comparability in these analyses by including as pre-test measures and covariates only those variables that were shared by all studies. This, however, posed another challenge, because to meet the requirement of comparability between countries, only a limited set of covariates could be included in the country-specific analyses. The analyses that were conducted resulted in outcomes that occasionally diverged strongly from the original, already published findings of the respective studies, which was deemed unacceptable. The explanation for the divergent outcomes is that, as consequence of including less covariates than in the original studies, the secondary analyses did not optimally exert control for selection bias, implementation fidelity, home background, and children's pre-test characteristics. For this reason, we decided not to pursue the orginal plan, but to change the research question for the present report.

As an alternative to the original T2.5, an analysis was added to T2.4 based on individual children's family background characteristics. Through recoding and index construction, comparable measures of the Socioeconomic Status (SES) and the home language situation (HL) of the families of the childen were created and related to the process quality measures in the five studies, giving insight into the position of socioeconomically and linguistically disadvantaged children in ECEC in the five countries.

In view of these adaptations, the present study addresses the following sets of research questions:

> RQ1: What are the relations between structural quality characteristics, including qualifications and resources of staff, and observed process quality? To what extent do structural quality characteristics interact in predicting process quality? Are there differences in the main and interaction effects between the five countries participating in this study?
>
> RQ2: What is the process quality of classrooms attended by socioeconomically disadvantaged children and by children from language minorities speaking a different home language than the majority language? Are there differences between the participating countries in the quality of the ECEC services they provide to disadvantaged children?

Relations between structural and process quality

Introduction

Process quality refers to children's daily experiences while involved in activities and interactions and, as such, encompasses the physical, emotional, social, and instructional aspects of children's interactions with teachers, peers, and materials (Howes et al., 2008; Layzer & Goodson, 2006; Pianta et al., 2005; Sylva et al., 2006; Thomason & La Paro, 2009). Process quality is viewed as a major proximal determinant of children's developmental and educational outcomes (Howes et al., 2008; Pianta et al., 2005; Thomason & La Paro, 2009), whereas aspects of structural quality, such as group size, children-to-staff ratio and required staff's qualifications, are considered the more distal, regulatable aspects of quality, which are assumed to be important preconditions for process quality (Cryer, Tietze, Burchinal, Leal & Palacios, 1999; Philips, Mekos, Scarr, McCartney, & Abbott-Shim, 2000; Philipsen, Burchinal, Howes, & Cryer, 1997; Pianta et al., 2005; Vandell, 2004). Aspects of structural quality are major factors in the costs of ECEC (Mashburn et al., 2008), but how strongly structural quality relates to process quality and to child development is not yet clear. Moreover, this relationship may vary by type of ECEC provision, age of the children enrolled, and countries. Also, characteristics of staff working with children, including pre-service training and work experience, and contextual characteristics, such as opportunities for in-service professional development, are considered important determinants of process quality (Goelman et al., 2006; Phillips et al., 2000). Although, not directly regulatable, these aspects do relate to the policies of ECEC organisations, and can be influenced by policies and regulations issued by local and national governments. The present study aims to increase our understanding of the relations between structural and process quality in five European countries, with different ECEC systems, quality standards, and ECEC policies, by conducting secondary data analyses of a comprehensive set of structural characteristics and observational measures of process quality, which are reasonably comparable across countries.

Most studies to date have focused on the so-called 'iron-triangle' of structural quality: children-to-staff ratio, group size, and staff's formal pre-service education (Philipsen et al., 1997). In studies in the USA and Canada, smaller group sizes and low children-to-staff ratios have been shown to be related to higher process quality (Cost, Quality & Child Outcomes Study Team, 1995; Goelman et al., 2006; Love et al., 2005; Mashburn et al., 2008; NICHD ECCRN, 2000; NICHD ECCRN, 2002; Phillips et al., 2000; Thomason & La Paro, 2009). However, other studies found very weak or no relationships at all between these structural characteristics and process quality (Blau, 2000; Pianta et al., 2005; Philipsen et al, 1997). European studies and international comparative studies including European countries also revealed mixed findings, with some studies confirming and others disconfirming the relationship between particular structural quality characteristics and process quality (Barros et al., 2010; De Kruif et al., 2009; De Schipper et al., 2006; Pessanha, Aguiar, & Bairrao, 2007; Rentzou & Sakellariou, 2011; Slot, Leseman, Verhagen, & Mulder, 2015). A cross-country comparison by Cryer et al. (1999) revealed that a smaller children-to-staff ratio was related to higher process quality in Germany and the United States of America (USA), but not in Portugal and Spain. In addition, a negative relation was found between group size and overall process quality for Spain, but, remarkably, a positive relation was found for Germany.

Likewise, inconsistent relations have been found regarding staff's formal pre-service education and process quality both in the USA (Early et al., 2006; Early et al., 2007) and in European studies (e.g. Barros & Aguiar, 2010; Cryer et al., 1999; De Kruif et al, 2009; Early et al., 2007; Fukkink et al., 2013; Leach et al., 2008; Vermeer et al., 2008). Although, in general, higher levels of staff education are (moderately) related to higher process quality (Blau, 2000; Cryer et al., 1999; NICHD ECCRN, 2000; Pianta et al., 2005; Philipsen et al., 1997; Thomason & La Paro, 2009), it remains unclear whether this is a linear relationship or, instead, indicates a curvilinear relation with process quality and possible threshold effects. More specifically, reaching a particular minimum level of education may be critical for process quality. For instance, holding a degree above the bachelor level has been shown to be positively related to classroom quality, but being trained below the bachelor level made no difference (Early et al., 2006).

Recent studies have included other quality aspects as well, in particular various forms of in-service professional development (Howes, James, & Ritchie, 2003; Zaslow, Anderson, Redd, Wessel, Tarullo, & Burchinal, 2010). Increasing evidence indicates that in-service training, coaching-on-the-job, and other strategies of, what is termed here, continuous professional development with a focus on working with young children in ECEC substantially contribute to process quality (Burchinal, Cryer, et al., 2002; Campbell & Milbourne, 2005; Domitrovich et al., 2009; Fantuzzo, Gadsden, & McDermott, 2011; Fukking & Lont, 2007; Hamre et al, 2012; Howes et al., 2003; Lambert, Donnell, & Abbott-Shim, 2008; LoCasale-Crouch et al, 2011; Pianta, Mashburn, Downer, Hamre, & Justice, 2008; Zaslow et al., 2010). Another, but less systematically studied, structural aspect included as a predictor of process quality in the current study, concerns the use of planned developmental and educational activities for children (Clifford et al., 2005; Domitrovich et al., 2009; Mashburn et al., 2008). The use a structured education program has been shown to be positively related to children's developmental outcomes in numerous (intervention) studies (Clements & Sarama, 2007; Dickinson & Caswell, 2007; Domitrovich et al., 2009; Fantuzzo et al., 2011; Lonigan, Farver, Philips, & Clancy-Menchetti, 2011).

In addition, there are country-specific contextual aspects that may be relevant for process quality. A few previous studies have included type of sector (e.g. education, welfare, social affairs and employment), legal status (public or private), and the organisation's primary mission (for-profit, non-profit) as predictors of quality (Barros & Aguiar, 2010; Goelman et al., 2006; Philipsen et al, 1997). According to OECD findings, centers in the private sector, compared to public centers, tend to be less well regulated regarding basic structural quality, to provide poorer working conditions, and to employ staff with lower educational qualifications (OECD, 2006). Another contextual aspect is the location of the ECEC center. In some cases, centers are located in an elementary school, whereas others are independently operating centers or centers that are part of a larger child care organization. In studies in the USA the location of a center is often included as predictor of process quality (Howes et al., 2008; Pianta et al., 2005), but it is also a relevant factor in the Finnish system concerning preschool classrooms (Pakarinen et al., 2010). Staff working in classrooms located within elementary schools are likely to be more exposed to the curriculum, methods and culture of elementary school through contact and perhaps collaboration with elementary school teachers. This might result in care and education practices with a stronger educational orientation compared to independently operating ECEC centers. For example, research has shown that ECEC classrooms located in schools provide less free play and more whole group instruction (Pianta et al., 2005). Staff working in ECEC centers that are part of a school may differ on other aspects as well. For instance, Clifford et al (2005) showed that teachers working in classrooms located in schools had higher education levels and were paid more compared to teachers working in independently functioning centers. Finally, staff

characteristics are related to process quality. For instance, work experience has been included as a predictor of process quality in numerous studies, however showing inconsistent effects varying from positive, null to negative (Barros & Aguiar, 2010; Cryer et al., 1999; La Paro et al 2009; NICHD ECCRN, 2000; Philipsen et al., 1997; Pianta et al., 2005; Wilcox-Herzog, 2004).

A possible explanation for the inconsistent relations between structural and process quality can be that, due to strict quality regulations, the range of structural and process quality within countries is restricted, leading to small and inconsistent effects (Love et al., 2003). Comparing countries with different structural quality regulations, that represent a wider range of structural quality, can help to clarify the issue. The inconclusive evidence may also suggest that the effects of structural, contextual and staff characteristics on process quality have complex interactions in which factors can act in opposition or can moderate the effect of another factor. For example, an unfavorable children-to-staff ratio can be compensated by a high level of professional competence of the staff or by efficient classroom management. Although, the possibility of structural aspects acting as moderators has been pointed out by several scholars, to date few studies have systematically examined interaction-effects of structural quality characteristics on process quality (Mashburn & Pianta, 2010; Zaslow et al., 2010). Philipsen and colleagues (1997) looked at two interaction effects in a sample of ECEC centers in the USA. The interaction-effect of education level and children-to-staff ratio on process quality was not significant, the interaction-effect of sector and state, however, was. However, this study did not systematically explore all possible interaction-effects. For European policymaking, more evidence on possible interaction effects is needed based on a range of European national contexts and quality regulation regimes.

In the current study we investigated the relations between structural and process quality in five different European countries. A comprehensive set of structural characteristics was selected from the available datasets, including the traditional 'iron triangle' aspects group size, children-to-staff ratio, and staff's pre-service training. In addition, a number of contextual and country-specific aspects and staff characteristics were included, such as staff's work experience and type of sector. Moreover, we explored the interaction effects of different types of variables, for instance structural aspects with staff characterictics (e.g. ratio with work experience) and structural with contextual characteristics (e.g. type of sector with professional development opportunities) to increase our understanding of how different aspects operate together in predicting process quality.

Method

To address the relationship between structural and process quality, several datasets with recently collected data from five different European countries were selected. All selected datasets included variables on both structural and process quality. The following datasets were included: (1) from the Netherlands: Pre-COOL (age range 2-6 years); (2) from Finland: First Steps (age range 5-13 years); (3) from Germany: BiKS (age range 3-8 years); (4) from England: EPPE/EPPSE (age range 3-16 years); and (5) from Portugal: Context and Transition Study (age 4-7 years). To maximize overlap and enhance comparability of the data, we focused on day care and preschool classrooms with children from two to six years old, and included only the data collected for this age range. Table 1 provides an overview of the measures that were used and descriptive information of all datasets that were included. There was considerable overlap in the conceptual definitions and operational measurement

of the core variables, although not all variables were similarly measured in all studies. All datasets, except for England, included data at the classroom level. The data from England were collected at the center level for both the process quality and the structural quality characteristics, although often centers had only one classroom, so that the center and classroom level coincided.

General analysis approach

The general approach to the secondary analyses involved a number of steps. The main aim was to analyze all data in the same way, using the same set of variables. All datasets used either the ECERS-R and the ECERS-E or the CLASS as process quality measures. Concerning the structural characteristics, we first identified the structural characteristics that were included in at least two, but preferably more, datasets. Second, all datasets were explored to investigate the way the constructs of interest were measured and, if necessary, the measures were recoded to increase comparability. Third, hierarchical regression analyses were conducted to investigate the relations between structural aspects and process quality, and the possible interaction effects of different combinations of structural characteristics on process quality. In the first model, all predictors were entered to investigate the main effects. In the second model, the interaction term was added to investigate the interaction effect. When in the second model predictors turned significant which were not significant as main effect in the first model, these effects were interpreted as *conditional* effects (Aiken & West, 1991; Hayes, Glynn, & Huge, 2012).

Effect sizes in the main effects models were based on the standardized regression coefficients in which $|\beta| < .10$ indicated a small effect, a $|\beta|$ of around .30 a medium-sized effect and $|\beta| > .50$ a large effect (Kline, 2005). Using standardized regression coefficients as measure of effect size is problematic in interaction models (Preacher, 2003) and, therefore, no measures of effect size were reported for the interaction models. To evaluate the significance and relevance of the interaction effects, several steps were taken. In the first step the significance of the interaction effects in the regression model was tested. In case of a significant interaction term, the strength of the relationships between structural aspects (X) and process quality (Y) within separate groups of the moderator variable (Z), were tested. The data were split in groups as defined by the moderator variable. Next, separate regression equations were estimated with X regressed on Y, which yielded so called simple slopes. The significance of the simple slopes was tested following recent recommendations (Dearing & Hamilton, 2006; Robinson, Tomek, & Schumacker, 2013). Empirically, the simple slopes test allows for a direct test of the direction of the relationship. In addition, the test has more statistical power and reduces the likelihood of Type II error compared with more common procedures. Finally, a graphical representation of the interaction effect was projected on the original scale of the observation measure (with known standard deviation) for inspection to determine the relevance of the interaction effect (Aiken & West, 1991). In line with common practice, the interaction effects were plotted using values of -1 SD below and +1 SD above the mean of the predictor (Cohen & Cohen, 1983). If the moderator variable was not a dichotomous variable, the same procedure was applied to create two distinct values. Finally, cross-tabulations were computed to determine for each study the percentage of classrooms that carried the interaction effect depicted in the graphical displays.

Process quality

Process quality concerns the children's day-to-day experiences and encompasses the physical, emotional, social, and educational aspects of children's interactions with teachers, peers, and materials (Howes et al., 2008; Pianta et al, 2005; Thomason & La Paro, 2009). Several observational measures are widely used to assess process quality. Three

observational measures, used most often in research (e.g. Harms et al., 2005, Pianta et al., 2005; Sylva et al., 2006), focusing on emotional and educational classroom quality are the Early Childhood Environmental Rating Scale Revised (ECERS-R; Harms et al., 2005), its extension (ECERS-E) developed by Sylva et al. (2006) and the Classroom Assessment Scoring System (CLASS; Pianta, Hamre, & La Paro, 2008). Although, the measures show considerable overlap concerning the quality constructs that are evaluated, there are also differences. The ECERS-R is a comprehensive measure focusing on a large number of quality indicators, including interactions and aspects of the physical environment, while the ECERS-E is targeted at the curriculum and the CLASS is specifically focused on emotional and instructional and for older children also organizational aspects of teacher-child interactions.

The ECERS-R and ECERS-E were used to measure global process and curriculum quality in the majority of the five countries involved in the current study (see Table 1 for an overview). For comparison purposes, two mean total scores were computed. One total score for the ECERS-R was calculated as the average of the scores for the subscales *Space and Furnishing* (e.g., indoor space, room arrangement for play, child-related display), *Personal Care Routines* (e.g., greeting/departing, meals/snacks), *Language-Reasoning* (e.g., books/pictures, encouraging children to communicate), *Activities* (e.g., dramatic play, nature/science), *Interaction* (e.g., supervision of children, staff-child interactions, interactions among children), *Program Structure* (e.g., free play, group time). Previous studies have shown different numbers of underlying factors for the ECERS-R, ranging from one overall quality concept to even seven separate subdomains (refs). As the findings regarding the factor-structure of the ECERS-R are far from conclusive, for the current analyses the choice was made to use one total score for the six aforementioned subscales, but without the *Parents & Staff* subscale, because this subscale was not used in all countries that worked with the ECERS-R. The internal consistency of the resulting ECERS-R score was satisfactory for all countries (with Cronbach's alphas ranging from .88 to .90). Another total score was calculated for the ECERS-E based on the subscales *Literacy* (e.g., adult reading with child, sounds in words) and *Mathematics* (e.g., counting, shape/space). The subscales Diversity and Science were not included, because these subscales were not used in all countries that used the ECERS-E. The internal consistency of the resulting ECERS-E scale was satisfactory in all countries (with Cronbach's alphas ranging from .68 to .76).

The CLASS was used to measure process quality in the Netherlands and Finland. The CLASS Toddler was used in the Netherlands to measure process quality in classrooms with two- to four-year-olds. This version of the CLASS consists of three broad domains of process quality, more specifically *Emotional Support* (constituted by the dimensions Positive Climate, Teacher Sensitivity and, Regard for Child Perspectives), *Behavioral Support* (constituted by the dimensions Negative Climate and Behavior Guidance), and *Engaged Support for Learning* (constituted by the dimensions Facilitation of Learning and Development, Quality of Feedback, and Language Modeling). The CLASS Pre-K was used in Finland in classrooms with four- to six-year-olds. This version of the CLASS comprises of the broad domains *Emotional Support* (constituted by the dimensions Positive Climate, Teacher Sensitivity and Regard for Child Perspectives), *Classroom Organization* (constituted by the dimensions Behavior Management, Productivity, and Instructional Learning Formats), and *Instructional Support* (constituted by the dimensions Concept Development, Quality of Feedback, and Language Modeling). Although the two versions of the CLASS are meant for different age ranges, the constructs measured are highly comparable and fit in with the same conceptual framework (Hamre et al., 2013).

Structural characteristics

The following structural or context characteristics were included as predictors of process quality: group size, ratio (number of children per teacher), education level, work experience, the use of a program or curriculum, additional in-service training (yes/no), professional development activities at the center. Depending on country specific characteristics of the ECEC system we also included type of provision (day care, preschool or similar types of provisions), the location of the provision in a school or in a day care center, and the sector of the provision (private or public).

Although, there was overall considerable overlap between countries in the operational definitions of core constructs, the way variables were measured sometimes differed. In some cases, the variables needed to be recoded to increase comparability between the countries. For instance, teacher's pre-service education level was recoded according to the ISCED levels (refs: see table 1 for an overview) to enhance comparability across datasets. For the English data some challenges were encountered in recoding the teacher's pre-service education level. The data from the England included multiple variables for each education level and indicated the amount of time a teacher with that particular level was present in the center. To increase the comparability of this variable with the counterparts in the other datasets, the English variables were transformed in two steps. First, the original multi-categorical variables were transformed into continuous variables based on category-weighted proportion scores. Next, they were multiplied with the ISCED ranking score. Finally, these seperate scores were combined into a single continuous variable by taking the mean of the different education level variables, resulting in a mean center level variable for teacher's qualifications.

Work experience, was included in four out of five datasets, but was measured rather differently across these studies. In Germany and Portugal this variable was continuous with the exact number of years of experience. In the Netherlands and in Finland this was a categorical variable with categories representing the number of years of experience (e.g. 5-10 years of experience). To align the variables from the Netherlands and Finland we recoded the variables into a continuous variable based on category-weighted proportion scores.

Continuous professional development and in-service training were assessed in three countries, but in quite different ways. In Portugal the teachers were ask to list the number of hours they spent in-service training during the past two years. For Finland there was a dichotomous variable concerning whether teachers had attended any form of in-service training after their graduation. For the Dutch data two separate variables were used to assess continuous professional development. The first variable derived from a question whether teachers had attended courses and workshops with different topics and forms of in-service training. This variable was recoded into a dichotomous variable to match the Finnish data. The other variable concerned a scale (8 items; $\alpha = .91$), which assesses the implementation of several strategies of continuous professional development at the center, within the team of teachers (Slot et al., 2015). Teachers rated how frequently these activities occurred, with a scale ranging from 1 (*never*), 2 (*less than once a month*), 3 (*once a month*), 4 (*twice or three times a month*), 5 (*weekly*), 6 (*two to four times a week*), and 7 (*every day*). Examples of professional development activities included in the list were: having regular staff meetings to discuss the developmental and educational goals of working with young children, discussing children with special developmental and educational needs, using collegial observation and feedback to improve practice, opportunities for in-service training and personal coaching, team-based reading of professional literature, and visiting professional conferences. For the Netherlands both variables for continuous professional development were included.

The early childhood and education systems differ between the countries involved on the current secondary analysis. A thorough description of the systems is beyond the scope of the current paper, but a few differences will be highlighted (for a more comprehensive overview, see OECD, 2006). In some countries different types of ECEC provisions exist. For instance, in the Netherlands the two main types concern day care for 0-4 year old children and preschools for 2-4 year old children. In England a wide range of provisions exist, including private day nurseries, playgroups, local authority, nursery school, nursery class and combined centers. In other countries differences exist concerning the responsible sector and the location of the classroom. For instance, in the Portuguese study the participating provisions came from both the public and private sector, possibly reflecting differences in quality. In the Finish study data either came from classrooms in independently functioning day care centers or from classrooms in elementary schools, which might also be related to differences in quality. Although Germany did not have different types of provisions, nor differences in sector or location, the German classrooms did differ substantially in ethnic classroom composition. Based on prior analyses with these data, the ethnic classroom composition appeared to be related to quality. In order to control for differences related to ECEC systems, we decided to include all these potentially relevant country-specific variables.

Some additional methodological challenges pertained to the German and English datasets. In Germany, the data for structural and process quality were not concurrently collected, but at four different measurement waves during two years making it difficult to relate concurrent measures of structural and process measures. Therefore, it was decided to use the average measures for both structural and process quality for the current analyses. In England the data were often collected at the center level instead of the classroom level, which means that the English data are not exactly comparable to the other data.

Table 1 Description of ISCED levels used in the secondary data analyses

Description	ISCED level
Lower secondary	2
Upper secondary	3
Post-secondary non-tertiary	4
Bachelor	6
Master	7

Results of the country analyses

Descriptive information on the datasets included in the secondary data analyses is shown in Table 2 and 3. The findings indicate large variation in both process and structural quality within and across countries. Regarding structural quality, group size and ratio were the most favorable in the Netherlands, reflecting also the younger age of the sample, whereas teacher's qualifications were the highest in Finland and Portugal which may relate to differences in the the ages of the children in the participating provisions. However, the process quality was overall the highest for England and Finland.

Table 2 Descriptive statistics for the structural quality in five different countries

	Finland (5-6 yrs) (N=49)	Germany (3-6 yrs) (N=97)	Netherlands (0-4 yrs) (N=121)	Portugal (4-7 yrs) (N=60)	England (3-5 yrs) (N=141)
Group size					
M (SD)	13.69 (5.40)	23.82 (3.96)	14.19 (1.81)	20.54 (3.13)	n.a.
Range	7-24	11-36	7-17	12-29	
Ratio					
M (SD)	n.a.	11.35 (2.50)	6.44 (2.30)	11.33 (5.29)	8.81 (5.77)
Range		5.67-19	1.67-17	5-24	0.94-26
Work experience					
M (SD)	13.37 (5.61)	16.36 (9.04)	12.57 (7.10)	16.83 (7.68)	n.a.
Range	0.5-18	1.3-41.0	0.5-35.5	3-33	
Education level (ISCED)					
Lower secondary (2)					59.4%[1]
Upper secondary (3)	0%		1.4%		87.2%
Post-secondary (4)	0%	100%	88%		
Bachelor (6)	85.4%		10%	100%	43.6%
Master (7)	14.6%		0.7%		
Education program/curriculum yes	n.a.	n.a.	83.7%	51.1%	
Additional courses yes	85.1%	n.a.	43.6%		
Professional development activities			**1-7 scale**	**# hours**	
M (SD)	n.a.	n.a.	3.17 (.98)	40.37 (44.95)	n.a.
Range			1.22-6.33	0-210	
Type of provision/ location of provision/sector	24.5% in school		43.5% day care 56.5% preschool	45% private, 55% public	63.1% educare 36.9% education

[1] For England the percentages represent the presence of a teacher with a certain level for at least part of the day in a particular center. The centers have multiple teachers, possibly differing in education level, therefore the percentages do not add up to 100%.

Table 3 Descriptive statistics for the process quality in five different countries

	Finland (5-6 yrs) (N=49)	Germany (3-6 yrs) (N=97)	Netherlands (0-4 yrs) (N=121)	Portugal (3-5 yrs) (N=60)	England (3-5 yrs) (N=141)
ECERS-R					
M (SD)		3.76 (.49)		3.61 (.86)	4.38 (1.01)
Range		2.69-4.98		1.68-5.28	2.16-6.73
ECERS-E					
M (SD)		2.93 (.64)	2.24 (.84)	2.66 (.79)	3.46 (1.01)
Range		1.72-4.51	1.00-6.00	1.25-5.92	1.17-6.17
CLASS	**Emotional support**		**Emotional support**		
M (SD)	5.54 (.62)		5.00 (.72)		
Range	3.48-6.43		2.67-6.75		
	Classroom organization		**Behavioral support**		
M (SD)	5.34 (.61)		5.93 (.48)		
Range	3.22-6.27		4.38-7.00		
	Instructional support		**Support for learning**		
M (SD)	3.97 (.84)		3.28 (.87)		
Range	1.65-5.52		1.42-6.25		

England

The data from England were collected within the Effective Provision of Pre-school Education (EPPE) study, which is a large-scale prospective study on the long-term effects of pre-school provisions (for more details see Sylva et al., 2006). The study included 141 centers for education and care provisions, which were randomly selected in five regions in England, representing urban, suburban and rural areas, and served children from socially and ethnically diverse backgrounds. The sample of families closely matched the demographic characteristics of England overall. The centers represent all types of early childhood centres in England at the time of the study (i.e., playgroups or parent cooperatives, nursery classes in state primary schools, free-standing nursery education schools, private day nurseries, social services day care centres and state nursery schools combining care and education). The ages of the children attending the provisions were between birth and five plus years of age. The observations were conducted when the vast majority of the children were 3-4 years old.

In order to increase comparability between datasets, several variables of the EPPE dataset had to be recoded. First, the type of provision was recoded into a dichotomy (in close collaboration with two of the principal investigators of EPPE). The category 'educare' was distinguished for provisions that had mainly a 'care' function and rarely employed teachers with a degree, including the private day nurseries, playgroups and local authority, daycare (coded as 0 in the analyses). The category 'education' was distinguished for provisions that had a substantial 'educational' function which were led by municipalities and employed a relatively large number of teachers with a degree, including the nursery school, nursery class and combined centers (coded as 1 in the analyses). Second, a new coding for the teachers' pre-service qualification variable was constructed based on the variables in the EPPE data that indicated the proportion of teachers with each education level in a center. The new variable was reconstructed as a continuous education level variable, based on ISCED, representing the mean education level of the staff at each center.

First, the results for the main effects analyses revealed several significant relations (see Table 12). Type of provision was significantly related to process quality, with a large effect size. Provisions with a stronger educational orientation provided higher quality both on the ECERS-R as well as on the ECERS-E. Higher teacher education levels were associated with higher curriculum quality, as measured with the ECERS-E, with a small-sized effect.

Next, after adding the interaction between type of provision with staff education level, a conditional effect for education level was found for global classroom quality. When controlling for the other variables and the interaction effect, higher teacher education was related to higher quality as measured with the ECERS-R. In addition, the interaction effect was significant for both the ECERS-R and the ECERS-E. The interaction effect of type with education level was significant for the ECERS-R with a substantial effect of about 1.5 SD for lower educated staff and about 1 SD for higher educated staff (note that the SD=1.01 for both process quality measures; see Table 3). To interpret the interaction effect, a graphical representation of the interaction between centre type and teachers' qualifications on the original scale of the observed global quality was made (see Figure 9). The simple slopes test revealed a significant effect on the ECERS-R for the 'educare' provision only (t (125) = 4.30, p<.001) and not for the 'educational' provisions (t (125) = .02, p=.985). Teachers with low qualifications provided higher global quality when working in an educationally oriented provision compared to their counterparts working in a more care oriented provision. For teachers with low qualifications, working in an educationally focused provision can act as a compensating factor. Likewise, the results for the ECERS-E indicated the same pattern (care: t(125)= 6.53, p<.001; education: t(125)= -1.64, p=.103) with even more pronounced effects**.**

A previous study has shown that low-educated teachers collaborating with higher qualified colleagues tend to model the behavior of their higher educated colleagues while interacting with children (Siraj-Blatchford, Sylva, Muttock, Gilden, & Bell, 2002). Also, the working conditions tend to be better in educationally oriented provisions, with more opportunities for professional development and higher salaries.

Table 12 Results from the regression analyses for England

	ECERS-R			ECERS-E		
Model 1	**R=.60, R^2=.36, *p*=.00**			**R=.61 , R^2=.35 , *p*=.00**		
	b	*β*	*p*	*b*	*β*	*p*
Type (EduCare, Education)	1.11	.53***	.00	1.11	.53***	.00
Ratio	-.02	-.13	.13	-.03	-.15	.07
Education level	.12	.17	.06	.14	.20*	.03
Model 2	**ΔR^2=.02, *p*=.05**			**ΔR^2=.07, *p*=.00**		
	b	*β*	*p*	*b*	*β*	*p*
Type (EduCare, Education)	1.10	.52***	.00	1.08	.58***	.00
Ratio	-.01	-.08	.37	-.01	-.06	.48
Education level	.27	.38**	.01	.43	.58***	.00
educationXtype	-.27	-.27*	.05	-.50	-.50***	.00

Note. *** p <.001; ** p < .01; * p < .05; + p < .10

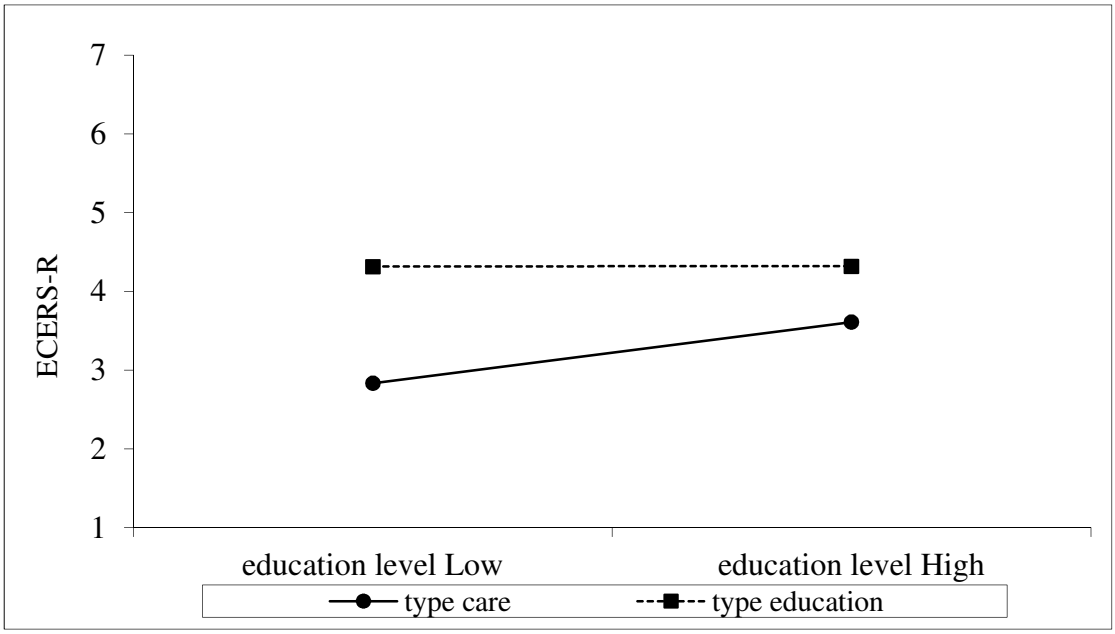

Figure 9 The interaction effect of type with education level on ECERS-R quality

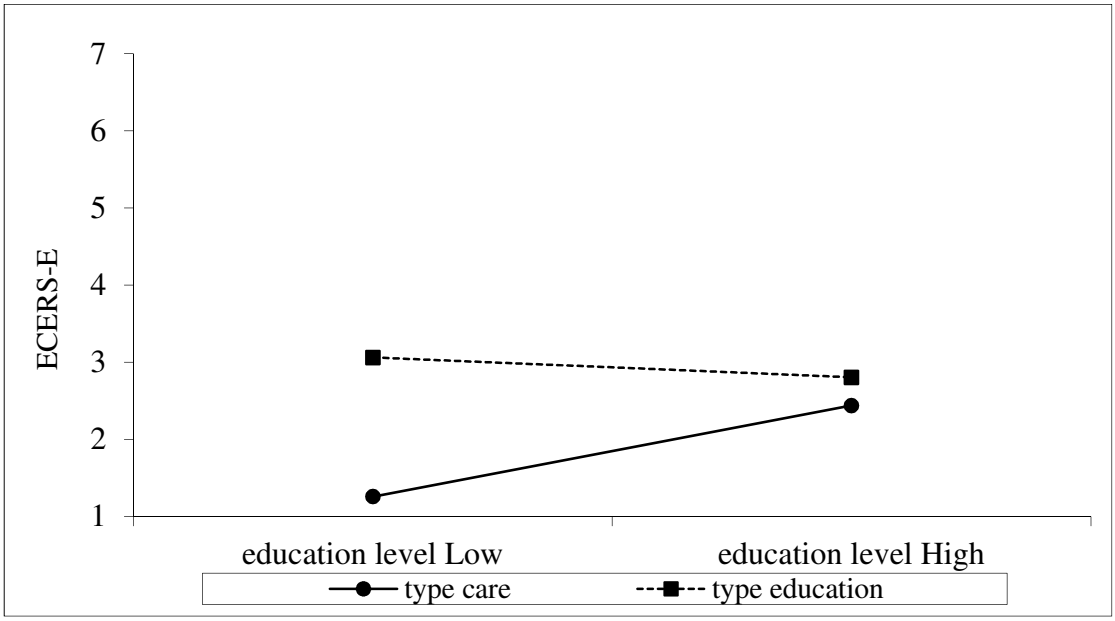

Figure 7 The interaction effect of type with education level on ECERS-E quality

Overall, the findings from England emphasize the importance of higher teacher qualifications in predicting higher quality, particularly in relation to the type of provision. Provisions with a stronger educational orientation and led by municipalities showed higher quality compared to provisions with a predominant care function. Table 13 shows the distribtution of the centers according to the different levels of the interaction effect. Almost half of the centers participating in EPPE were working within the educare tradition *and* employed comparatively low educated teachers (46.9%), which was found to be associated with the lowest observed global quality and curriculum quality.

Table 13 The distribution of classrooms according to the levels of the interaction terms

	Type = educare	Type = education	Total
Education level			
Low	61 (46.9%)	10 (7.7%)	71 (54.6%)
High	21 (16.2%)	38 (29.2%)	59 (45.4%)

Finland

For Finland, data on 49 kindergarten classrooms, part of the longitudinal First Steps Study (for more information, see Pakarinen et al., 2010), were used for the current secondary analysis. The 49 classrooms were located in semi-rural and urban areas in Central and Eastern Finland. 75.5% of the kindergartens were organized by day care authorities, whereas the remainder was organized by elementary school authorities. Although the same regulations applied concerning group size and the children-to-staff ratio, there exist differences between the two types (Pakarinen et al., 2010). For instance, when kindergarten is organized in the school, teachers are allowed an assistant when the group size increases and the children-to-staff ratio exceeds 13: 1. Also, teachers working in kindergarten in a

school more often have a Master's degree compared to teachers working in a day care organization, who have a Bachelor's degree. Most classrooms were attended by six-year-old children, although about 17% also included five-year-old children. The CLASS pre-K was used to assess classroom quality. The data were collected on two separate days by two observers and were averaged across observers and collapsed for the two days, resulting in an average domain score for the three CLASS domains Emotional Support, Classroom Organization, and Instructional Support.

Table 4 Results from the regression analyses for Finland

	Emotional support			Classroom organization			Instructional support		
Model 1	**R= .31, R^2=.10, *p*=.53**			**R=.41 , R^2=17 , *p*=.19**			**R=.21, R^2=.02, *p*=.86**		
	b	*β*	*P*	*B*	*β*	*p*	*b*	*β*	*p*
Location (day care, school)	.01	.04	.95	-.08	-.02	.91	-.23	-.12	.45
Group size	-.01	-.11	.47	-.01	-.07	.66	-.01	-.06	.73
Education level	.43	.25	.11	.45	.26^{+}	.08	.16	.07	.67
Work experience	.02	.13	.43	.04	.33*	.05	.02	.13	.46
In-service training (no/yes)	.06	.04	.83	-.08	-.05	.76	.17	.07	.68
Model 2	**ΔR^2=.14, *p*=.01**			**ΔR^2=.15, *p*=.01**			**ΔR^2=.12, *p*=.02**		
	b	*β*	*P*	*b*	*β*	*p*	*b*	*β*	*p*
Location (day care, school)	.05	.04	.80	.02	.01	.93	-.18	-.10	.53
Group size	-.04	-.33*	.05	-.03	-.29^{+}	.07	-.04	-.26	.14
Education level	.44	.25^{+}	.08	.46	.27*	.05	.17	.07	.62
Work experience	.02	.17	.29	.04	.36*	.02	.02	.16	.33
In-service training (no/yes)	-.01	-.01	.97	-.15	-.09	.54	.08	.03	.84
Location × groupsize	.10	.44**	.01	.10	.45**	.01	.12	.40*	.02

Note. *** p <.001; ** p < .01; * p < .05; + p < .10

First, the main effects were investigated for each domain (See Table 4). No significant associations were found between structural quality and emotional support. For classroom organization, work experience was the only predictor, with a medium-sized effect. Also, for instructional support no main effects were found.

Next, the interaction models were investigated and revealed significant interaction effects of the relation between the location of the center with group size on quality. After adding the interaction term several conditional effects appeared. When controlling for all variables including the interaction term, there appeared a statistically significant negative association between group size and emotional support. In addition, a positive relation appeared between teacher's education level and classroom organization, when controlling for all other predictors including the interaction effect. To interpret the interaction effect, a graphical representation of the interaction between group size and the location of the classroom on the original seven-point scale of observed emotional support was made (see Figure 1). Furthermore, the significance of the slopes indicated effects for centers located in a day care center (t(38)=-39.00, p<.001) and to a less extent for centers located in a school (t(38)=1.90, p=.066). The findings indicate that emotional support is higher in larger groups, when the classroom is located in a school. For classrooms located in a day care center, lower group size is associated with higher quality. The effects are substantial and amount to about half a scale point on the original observation scale and to an effect of about 1 SD for both small and large groups (note the SD=.62; see Table 3).

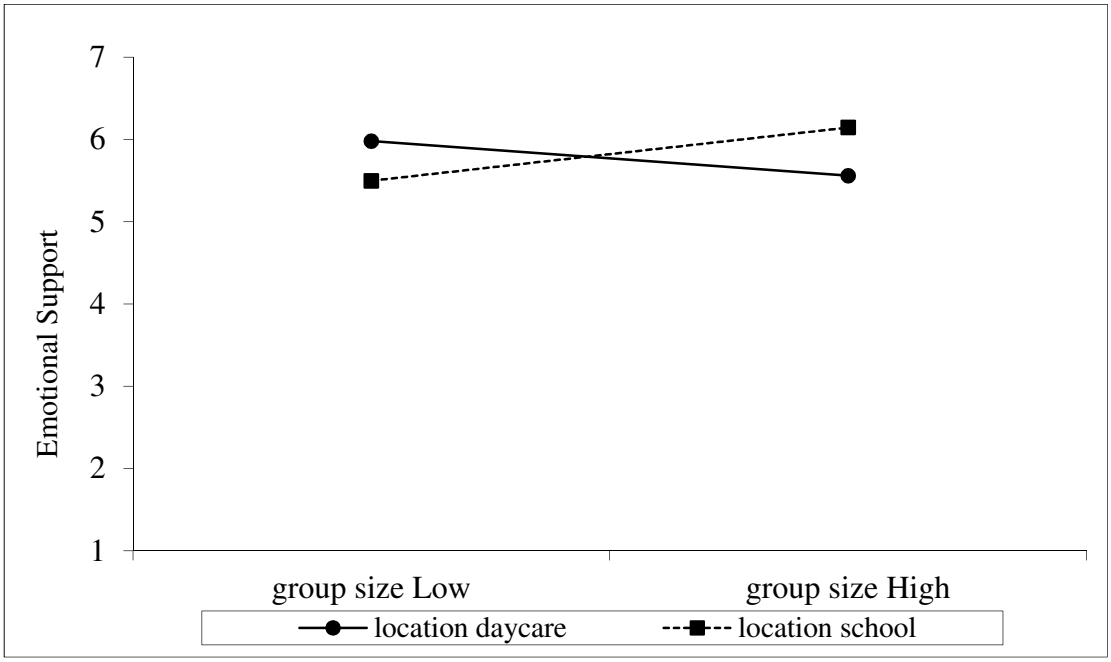

Figure 1 The interaction effect of location of the classroom with group size on emotional support

For classroom organization similar results were evident with significant effects for the slope for classrooms located in a day care center (t(38)=-33.00, p<.001) and in a school (t(38)=2.12, p=.041) (see Figure 2). The findings indicate effects of about 1 SD for both small and large group sizes (SD=.61). Also, the results for instructional support showed the same pattern for the slopes for centers located in a day care center (t(38)=-40.00, p<.001) and in a school, respectively (t(38)=2.62, p=.01) (see Figure 3). The effects for a small group size are more than 1 SD larger, compared to a big group size (SD=.84).

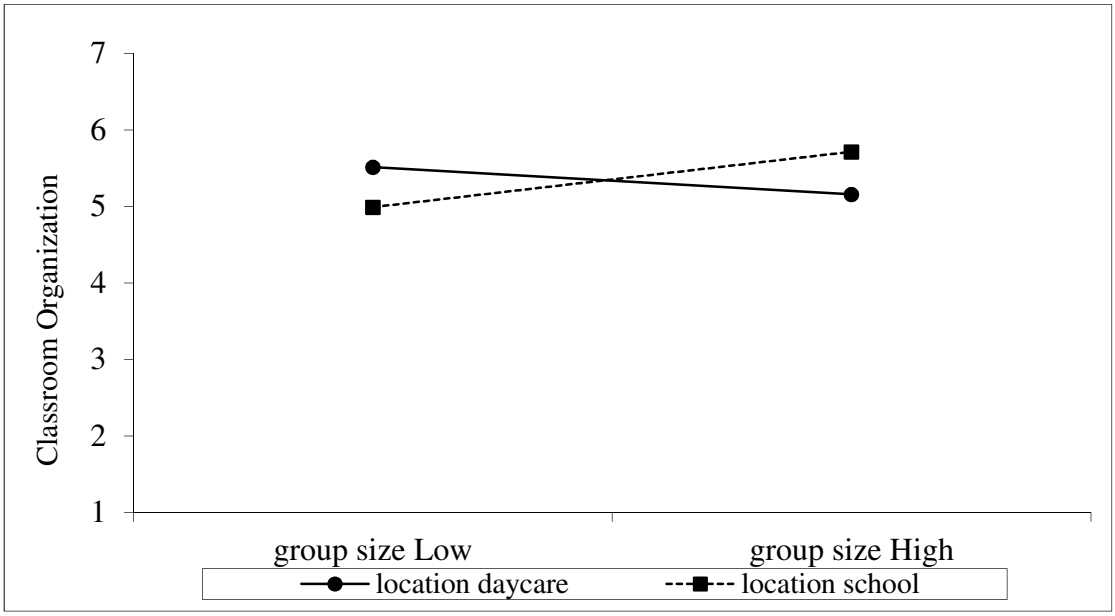

Figure 2 The interaction effect of location of the classroom with group size on classrrom organization

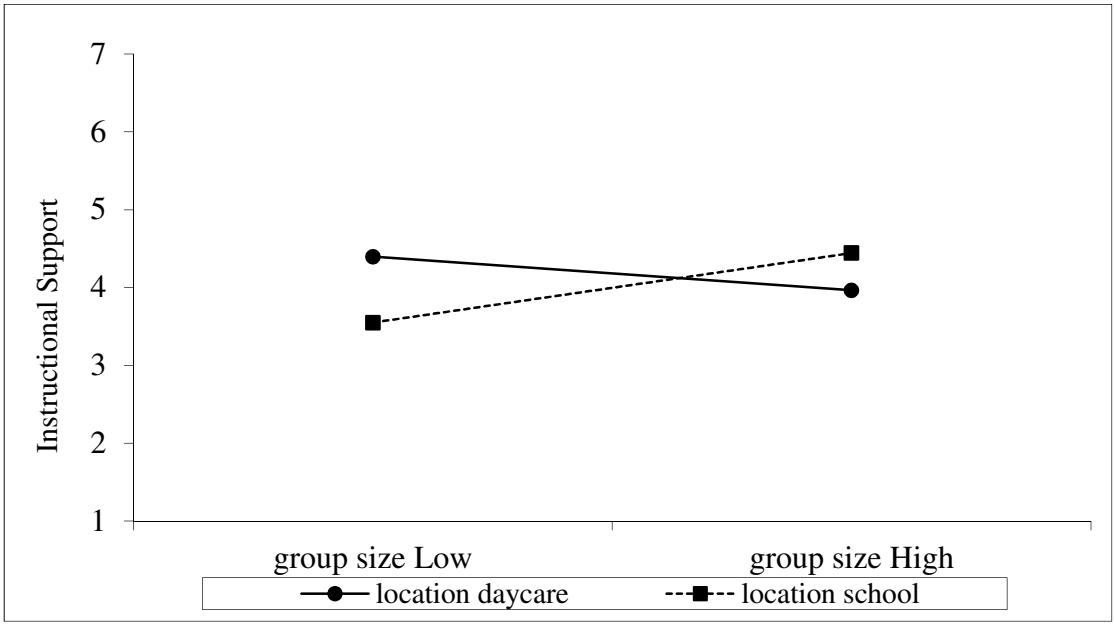

Figure 3 The interaction effect of location of the classroom with group size on instructional support

Overall, only work experience showed a main effect on the quality of classroom organization. In addition, it appeared that after adding the interaction term smaller group size and higher teacher qualifications were also related to higher quality. In addition, staff working in a kindergarten organized by schools seems to compensate for the negative effects of a larger group size on process quality. Perhaps, working in a school setting can have additional benefits for teachers such as being part of a team of elementary school teachers. Note, however, as Table 5 shows, that in this study the vast majority of the classrooms were located in day care centers with an unfavorable group size.

Table 5 The distribution of classrooms according to the levels of the interaction term

	Location in daycare center	Location in school	Total
Emotional Support			
Groups size Low	13 (26.5%)	4 (8.2%)	17 (34.7%)
Groups size High	24 (49.0%)	8 (16.4%)	32 (65.3%)
Classroom Organization			
Groups size Low	14 (28.6%)	7 (14.3%)	21 (42.9%)
Groups size High	23 (46.9%)	5 (10.2%)	28 (57.1%)
Instructional Support			
Groups size Low	15 (30.6%)	8 (16.4%)	23 (46.9%)
Groups size High	22 (44.9%)	4 (8.2%)	26 (53.1%)

Germany

For Germany, data were used from the longitudinal BiKS study involving three datawaves collected in 97 preschools in the federal states Bavaria and Hessen, which were located in both urban and rural areas (more information regarding this study can be found in Anders et

al., 2012; Kuger & Kluczniok, 2008; Von Maurice, 2007). Eight regions from Bavaria and Hessen were selected to represent a wide range of variation in children's socioeconomic and cultural backgrounds attending the preschools. The classrooms were mixed in age, serving children from age three to six years, and mixed in migration background of the children. On average, classrooms had 24% children with a migration background (SD=25%), but the share of migrant children ranged from 0-90% and 15% of the classrooms had 50% or more children with a migration background. The data were collected on two time points, when children were three and four years of age respectively. Both the structural and process quality measures were averaged over the different measurement points for the current analyses.

For the present data an additional variable was included in the analyses, namely the percentage of children in the classroom with a migration background. Due to a complete lack of variation in teacher's qualifications, this variable was not included in the regression analyses. The regression model of the main effects showed that the proportion of children with a migration background was, as a matter of fact, the strongest predictor of process quality, with a medium-sized effect (see Table 6). The results indicate that quality is lower when classrooms serve a higher proportion of children with migration background.

Next, the interaction models were investigated, showing one significant interaction effect of teacher's work experience with the proportion of children with migration background on the curriculum quality, as measured with the ECERS-E. To interpret the interaction effect, a graphical representation of the interaction between proportion of migration background children and work experience on the original scale of the observed curriculum quality was made (see Figure 4). The simple slopes test showed that quality is higher in classrooms with a higher proportion of children with migration background if the teachers have more work experience ($t(90) = 8.79$, $p<.001$). The simple slopes test also revealed that quality is higher in classrooms with a a lower proportion of children with migration background if the teacher is less experienced (t (90) = -6.98, $p<.001$). The findings show that if the teacher is less experienced, the quality is much lower in classrooms with a high proportion of migrant children, with an effect of almost 2 SD, suggesting that teacher experience mitigates the negative (main) effect of the proportion of migrant children (SD=.64; see Table 3). Note that, given the mean and standard deviation, a low proportion of migrant children in fact means that there are no children with migration background in this classroom, whereas the high proportion indicates the presence of at least 50% children with migration background.

Table 6 Results from the regression analyses for Germany

	ECERS-R (N=96)			ECERS-E (N=96)		
Model 1	**R= .36, R^2=.13, *p*=.01**			**R=.36 , R^2=.13 , *p*=.01**		
	b	*β*	*p*	*b*	*β*	*p*
Group size	-.01	-.09	.39	.00	.02	.88
Ratio	-.01	-.02	.82	.01	.03	.78
% children with migration background	-.01	-.37**	.00	-.01	-.33**	.00
Work experience	.00	.07	.82	.01	.08	.46
Model 2				**ΔR^2=.05, *p*=.03**		
				b	*β*	*p*
Group size				-.01	-.04	.75
Ratio				.01	.05	.66
% children with migration background				-.01	-.34**	.00
Work experience				.01	.08	.40
experienceXmigration background				.00	.22*	.03

Note. *** p <.001; ** p < .01; * p < .05; + p < .10

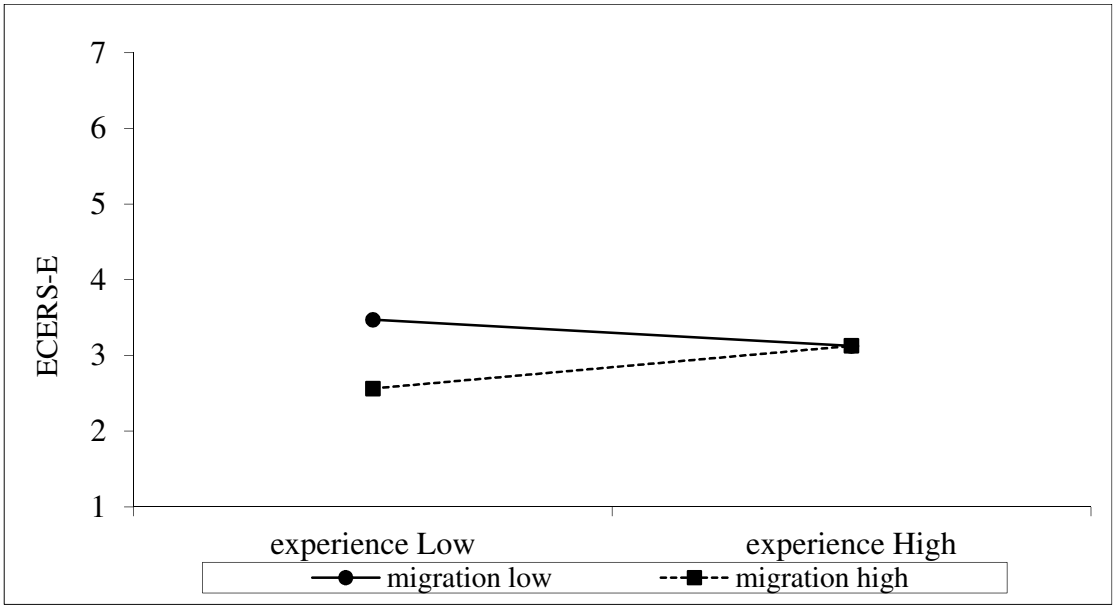

Figure 4 The interaction effect of teacher's work experience with the proportion of children with migration background on the ECERS-E.

Overall, the findings showed a negative main effect of a higher proportion of migrant children on curriculum quality. The interaction effect illustrated that teacher's work experience migitates these negative effects. However, as Table 7 shows more than 20% of the classrooms in the BiKS study had less experienced teachers with a high proportion of migrant children in their classroom.

Table 7 The distribution of classrooms below and above the interaction term

	% migration background low	% migration background high	Total
Work experience			
Low	31 (32.0%)	21 (21.6%)	52 (53.6%)
High	33 (34.0%)	12 (12.4%)	45 (46.4%)

The Netherlands

The present study used data from the national cohort study pre-COOL (more information on the study can be found in Slot et al., in press). Data from the first measurement wave were used, when children were about two years of age. Observational data for the CLASS Toddler and ECERS-E, and information on structural aspects were available for 141 centers. The participating preschools and day care centers were geographically spread over all parts of the Netherlands and were located in urban, semi-urban and rural areas. All classrooms included two- and three-year-old children; a minority of classrooms also incuded younger children who were not the focus of the study. Classroom composition with regard to children's age and ethnicity differed between day care centers and preschools, as is representative for the Netherlands. Specifically, day care centers (coded 0 in the analyses) included children from birth to four years of age. Preschools (coded 1 in the analyses) were

attended by children from age two to four years and often included children with an immigrant background as a consequence of the targeted educational policy in the Netherlands. In the Netherlands children enroll in kindergarten at age four years. Kindergarten in the Netherlands is part of the primary school system and attendance is compulsory from age five years.

The results of the regression analyses indicate main effects of group size, children-to-staff ratio, and work experience on emotional and behavioral support (see Table 8). Specifically, smaller group size, more unfavourable ratios, and more work experience are related to higher quality, showing small-to-medium-sized effects. More work experience was the only significant predictor of higher support for learning, with a small-to-medium sized effect. For the ECERS-E smaller group size was related to higher curriculum quality, with a small-to-medium effect size. There was a trending effect ($p < .10$) indicating that the provision of professional development activities at the center was positively associated with higher curriculum quality as measured with the ECERS-E.

Next, the interaction models were tested. For emotional and behavioral support no significant interaction effects appeared. The analyses revealed two interaction effects for support for learning and one for curriculum quality. After adding the interaction term two conditional effects appeared for curriculum quality. When controlling for all variables including the interaction term, there appeared two statistically significant positive associations for professional development and work experience with curriculum quality. Thus, the provision of more professional development activities at the center and more work experience was related to higher curriculum quality. In the first interaction model there appeared an interaction between children-to-staff ratio and the provision of professional development actities at the center, with a medium effect of about half a SD. (SD=.87; see Table 3). To interpret the interaction effect, a graphical representation of the interaction between professional development and ratio on the original scale of the observed educational quality was made (see Figure 5). The significance test of the simple slopes indicated that educational quality is higher in classrooms with higher (less favorable) ratios if the teachers are provided with more opportunities for professional development ($t(111)=2.27$, $p=.025$). There were no effects for classrooms with fewer professional development opportunities ($t(111)=-.56$, $p=.576$). This seems to suggest that the provision of professional development can be a compensating factor in dealing with more unfavorable ratios.

Table 8 Results from the regression analyses for the Netherlands

Model 1	Emotional support **R= .37, R^2=.14, *p*=.03**			Behavioral support **R=.35 , R^2=12 , *p*=.07**			Support for learning **R=.34, R^2=.11, *p*=.09**			ECERS-E **R=. 32, R^2=.10, *p*=.15**		
	B	*β*	*P*	*B*	*β*	*P*	*B*	*β*	*P*	*B*	*β*	*P*
Type provision (day care, preschool)	-.15	-.11	.32	-.04	-.04	.69	.32	.10	.10	.04	.03	.83
Ratio	.07	.24*	.02	.05	.22*	.03	.04	.10	.34	.04	.11	.29
Group size	-.09	-.24*	.02	-.07	-.25*	.01	-.07	-.14	.16	-.07	-.15	.14
Education program	-.07	-.04	.72	.12	.09	.36	-.07	-.03	.76	.39	.17	.11
In-service training (no/yes)	.12	.08	.38	.14	.15	.12	.24	.14	.15	.03	.02	.84
Professional development	.01	.02	.85	.03	.06	.54	.03	.03	.73	.14	.16+	.09
Work experience	.03	.25**	.01	.01	.19*	.05	.03	.22*	.02	.02	.13	.18
Education level	.07	.07	.47	.06	.09	.33	-.01	-.01	.95	.12	.09	.32
Model 2							**ΔR^2=.04, *p*=.03**					
							B	*β*	*P*	*B*	*β*	*P*
Type provision							.33	.19+	.08	.17	.10	.36
Ratio							.06	.14	.16	.03	.09	.35
Group size							-.07	-.15	.12	-.08	-.18	.07
Education program							-.14	-.06	.57	.37	.16	.10
In-service training (no/yes)							.25	.14	.13	-.02	-.01	.90
Professional development							.01	.01	.92	.18	.20*	.03
Work experience							.03	.22*	.02	.03	.22*	.02
Education level							-.00	-.00	.99	.14	.11	.21
Ratioxprofdev							.06	.20*	.03			
Model 3							**ΔR^2=.09, *p*=.03**					
							B	*β*	*P*	*B*	*β*	*P*
Workexpxprofdev							.02	.19*	.03			
Model 4										**ΔR^2=.06, *p*=.00**		
										B	*β*	*P*
Ratioxworkexp										.02	.27**	.00

Note. *** p <.001; ** p < .01; * p < .05; + p < .10

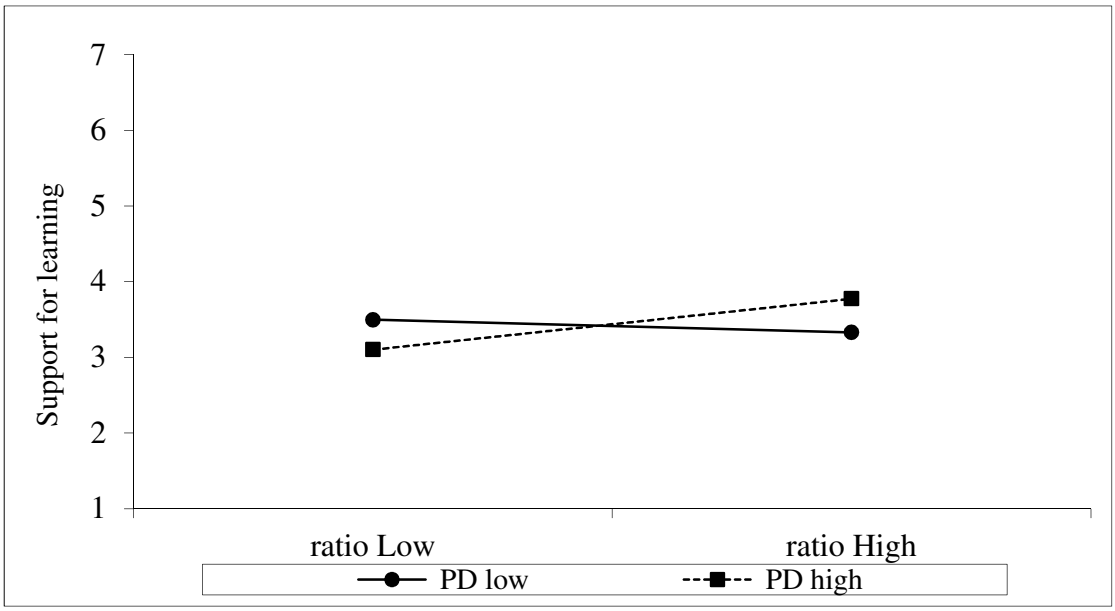

Figure 5 Interaction effect of ratio with professional development activities on support for learning

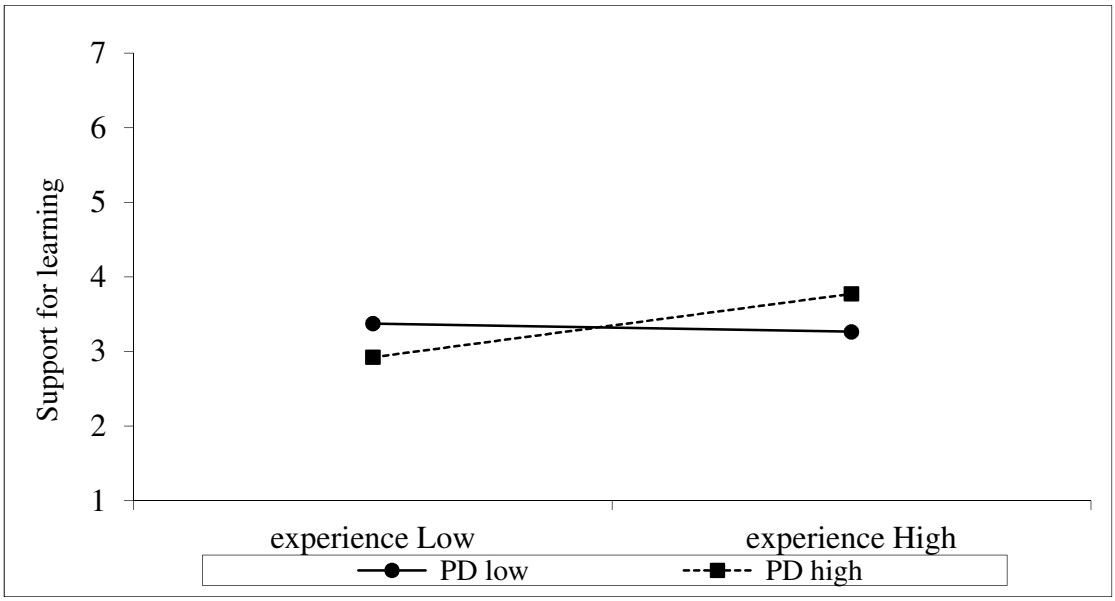

Figure 6 Interaction effect of work experience with professional development activities on support for learning

The second interaction model indicated a significant interaction between work experience and the provision of professional development activities, with medium effects of about half a SD (see Figure 6; note SD=.87, see Table 3). The simple slopes test showed a significant effect for both slopes. Educational quality is higher for teachers with more experience, but only if they are provided with more professional development activities (t(111)=598.10, p<.000). The reverse is also true. Teachers with less working experience tend to provide higher quality when provided with fewer opportunities for professional development (t(111)=-78.10, p<.000). These results might seem counterintuitive. However, young teachers with less work experience received their teacher training more recently and are perhaps be less susceptible to professional development because of the lasting impact of

this recent training. Experienced teachers, on the other hand, may profit more from professional development activities as more time has passed since they completed their professional training.

In addition, for the ECERS-E, one significant interaction appeared, again for working experience with ratio (see Figure 7; note that the average scores on the ECERS-E are very low). The results indicate that there are more literacy and math related activities in classroom with higher, more unfavourable, children-to-staff ratios, but only if the teacher has more work experience (t(103)=-5.73, p<.000) with a substantial effect of 1 SD (note SD=.84; see Table 3). For less experienced teachers, working in a classroom with a more favorable children-to-staff ratio is related to higher quality (t(103)=11.74, p<.000), but with a smaller effect of half a SD. Alltogether, the results seem to indicate that work experience can compensate for less favorable working conditions.

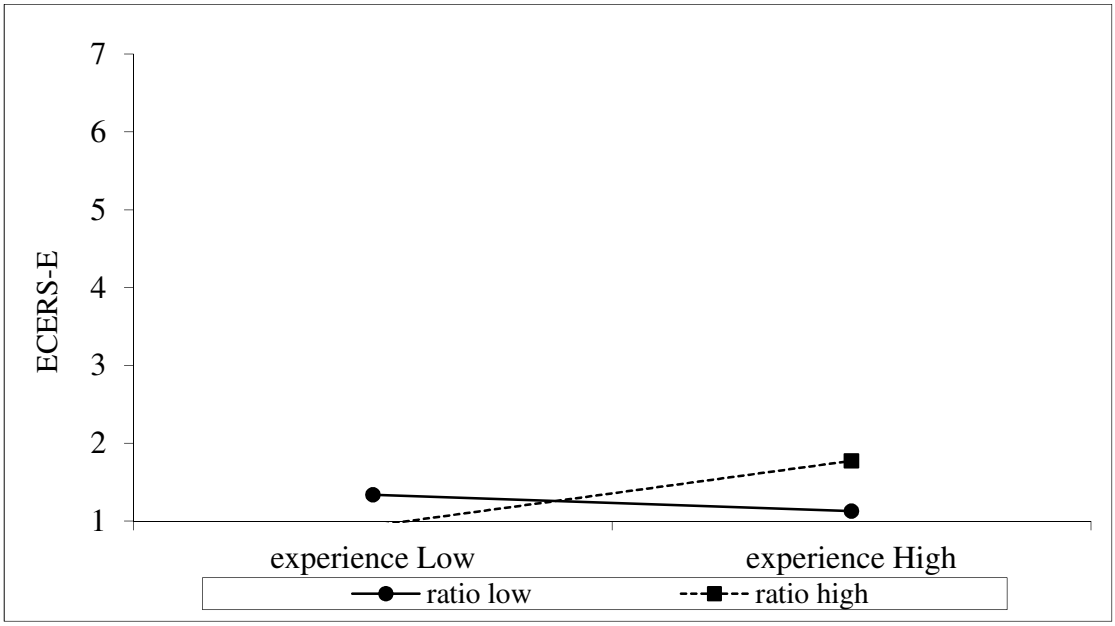

Figure 7 Interaction effect of work experience with ratio on the ECERS-E

Overall, the findings from the Netherlands revealed significant positive effects of work experience and professional development activities at the center. Both work experience and the provision of professional development activities also acted as moderators of other structural quality characteristics, pointing to a complex interplay of different factors in setting the conditions for process quality. Table 9 shows the distribution of classrooms according to the different levels of the interaction effects. It is striking that in particular more experienced teachers are apparently given the *least* opportunities for professional development at the center (19.8%), although the interaction effects revealed this to be most beneficial for quality. Less experienced teachers, on the other hand, are given the *most* opportunities for professional development (35.5%), although the results indicate that this is probably not related to higher process quality. In addition, more experienced teachers tend to have unfavorable children-to-staff ratios, which was shown to be related to higher curriculum quality.

Table 9 The distribution of classrooms according to the levels of the interaction terms

		PD low	PD high	Total	Ratio low	Ratio high	Total
Work exp							
	Low	26 (21.5%)	43 (35.5%)	69 (57.0%)	31 (26.1%)	21 (17.6%)	52 (43.7%)
	High	28 (23.1%)	24 (19.8%)	52 (43.0%)	28 (23.5%)	39 (32.8%)	67 (56.3%)
Ratio							
	Low	40 (29.0%)	38 (27.5%)	78 (56.5%)			
	High	27 (19.6%)	33 (23.9%)	60 (43.5%)			

Portugal

In Portugal, 60 preschool classrooms participated in the Context Study (for more information, see Abreu-Lima, Leal, Cadima, & Gamelas, 2013). The classrooms were recruited from the Metropolitan Area of Porto, a large city in northern Portugal. Over half (55%) of the centers were public (scored as 1 in the analyses) and the remainder concerned centers from the private sector (scored as 0 in the analyses). Most of the classrooms had mixed-age groups, with children ranging from three to five years, and all children were Portuguese speaking.

Table 10 Results from the regression analyses for Portugal

Model 1	ECERS-R **R= .37, R^2=.14, *p*=.05**			ECERS-E **R=.35 , R^2=12 , *p*=.10**		
	b	β	*p*	*b*	β	*P*
Sector (private, public)	.64	.38	.14	.53	.37	.15
Ratio	.02	.12	.45	.02	.11	.51
Group size	.01	.02	.92	.01	.04	.80
Education program	-.04	-.02	.89	-.00	-.00	.99
In-service training (# hours)	.00	.24	.17	.00	.23	.18
Work experience	-.01	-.05	.82	-.00	-.05	.82
Model 2	**ΔR^2=.20, *p*=.00**			**ΔR^2=.04, *p*=.03**		
	b	β	*p*	*b*	β	*P*
Sector (private, public)	.77	.45*	.05	.74	.47*	.05
Ratio	-.05	-.31	.12	-.05	-.34	.11
Group size	.01	.04	.77	-.01	-.03	.85
Education program	-.01	-.00	.98	.01	.01	.96
In-service training (# hours)	.01	.34*	.03	.00	.16	.32
Work experience	-.02	-.21	.28	-.01	-.10	.64
sectorXratio	.17	.64**	.00	.11	.45*	.04

Note. *** p <.001; ** p < .01; * p < .05; + p < .10

In the first step, regression analyses were conducted to investigate main effects of structural aspect on process quality, as measured with the ECERS-R and ECERS-R (see Table 10). Due to a lack of variation in teachers' qualifications, this variable was not included in the regeression analyses. The results indicated no siginificant main effects of structural characteristics.

In the next step, the interaction models were tested. The interaction models revealed significant interaction effects of sector with ratio and, in addition, significant conditional effects. The results for the ECERS-R showed that the number of hours of in-service training, as a measure of professional development, was positively related to global process quality, but only when accounting for the interaction between sector with ratio and the other

predictors in the model. Moreover, when accounting for the interaction effect and the other predictors, type of sector was also related to process quality. Working in the public sector was related to higher quality on both the ECERS-R and ECERS-E. The interaction effect of sector with ratio was significant for the ECERS-R with a substantial effect of about 2 SD (note that for ECERS-R the SD=.86 and forECERS-E the SD=.79; see Table 3). To interpret the interaction effect, a graphical representation of the interaction between sector and ratio on the original seven-point scale of the observed global quality was made (see Figure 8). The simple slopes test only revealed a significant effect of the slope for the public sector. Having higher, unfavorable, children-to-staff ratios was related to higher global quality, but only for the classrooms in the public sector (t(31)=3.70, p=.001). The slope for the private sector was not significant ((t(31)=-1.58, p=.124), meaning that there was no significant difference in global quality for the private sector for different children-to-staff ratios. Likewise, based on the regression analyses, the interaction effect of sector with ratio was significant for the ECERS-E with a substantial effect of about 1.5 SD (see Figure 9). The simple slopes test only revealed a trending effect of the slope for the public sector (t(31)=1.83, p=.076) indicating that global quality was higher in classrooms with a higher children-to-staff ratio in the public sector only. The simple slope for the private sector was not significant (t(31)=-1.58, p=.124), meaning that there were no significant differences in curriculum quality for the private sector depending on the children-to-staff ratio. The results seem to indicate that working in the public sector can be considered a compensating factor for unfavorable children-to-staff ratios. A possible explanation for this interaction effect might be that the public and private sector differ in other aspects of the working conditions that were not fully accounted for in the present dataset. For instance, the centers in the public sector might provide more attractive working conditions or attract more motivated staff.

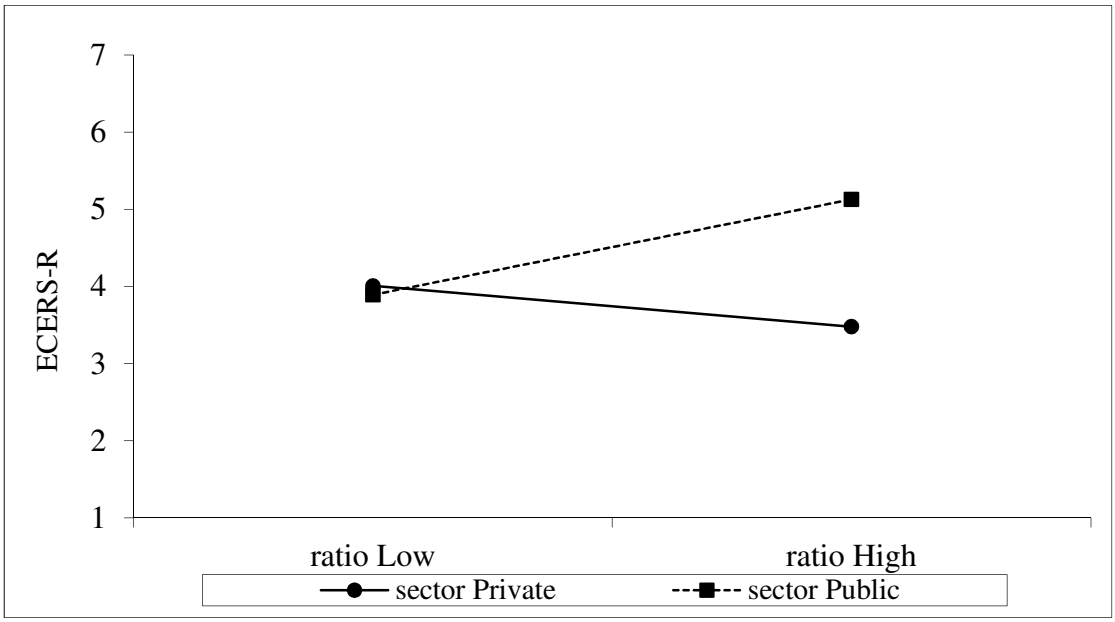

Figure 8 The interaction effect of sector with ratio on ECERS-R quality

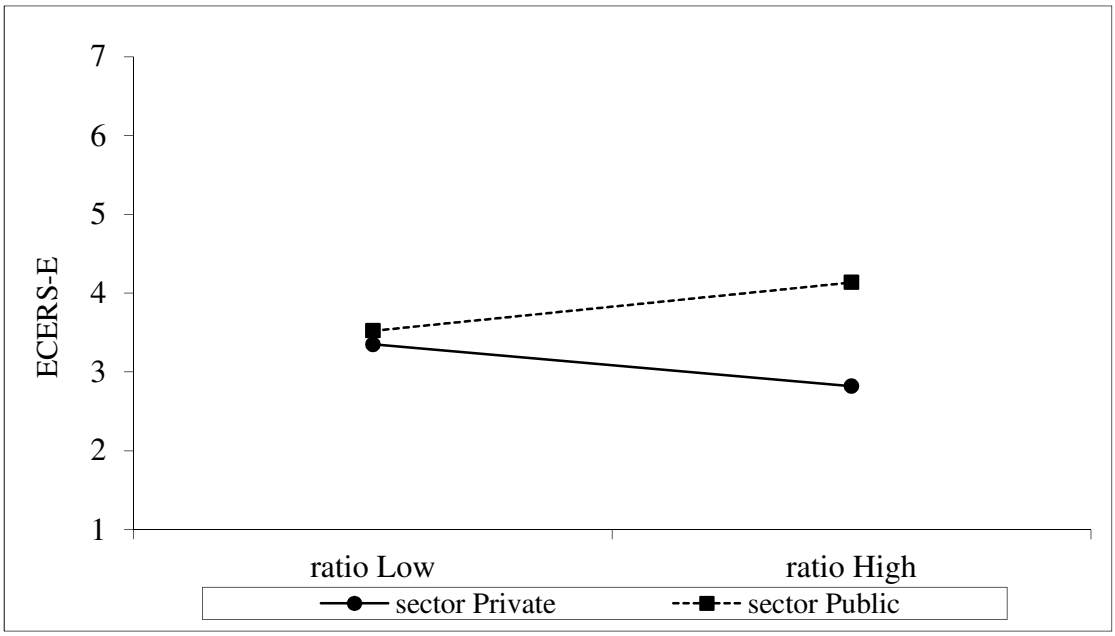

Figure 9 The interaction effect of sector with ratio on ECERS-R quality

Overall, the findings from Portugal showed that sector is an important aspect of the ECEC system that moderates the relationship of the usual structural quality characteristics with observed process quality. Classrooms in the public sector tend to provide higher global and curriculum quality. In addition, after adding the interaction effect, the number of hours of in-service training, as a measure of professional development, also positively contributed to higher global quality. Likely, there are other characteristics within the public sector that might account for the differences between centers. Table 11 shows the distribution of the classrooms according to the different levels of the interaction effect. Evidently, the positive interaction effect of higher children-to-staff ratios and classrooms in the public sector only applies to a small number of classrooms (13.5%). In contrast, about a quarter of the classrooms (23.1%) is part of the private sector and has high (unfavourable) ratios, which was found to be associated with lower process quality.

Table 11 The distribution of classrooms according to the levels of the interaction term

		Sector = private	Sector = public	Total
Ratio				
	Low	10 (19.2%)	23 (44.2%)	33 (63.5%)
	High	12 (23.1%)	7 (13.5%)	19 (36.5%)

Summary

The cross-cultural analyses showed the importance of several structural aspects that are related to higher process quality, some of which are associated with country specific characteristics of the ECEC system. First of all, the descriptive information regarding the structural characteristics (presented in Table 2) revealed large variation both within and across countries. Research on the relations between structural and process quality has revealed inconsistent findings, which have been suggested to be related to restricted range of variance within countries (Love et al., 2003). However, within the datasets used in the current secondary analyses, the variation within countries was almost as large as the variation between countries.

A number of main and conditional effects were found. Larger group size was related to lower quality in Finland and the Netherlands, with medium-sized effects. Furthermore, higher teacher qualifications were found to be related to higher quality in Finland and England. In England there was quit some variation in teacher's qualifications revealing large effects on process and curriculum quality. Interestingly, in Finland all teachers have at least a Bachelor's degree, but still positive medium-sized effects were found for teachers with a Masters degree. This might suggest that a certain threshold is necessary for higher process quality, as has been demonstrated in othher studies (Early et al., 2006). Moreover, continuous professional development was included in two countries, the Netherlands and Portugal, and was related to higher quality in both countries. In addition, more work experience was related to higher process and curriculum quality in Finland and the Netherlands. Finally, country specific characteristics were found to be related to quality. In Portugal, classrooms from the public sector provided higher process and curriculum quality compared to classrooms from the private sector. Likewise, for Finland quality differed depending on whether the classroom was located in a day care center or in a primary school, favouring the latter. In England many different types of ECEC provisions exist, which can be broadly defined as having a mainly 'care' orientation or an additional 'education' function as well. The provisions with an 'education' orientation were led by municipalities and more often employed higher qualified staff and showed higher process and curriculum quality compared to the 'care' provisions, with a large effect size. In Germany, no differences exist regarding the type of provision or the type of sector. However, there are differences in the population served, with some centers attended by a high proportion of children with migration background, which in previous analyses has shown to be related to quality. The current analyses confirmed this and showed that the proportion of children with migration background was the only predictor of both process and curriculum quality, with medium-sized effects.

In addition, several interaction effects were found for all countries. Particularly, work experience, continuous professional development, and country specific factors appeared important moderators of process quality in several countries. More work experience can compensate other, less favourable, structural aspects. For instance, in Germany classrooms with a higher proportion of children with migration backgrounds were associated with lower process quality, but teachers with more work experience demonstrated higher quality

compared to their less experienced colleagues, suggesting that work experience can migitate these negative effects. In the Netherlands, more experienced teachers were better capable in dealing with a more unfavourable children-to-staff ratio in the classroom, compared to less experienced teachers. Continuous professional development also appeared to be a moderator in the Netherlands. In centers with more professional development opportunities teachers better able to provide higher quality while dealing with higher children-to-staff ratios compared to teachers provided with less professional development. In addition, Portuguese teachers working in the public sector were better able to work with unfavourable children-to-staff ratios compared to teachers working in the private sector. Furthermore, in England teachers with lower qualifications who worked in an educationally oriented provision provided higher process and curriculum quality, compared to teachers with the same qualifications working in a care oriented provison.

Further interpretation of the interaction analyses revealed that the combination of unfavourable structural quality conditions apply to quit a large amount of classrooms. For instance, in Germany over 20% of the classrooms had less experienced teachers working with a large share of migrant children, which was negatively related to observed curriulum quality. There tends to be little, if any, extra support or resources for teachers working with large proportions of children with migration background (Leu & Schelle, 2009), which might lead more experienced teachers to seek employment in centers with less challenging working conditions. In Finland 45 to 50% of the preschool classrooms in this sample (generally this is 75%) were part of a day care center and had relatively large groups, which was associated with lower quality. However, the classrooms part of a school, with more favourable group size, showed the lowest quality, although this only concerned about 16% of the classrooms. Classrooms in schools were located more often in rural areas, where these classrooms might be integrated with 1st and 2nd grade, posing challenges for teachers to follow the preschool curriculum. In the Netherlands, more experienced teachers are provided with the least opportunities for professional development concerning 20% of the classrooms, which based on the interaction effects, would be the most beneficial for process quality. Less experienced teachers, on the other hand, are provided with more continuous professional development applying to 35% of the classrooms, which does not seem to be related to higher process quality. This indicates a mismatch of providing professional development to teachers who would benefit the most. For Portugal, 45% of the classrooms operated in the private sector, which was related to poorer process and curriculum quality of which more than half also had an unfavourable children-to-staff ratio. Working in the public sector is related to higher quality and seems to be a compensating factor for dealing with more unfavourable children-to-staff ratios. Likely, there are other characteristics in the public sector accounting for the differences in quality, such as higher pay for staff. Finally, for England about 43% of the centers was working in the care tradition and employed relatively low-educated teachers, which was strongly related to poorer process and curriculum quality.

Overall, the findings point to less than optimal quality conditions in most countries, which might have consequences for the potential benefits ECEC quality can have on children's developmental and educational outcomes.

Process quality and disadvantaged children

Introduction

It has been well established that high quality education and care can have beneficial effects on children's cognitive, language, and social-emotional development (e.g. Burchinal et al., 2008; Howes et al., 2008; Mashburn et al., 2008; Melhuish et al., 2015; NICHD ECCRN, 2002). All studies included in these secondary data analyses have established effects of quality on children's development and achievement, in the short term and some also in the long term. For instance, the longitudinal EPPE study conducted in England showed both short and long term effects of higher process and curriculum quality on a large variety of children's cognitive, language, and social-emotional outcomes (Hall et al., 2009; Sylva et al., 2006; Sylva et al., 2011). Specifically curriculum quality, as measured with the ECERS-E, was found to be related to gains in children's literacy and math skills, whereas process quality as measured with the ECERS-R was more strongly related to children's social-emotional development. Moreover, effects of quality were strongest for children with a disadvantaged background. Likewise, the longitudinal BiKS study in Germany has shown that particularly curriculum quality was related to gains in math (Anders et al., 2012, 2013). Curriculum quality was also related to children's vocabulary skills, but only for non-German speaking children (Ebert et al., 2013). The results from the longitudinal Portuguese Contexts and Transition study showed the opposite pattern with effects of process quality on language and literacy outcomes, but not on children's math skills (Abreu-Lima et al., 2013; Pinto et al., 2013). Mixed findings were reported regarding children's social-emotional skills (Abreu-Lima et al., 2013). Likewise, the longitudinal Dutch cohort study pre-COOL showed positive effects of process quality on children's vocabulary and attention skills (Slot, 2014), as well as mixed findings concerning social-emotional development (Broekhuizen, 2015). In Finland, the longitudinal First Steps study revealed that higher classroom quality was related to better learning-related skills and more adaptive social-emotional development (Pakarinen et al., 2011; Pakarinen, Kiuru et al., 2010; Siekkinen et al., 2013).

In view of combating early disadvantages, pre-primary education can provide an important contribution, depending on certain conditions. Leseman and Slot (2014) point to issues of coverage as well as issues of selective use of ECEC related to quality of the services. Quality of the provided education and care is essential, as some studies have shown that only high quality is related to better child outcomes, whereas poor quality did not have any benefits at all (Sylva et al., 2011). An issue of concern is that children from disadvantaged family backgrounds (i.e. with lower educated parents or having another first language than the majority language) tend to have less access to (good quality) ECEC provisions (Arnold & Doctoroff, 2003; Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; Sylva et al., 2007; Vandenbroeck, De Visscher, Van Nuffel, & Ferla, 2008). For instance, in Germany Lehrl, Kuger, and Anders (2014) found that children with a migration background were less likely to

attend a high quality ECEC provision compared to German children. Relatedly, Leu and Schelle (2009) point to the fact that children with a migration background tend to be clustered together in a limited number of ECEC provisions in Germany, with lower overall quality. Also, other studies have shown that disadvantaged families tend to use ECEC provisions of lower quality (Magnuson & Waldfogel, 2005; NICHD, 2001). Social selection in ECEC use has been mainly attributed to parental choice. For instance, disadvantaged families have shown to favor informal relatives care instead of formal center-based care (e.g. Sylva et al., 2007), particularly for younger children (Van Schaik, Leseman & De Haan, manuscript in preparation), although center-based care tends to be of higher quality. Comparative European studies on the quality children from disadvantaged backgrounds experience are scarce. Therefore, the aim of the current secondary analysis is to investigate the process quality disadvantaged children experience and to relate this to the results of the prior analyses on the relations between structural and process quality. This can increase our understanding of the social disparities and the relations with country-specific system characteristics.

Method

To investigate the process and curriculum quality disadvantaged children experience, we used the same datasets as decribed above. Tables 2 and 3 show the descriptive information on both structural and process quality from the following countries and longitudinal datasets: (1) from the Netherlands: Pre-COOL (age range 2-6 years); (2) from Finland: First Steps (age range 5-13 years); (3) from Germany: BiKS (age range 3-8 years); (4) from the UK: EPPE (age range 3-16 years); and (5) from Portugal: Context and Transition Study (age 4-7 years).

General analysis approach

Three different quality measures were used for the present comparisons. The ECERS-R and ECERS-E were used as measures of global process and curriculum quality in all countries, except for Finland. . The CLASS was used as measure of process quality in Finland and in the Netherlands. To increase compability, six subscales of the ECERS-R and two subscales of the ECERS-E were used for the comparative analysis , following the same procedure as outlined above.Two different background variables were used to identify disadvantaged children. First, maternal education was coded according to the ISCED levels in all datasets for comparability purposes (see Table 14). Next, the children were split into two groups based on maternal education with ISCED level 2 recoded as low maternal education (coded as 0) and all other levels as comparison group (coded as 1). For home language a similar procedure was followed, where children speaking the non-native language at home were coded as 0 and children speaking the native or majority language were coded as 1. In Portugal there were no children speaking another home language and were, thus, excluded from this analysis. Next, t-tests were conducted to test whether disadvantaged children experienced differences in quality compared to their more affluent peers.

Table 14 ISCED levels for maternal education

Description	ISCED level
Lower secondary	2
Upper secondary	3
Post-secondary non-tertiary	4
Bachelor	6
Master	7

Results

The results of the *t*-tests for each country are presented in Table 15. The findings showed both *negative* and *positive* selection effects. The findings from Finland revealed that quality was significantly higher for native Finnish speaking children compared to non-native children, although the latter comprised a very small part of the sample (4%). The effect for observed emotional support is about half a SD, whereas the effect of instructional support is almost 1 SD. Particularly the difference in instructional support provided to non-Finnish speaking children is striking. Finland follows a strong child-centered approach with individual learning plans based on children's developmental and educational needs. In addition, for targeted groups of socially, culturally, or linguistically disadvantaged children, specific language programmes are used, occasionally in separate settings or groups (Eurydice, 2009). However, it could be that these efforts were made to a less extent in classrooms located in rural areas or when the number of non-Finnish speaking children in the classroom was rather limited. In the current sample 16 non-native children were spread over 12 classrooms. Perhaps, because of the limited number of non-Finnish speaking children within a single classroom no targeted language programme was used within these particular classrooms.

Likewise, in Germany non-German speaking children experience lower process and curriculum quality, although the effects are only a fifth of a SD. This is in line with a recently published study by Lehrl et al. (2014), which suggests that the cause of the lower quality for immigrant children that was found is not so much related to parental choices, but to the neighbourhoods families live in. In Germany, children are enrolled in preschools in their own neighbourhood, meaning that the fact that children with migration background tend to be clustered together in preschools is reflective of their neighbourhoud population. Further investigation of the data showed that non-German speaking children from the BiKS sample were indeed in classrooms with a higher proportion of children with migration background (on average 52% and SD=29) compared to German speaking children (on average 17% and SD=17) supporting the idea of clustering of disadvantaged children.

Disadvantaged children in the Netherlands, in contrast, experienced *higher* educational and curriculum quality, although with small to medium effects up to about half a SD. In fact, although in the Netherlands there is not a similar official placement policy for preschools

and elementary schools as in Germany, parents tend to choose the schools in their own neighbourhood, resulting in similar concentrations of disadvantaged children. However, in the past years efforts have been made to create balanced and mixed classrooms, for instance by using waiting lists or priority lists for certain groups of children. Moreover, there exists a targeted educational policy in the Netherlands for several decades now, which aims to combat early disadvantages by ensuring access to preschools working with an education programme focused on children's broad development with an emphasis on language (Eurydice, 2009) and with employment of additional staff and provision of extra professional development activities. These education programmes have sofar been used mostly in the preschools that serve a large part of the disadvantaged population (which are funded for the most part by municipalities), meaning that there tend to be selective placement of children. However, day care centers are increasingly using these programmes as well, due to new legislation aiming to integrate preschool and day care provisions under the same statutory quality framework (Leseman & Slot, 2013). This policy seems to be effective, at least with regard to providing higher quality to children who need it most (Van Schaik et al., manuscript in preparation), although it should be noted that overall educational and curriculum quality in Dutch ECEC was rather low.

Similarly, in Portugal children with low educated mothers experienced higher process quality with an effect size of about a third of an SD. A further investigation of the data revealed that 70% of the children with low educated mothers attended public ECEC provisions. Although, the private and public provisions fall under the same Ministry of Education, with the same regulations concerning group size, teachers'qualifications, and the presence of auxiliary staff (Abreu-Lima et al., 2010), our prior analyses revealed higher process and curriculum quality for the public provisions. Therefore, follow-up analyses were conducted to investigate the quality differences for the two sectors separately (see Table 16). These analyses no longer revealed significant differences in quality for children with low educated mothers, supporting the explanation that disadvantaged children are benefitted by the selective use of public provisions. There may be several reasons for the selective use of public provisions, such as lower costs, higher (perceived) availability or accessibility. Indeed, public and also non-profit private institutions receive subsidies from the state to improve access for disadvantaged families (Eurydice, 2009; Ministry of Education, 2002), meaning that low-income parents only pay a small income-based fee. These institutions are meant to prioritize disadvantaged families, particularly in places with a limited number of public preschools, for instance in rural areas. However, public preschool for three- to five-year-old children is free of charge in Portugal, which might explain the selective placement in public provisions in Portugal. Overall, process and curriculum quality is considered low in Portugal, but more favourable for children who need it the most because they are attending higher quality public preschools.

Finally, in England no differences in experienced EC EC quality were found for children with a disadvantaged background compared to non-disadvantaged children. However, as the prior analyses have shown that process and curriculum quality were higher in education provisions compared to the so called educare provisions in England, we investigated the quality provided to disadvantaged chidlren further for the two types of provision separately

(see Table 16). The results for the education-oriented provisions showed *lower* process quality, but *higher* curriculum quality for non-English speaking children. The results for the care-oriented provisions revealed that both process and curriculum quality were lower for children with low educated parents. The latter finding is in line with a recently published report by Mathers and Smees (2014) based on data collected shortly after the EPPE data were collected. Table 16, in fact, shows that more than half of the children with low educated mothers and about 65% of the non-English speaking children were attending an educare provision of lower quality.

Table 15 Comparison of quality based on the background characteristics: maternal education and home language

	Finland (5-6 yrs)		Germany (3-6 yrs)		Netherlands (0-4 yrs)		Portugal (3-5 yrs)		England (3-5 yrs)	
	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	N
ECERS-R										
Low education			3.48 (.82)+	34			3.70 (.89)*	114	4.52 (1.03)	1627
High education			3.70 (.71)+	466			3.38 (.85)*	76	4.47 (.97)	1165
Non-native language			3.51 (.71)*	80					4.24 (.94)	155
Native language			3.72 (.73)*	463					4.22 (.93)	1990
ECERS-E										
Low education			2.55 (.84)	34	2.22 (.72)*	100	2.75 (.74)	110	3.58 (1.02)	1627
High education			2.76 (.92)	466	2.06 (.67)*	449	2.56 (.90)	76	3.64 (.96)	1165
Non-native language			2.58 (.79)+	80	2.39 (.90)***	140			3.41 (1.03)	155
Native language			2.77 (.93)+	463	2.08 (.67)***	386			3.34 (.90)	1990
CLASS	**Emotional Support**				**Emotional Support**					
Low education	5.51 (.64)	34			4.90 (.74)	112				
High education	5.50 (.65)	379			4.90 (.75)	465				
Non-native language	5.17 (.77)*	16			4.89 (.72)	152				
Native language	5.54 (.62)*	349			4.91 (.71)	411				
CLASS	**Classroom Organization**				**Behavioral Support**					
Low education	5.33 (.65)	34			5.84 (.52)	112				
High education	5.31 (.65)	379			5.90 (.45)	465				
Non-native language	5.02 (.68)	16			5.90 (.49)	152				
Native language	5.36 (.62)	349			5.86 (.47)	411				
CLASS	**Instructional Support**				**Support for Learning**					
Low education	4.09 (.87)	34			3.47 (.86)***	112				
High education	3.99 (.90)	379			3.15 (.72)***	465				
Non-native language	3.30 (.88)**	16			3.39 (.94)*	152				
Native language	4.05 (.87)**	349			3.21 (.79)*	411				

Note. *** p <.001; ** p < .01; * p < .05; + p < .10

Table 16 Comparison of quality based on the background characteristics: maternal education and home language specified for the type of sector/provisions

	Portugal (4-7 yrs) Private sector		Portugal (4-7 yrs) Public sector		England (3-5 yrs) Educare provisions		England (3-5 yrs) Education provisions	
	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	N
ECERS-R								
Low education	3.09 (.76)	34	3.95 (.82)	80	3.92 (.87)*	837	5.15 (.78)	790
High education	3.17 (.73)	55	3.93 (.91)	21	4.01 (.85)*	698	5.15 (.71)	467
Non-native language					4.01 (.94)	100	4.64 (.81)*	55
Native language					3.96 (.85)	1457	4.93 (.73)*	533
ECERS-E								
Low education	2.16 (.60)	34	3.01 (.64)	76	2.95 (.81)***	837	4.24 (.78)	790
High education	2.31 (.57)	55	3.20 (1.25)	21	3.23 (.87)***	698	4.25 (.75)	467
Non-native language					2.97 (.94)	100	4.19 (.63)+	55
Native language					3.09 (.84)	1457	4.01 (.67)+	533

Note. *** p <.001; ** p < .01; * p < .05; + p < .10

Summary

Overall, the findings revealed both *positive* and *negative* selection effects regarding the ECEC quality disadvantaged children in the five countries are provided with, which point to different policies with varying success. According to recent data Finland and the Netherlands are the two countries with the smallest proportions of disadvantaged children (i.e. children at risk for poverty or with a migration background), whereas England, Germany and Portugal have much larger proportions of disadvantaged children (Eurydice, 2014). This might result in different policies.

Finland has a universal ECEC system, with overall high quality, but based on the currently used data does not seem to be able to provide high quality for the children who need it the most. Particularly striking is the fact that instructional support was much lower for non-Finnish speaking children, which seems to be the most important aspect of quality if the purpose is narrowing the education gap. Likewise, Germany also provides a universal ECEC system in which children are entitled to ECEC from age one year (until 2013 this was from age three years; Eurydice, 2014). However, with a relatively large at-risk population and in the absence of targeted measures to increase the quality and to attract better staff, disadvantaged children are not well-off. This raises the question whether the policy is effective in view of combating early disadvantages. It seems that a quality impetus is essential to provide benefits for this disadvantaged population. In England all children are entitled to 15 hours of free ECEC (this number was recently increased), in which parents can make their own choice for the type of provision the want their child to attend, and this entitlement is even starting from age two years for the most disadvantaged children (Eurydice, 2014). However, this type of universal policy does not seem to be beneficial for all disadvantaged children, given the fact that at least half of the children attend an educare provision of lower quality, suggesting the working of selection tendencies that partly counter-act measures that are meant to close the early education gap. Despite, the strong school readiness tradition in England (OECD, 2006), which is manifested in the generally higher curriculum quality that was found compared to the other countries in this study, the differences between the educare and education-oriented provisions is striking. Non-English speaking children appeared to profit from higher curriculum quality, but only in educationally oriented provisions, which were found more often in the public sector. However, more than half of the children from low-educated mothers and non-English speaking families were attending educare provisions of poorer process and curriculum quality, mostly in the private sector.

Portugal and the Netherlands use a targeted approach. In Portugal, the public preschools are free of charge. Although, in the private provisions low-income parents only pay a small income-based fee, there appears to be a tendency for low-educated parents to choose the free public preschool. Evidently, quality was highest in these preschools, thus this policy seems to support disadvantaged families in narrowing the education gap for these children, at least under the assumption that process quality relates to outcomes. The Netherlands provides an even stronger targeted approach for children from low-educated parents, by subsidizing preschools that use an education programme targeted at addressing children's broad development, and language skills in particular, and employ extra staff for additional support. Parents pay a small income-based fee for this preschool, which is particularly used by immigrant families (Van Schaik et al., in preparation). Although, there are clear disadvantages of adopting a targeted approach for disadvantaged children, including the risk of early segregation tendencies and social stigmatization, such an approach does seem to work in terms of

providing higher quality care for lower costs (Akgündüz, Ünver, Plantenga, & Nicaise, 2015). The combination of working with an education program, the appointment of extra staff and the additional training of the staff resulted in higher educational and curriculum quality provided to disadvantaged children.

General conclusion

Secondary data analyses were conducted on datasets obtained in five European countries with varying ECEC systems and differences in both structural aspects and process quality to increase our understanding of the associations between structural and process quality and how process quality differs for children depending on their family background. Few general patterns were evident, but the findings altogether clearly point to the need to contextualize the often taken for granted knowledge about the effects of structural quality characteristics and to also consider country-specific factors. More specifically, profound interaction patterns emerged across the data, which might be an explanation for the inconsistencies regarding the relation between structural and process quality found in previous studies.

Main and interaction effects in context

Generally, both pre-service and additional in-service training were related to process and curriculum quality. Higher pre-service training was related to higher quality in both England and Finland. Interestingly, for Finland this effect of higher pre-service education was based on having a Master's degree instead of a Bachelor's degree, which might point to a threshold effect indicating that differentiation in staff's education levels at or below the bachelor level does not have much impact on process quality. In the Netherlands, where teachers generally had lower qualifications, the main effect of education level on process quality was rather small, but providing continuous in-service professional development, in contrast, was clearly related to higher quality. Moreover, in Portugal where teachers all have a Bachelor's degree, in-service training was also related to higher quality. A recent study from England also shows positive effects of continuous professional development (Otero & Melhuish, 2015). More opportunities for professional development also moderated the relation between higher children-to-staff ratios and educational quality, suggesting a compensating effect.

The minimum educational requirements differ between the participating countries, which can be partly explained by the type of system (unitary or split ECEC system). For instance, England and Portugal employ both professional and auxiliary staff with different educational requirements and the Netherlands has a split system with different educational requirements for professionals working with younger and older children (Eurydice, 2009; Sylva et al., 2015). However, the evidence based on the secondary analyses of five different countries does not unequivocally support the benefits of overall increasing the demands on pre-service training. Raising the overall level of teacher's qualifications is a very costly matter, which might not be the most cost-effective way to improve quality. Findings from England revealed that teachers with lower qualifications working alongside

higher qualified teachers also resulted in higher quality. Moreover, the findings suggest that investing in continuous professional development might be more, or at least equally, effective in raising process quality and more cost-effective compared to ensuring higher pre-service qualifications for all teachers. The current findings are strongly aligned with the increased focus on continuous professional development in both policy and in the field (Eurydice, 2014; OECD, 2006; 2011).

Work experience was another factor found to be related to higher quality in Finland and the Netherlands and, in addition, appeared to be an important moderator in the Netherlands and Germany. More experience appeared to compensate for less favourable classroom characteristics, such as higher children-to-staff ratios or a higher proportion of children with migration background. However, findings from the Netherlands also revealed that the combination of more work experience and more professional development opportunities were related to higher quality, whereas less experienced teachers provided higher quality when given fewer opportunities for professional development. This counterintuitive finding stresses the importance of ensuring a good balance of different profiles of teachers working together in a team concerning work experience, but perhaps also regarding their educational qualifications as pointed out earlier.

In addition, country specific factors played a role as well as likely determinant of process and curriculum quality in all countries, except the Netherlands. Country-specific context factors pertained to the societal sector, type of funding, and characteristics of the ECEC system as such. These country specific factors were mostly directed related to process and curriculum quality, but in addition appeared important moderators in combination with other teacher or classroom characteristics.

In England the type of provision was the strongest predictor of process and curriculum quality, in which the educationally oriented provisions provided higher quality than the educare provisions. For teachers with lower educational qualifications, working in these education provisions supported them in providing higher quality compared to equally qualified staff working in educare provisions. Previous studies have shown the mechanism of collaboration between lower and higher qualified staff, in which the latter tends to function as a rolemodel resulting in higher quality (Siraj-Blatchford et al., 2002). In addition, there could be other benefits of working in publicly funded provisions, such as the educationally oriented provisions in England, including increased attention for professional development and higher salaries (Taggart et al., 2000). In fact, the findings from Portugal in this respect align strongly with the findings from England, by revealing that teachers working in the public sector were better able to deal with a more unfavourable children-to-staff ratio compared to teachers working in the private sector. For Finland the location of a preschool classroom mattered in combination with group size, showing that larger group size was associated with higher quality when the classroom was located in a school whereas smaller group size was related to higher quality for preschool classrooms in a day care center. For Germany, the classroom composition regarding children's migration background was the only predictor of quality, but appeared to interact with teacher's work experience. Quality was lowest in classrooms with the highest proportion of migration background children; however, this effect was mitigated by having a more experienced teacher. Overall, the findings point out that in most countries there is a considerable number of classrooms operating under the most unfavourable combination of structural characteristics, which consequently poses threats to the potential positive effects of ECEC on children developmental and educational outcomes, particularly for children at risk.

Selection effects in the contexts of system interactions

There appeared *negative* and *positive* selection effects regarding the quality disadvantaged children experienced in the five countries, which are related to country-specific policy and ECEC system characteristics. Finland, for instance, has a universal ECEC system of high quality compared to the other countries, and has a relatively small at risk population. However, the data in this study revealed that children with another home language than Finnish attended preschools of lower quality compared to Finnish speaking children, particularly for instructional support. Despite the universal ECEC system in Finland, which is meant to provide equal opportunities to all children, it will not have the desired equal outcomes for children of different socioeconomic and linguistic backgrounds unless special targeted measures are taken (Akgündüz et al., 2015). Germany has a universal ECEC system as well, but of considerably lower quality than Finland, and at the same time with a larger at-risk population, without until recently a targeted policy. In this constellation, children with migration background tend to be clustered in provisions of the lowest quality with teachers with the least work experience. An important question is whether this policy is effective in combating early disadvantages and narrowing the education gap. In England there is a patchwork of ECEC provisions with a mix of publicly and privately funding. The education-oriented provisons, which are publicly funded, appeared to provide higher quality than the educare provisions, while disadvantaged children tended to be enrolled in both types almost equally. Moreover, all children experienced lower quality in educare provisions, but this was the most extreme for children with low educated mothers. Thus, despite a targeted policy of providing disadvantaged children with free ECEC at an earlier age than children from more affluent families (i.e. at age two years instead of age three years), there appeared to be selection tendencies in which lower educated English and non-English immigrant parents tended to choose ECEC provisions of poorer quality. The Portuguese ECEC-system resembles the English system with a division between public and private provisions in combination with a targeted policy for disadvantaged families. Non-profit private organizations receive subsidies to prioritize children from disadvantaged families and charge them with a reduced fee. However, public provisions were found to provide higher process and curriculum quality compared to private institutions. Since public preschools, starting at age three years, are free of charge and most children in the current study were enrolled there, this points to a positive selection effect concerning the quality disadvantaged children experienced. Although, quality in Portugal was generally lower, at least the disadvantaged children seemed to profit the most of high quality care. Similarly, in the Netherlands an even stronger targeted approach is adopted to combat early disadvantages by using an education programme focused on broad development and language skills in particular together with the appointment of extra staff. This policy seems to pay off because in the Netherlands disadvantaged children experienced higher educational and curriculum quality. Despite, the overall lower quality in the Netherlands, the policy seems to be beneficial for disadvantaged children.

Altogether, the findings from the five studies showed that process and curriculum quality is not yet optimal in most countries, and even worse for disadvantaged children, also due to complex interactions between structural characteristics. The need to increase process quality has already been identified and several pathways have been suggested (e.g. OECD, 2006). The findings from this comparative study add to the existing evidence. Overall, the relations between structural and process quality are complex and not always straightforward, because they are dependent on other structural or system characteristics. However, the findings do provide starting points for both policymakers and center managers.

Implications and future research

Creating a balanced team of teachers with varying educational qualifications and work experience might be an approach to increase quality. This requires good leadership, which in itself has shown to be related to higher process quality (Sylva et al., 2004). The evidence of England has shown the benefits of creating teams of teachers with both lower and higher educational qualifications working together. In addition, work experience was an important moderator in some countries, which supports the idea of creating teams of teachers varying in work experience. Embedding this in a context of continuous professional development in the center, including time for observation, reflection and feedback on practices or coaching on the job could strengthen the knowledge and skills of teachers, thus resulting in higher quality (Slot et al., in press).

Continuous professional development has been identified as promising strategy (Eurofound, 2015; OECD, 2006; 2011) and also in the current study turned out as a common denominator of several approaches that were found to contribute to higher quality. In most countries, included in this secondary data analysis, continuous professional development is now considered a professional duty, meaning that it is regulated on the country, local or institution level, whereas in 2009 this was mostly still optional. Professional development is also considered a prerequisite for promotion in some countries (Eurydice, 2014). However, not all staff gets these opportunities, as some countries make a distinction of working with younger or working with older chidren, or it is depending on the status of the staff, educational and care staff versus auxiliary staff.

However, for some countries providing continuous professional development may not be enough. For instance, in Germany a great effort has to be made to increase quality overall, and for disadvantaged children in particular. This might require more than providing professional development. Working with a disadvantaged population is challenging and it is essential to attract more qualified staff that can provide higher process and curriculum quality, which might require additional staffing or financial incentives for staff working in these centers (Eurydice, 2009). For countries with different types of provisions and selective use of these provisions, specifically England and Portugal, two different directions can be taken. First, policy could be targeted at ensuring that all disadvantaged families have access to and will indeed make use of the higher quality provisions, with the obvious disadvantage of early segregation and stigmatization of at-risk groups. However, in the short term this might require less financial investments with clear benefits for disadvantaged children. Or, alternatively, policy could be aimed at increasing the overall quality of the ECEC system, specifically for the private sector in Portugal and the educare provisions in England. This would require a more substantial investment, but would benefit all children in the end.

Future studies should further explore the interaction effects of different structural and contextual characteristics in predicting process quality. Secondary data analyses of cross-country comparative data sets have the great advantage that the same analyses can be applied for data obtained in different contexts, which can strengthen the conclusions regarding effective factors. However, this can be a challenging endeavour, as this study showed. Therefore, it would be useful for studies yet to be conducted to consider using the same comprehensive set of structural and contextual variables, and preferably measure these constructs in the most straightforward way (i.e. as continuous variables instead of categorical variables). In addition, future studies could also explore possible

three-way-interactions or investigate whether there are certain profiles (particular combinations of structural characteristics) that are more or less effective in view of optimal process quality.

To conclude, the current study revealed profound interactions between all different levels: country or system specific, center, classroom and teacher characteristics, and calls for a reconsideration of current views on relations between structural and process quality. Therefore, in view of enhancing process and curriculum quality, policy should not focus on regulating single structural aspects, but rather take a broader view taking into account the the possible interplay with other structural characteristics, while also bearing in mind country-specific aspects of the ECEC system. Worrying is that the interaction effects we found in this study show a tendency towards lower quality for the most disadvantaged populations, pointing to hidden disadvantaging mechanisms of which policmakers may not always be aware.

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