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Can Pre-Academic Activities in Norway's Early Childhood Education and Care Program Boost Later Academic Achievements in Preschoolers at Risk?

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ABSTRACT

Low academic achievements are predicted by early disadvantages. Because achievement gaps typically escalate with age, early efforts to prevent future academic disadvantages are called for. The current study examines whether exposure to structured pre-academic activities in Early Childhood Education and Care (ECEC) play a compensatory role for the early academic achievements in school (teacher ratings and screening tests of reading and math) of children who were at developmental (low receptive language), behavioral (high externalizing behavior and low effortful control) and socio-economic (low maternal education) risk in preschool. Using a sample of 934 children from the longitudinal Behavioral Outlook Developmental Study to examine between-school comparisons and within-school fixed effects models, findings suggest that preschoolers with externalizing behaviors may moderately benefit from structured pre-academic activities prior to school entry. However, it is concluded that this pre-academic boost is weak and may be limited to a short transition period from ECEC to school.

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Early risk; pre-academic activities; ECEC; academic achievements; multilevel design

Introduction

The transition from Early Childhood Education and Care (ECEC) to more structured and formal kindergarten and school settings involves an increased demand on children to regulate their focus of attention, emotional responses and behaviors (Magnuson, Duncan, Lee, & Metzger, 2016; McClelland et al., 2007; Rimm-Kaufman & Pianta, 2000). Targeted pre-academic activities or programs have been proposed to be effective in preparing preschoolers for the transition to school by stimulating skills relevant for this new formal learning context (Diamond, Barnett, Thomas, & Munro, 2007; Gray, Carter, Briggs-Gowan, Jones, & Wagmiller, 2014; Weiland & Yoshikawa, 2013). Exposure to pre-academic ECEC components may particularly benefit children who experience more challenges than usual with the shift from ECEC to school settings (Rimm-Kaufman, Pianta, & Cox, 2000) and who are at risk for future academic disadvantages, such as preschoolers at developmental (Beitchman et al., 2001), behavioral (Arnold et al., 1999), or social risk (Duncan & Magnuson, 2013). If this is the case, this calls for efforts to stimulate a developmental boost in this group of children in the transition

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from ECEC to school, which in turn might prevent unwanted stability in educational risk trajectories (Heckman, 2006). In the current study, we examine whether pre-academic activities in ECEC help promote early school academic performances for preschoolers at early risk.

Pre-Academic Activities in ECEC

Because early academic achievements is strongly predictive of later achievement and attainment (Casillas et al., 2012; Duncan et al., 2007; Herbers et al., 2012), this speaks to the importance of identifying ways to close this gap early on and prior to school entry (McClelland, Acock, & Morrison, 2006). Despite modest effect sizes (Burchinal, Kainz, & Cai, 2011), process quality has consistently been identified as a key "ingredient" in ECEC promoting positive child outcomes (Hamre, 2014). However, what particular elements of that ingredient that needs to be pressed in order to stimulate particular child behaviors and performances still needs to be examined. Because structural ECEC quality features that are typically subject to policy regulations are only modestly related to process quality (NICHD ECCRN, 2002), Duncan and Magnuson (2013) refer to curriculum and professional development as potential policy levers deserving increased attention. In fact, studies examining the impact of targeted programs suggest that it might be particularly effective to stimulate pre-academic and cognitive regulation skills in order to prepare children for the transition to school (Diamond et al., 2007; Gray et al., 2014; Weiland & Yoshikawa, 2013). This is supported by findings of longitudinal associations between academic elements of school readiness skills and later school literacy and math (Duncan et al., 2007), and cross-sectional associations found between advanced kindergarten academic content and student learning (Claessens, Engel, & Curran, 2014). In sum, early childhood education programs can be an environmental booster for children at risk, calling for a focus on intervention and outcome heterogeneity across subgroups (Duncan & Magnuson, 2013).

Educational Disadvantage in Children at Early Risk

Overall, preschoolers who struggle with structural and teacher-directed learning situations are at a higher risk for lower pre-academic and academic outcomes in preschool and in the first years of school (Bulotsky-Shearer & Fantuzzo, 2011; Bulotsky-Shearer, Fantuzzo, & McDermott, 2008). Importantly, such early detriments in educational trajectories are not distributed in a random manner, but are associated with social, developmental and behavioral risk factors. Some of the strongest environmental predictors of the school readiness levels displayed by preschoolers prior to school entry are socio-economic family factors. Research rooted in intentions to disrupt such risk processes from unfolding show that preschool children at socio-demographic risk benefit both socially and academically from enriched ECEC interventions programs (Bierman et al., 2008; Denham et al., 2012) and show the largest gains of ECEC in general (Dearing, McCartney, & Taylor, 2009; Duncan & Sojourner, 2013; Geoffroy et al., 2010; Love et al., 2003; Magnuson, Ruhm, & Waldfogel, 2007). However, it remains to be examined whether particular pre-academic components of ECEC have an enhanced impact for lower SES preschoolers in sociopolitical contexts with universal subsidized and regulated ECEC.

Other strong predictors of children's academic trajectories are early developmental or behavioral risk. In fact, preschoolers with cognitive-linguistic delays or with problem behaviors are also at a higher risk for future academic disadvantages. In particular, individual differences in early language development and language-related pre-literacy skills in preschool is associated with early school achievements (Beitchman et al., 2001), and especially reading (Catts, Herrera, Nielsen, & Bridges, 2015). Another robust finding in the literature is that high-quality ECEC is positively associated with language competence (e.g., Lekhal, Zachrisson, Wang, Schjølberg, & von Soest, 2011; Melhuish, 2011; Li, Farkas, Duncan, Burchinal, & Vandell, 2012), and in some cases even into the early school years (Belsky et al., 2007). However, there has been little focus on whether particular aspects of ECEC

have any added implications for the academic readiness of children who show low language performance scores.

Moreover, a substantial line of research has shown how children with early externalizing behaviors display both lower levels of emergent academic skills (Arnold, Kupersmidt, Voegler-Lee, & Marshall, 2012; Curby, Brown, Bassett, & Denham, 2015; Doctoroff, Greer, & Arnold, 2006), and struggle with adapting academically in the first years of school (Arnold et al., 2012; Bub, McCartney, & Willett, 2007; Choi, Elicker, Christ, & Dobbs-Oates, 2016; Gray et al., 2014; McClelland et al., 2006; Raver, 2002). Early externalizing behaviors comprise a range of behavioral indicators, such as aggression, hyperactivity and inattention (Gray et al., 2014). Thus, in addition to the apparent problem behaviors, children with high levels of externalizing behaviors often experience challenges with regulation skills important for academic learning processes, such as attention and the ability to following instructions (Arnold et al., 1999; Bub et al., 2007; Rimm-Kaufman et al., 2000). It has been suggested that such behavioral challenges would result in an unfavorable cycle of negative learning experiences over time, involving both children's ability to and interest in taking part in learning processes and teachers' capability of teaching the children (Arnold et al., 1999; Montroy, Bowles, Skibbe, & Foster, 2014).

To address the factors underlying relations between behavioral risks and poor academic performance, some researchers have examined different sub-components of externalizing behaviors to disentangle their combined and unique prediction on school outcomes. No associations to moderate associations have been reported between externalizing behaviors in Kindergarten and poor school achievements later on, while attention problems in Kindergarten seem to a stronger predictor for future poor academic achievements (Arnold et al., 2012; Duncan et al., 2007; Gray et al., 2014; Grimm, Steele, Mashburn, Burchinal, & Pianta, 2010). ECEC programs have been found to have effective preventive effects on the externalizing behavior problems in and of itself when introducing a level of practice that clearly and intensively focus on the children's socio-emotional behaviors and skills (see Schindler et al., 2015). Yet, based on the reports of later challenges with the structure of formal learning situations, ECEC pre-academic activities might also provide important early experiences with structural learning situations for this group of children. From a practice perspective, it is essential to identify intervention components that are effective in boosting the later academic achievements of children at risk, as well as understanding whether specific intervention components are more or less effective for children with different risk profiles (i.e., environmental, developmental and behavioral).

In line with others (Arnold et al., 1999, p. 593), we propose that "a key leverage point" in addressing the behavioral and academic challenges of children at risk could be to increase their early pre-academic receptiveness. More structured pre-academic activities provide experience with situations that both require attentional and behavioral regulation and that address their pre-academic skills, which essentially are prerequisites for early literacy and mathematics (e.g., such as language comprehension skills and informal mathematics knowledge). Studies have shown that such pre-academic skills can effectively be targeted and promoted through early randomized interventions and structured programs (Rogde, Melby-Lervåg, & Lervåg, 2016). For example, though in the US, structured programs promoting preschool spatial and numerical skills can prevent future school failure (Clements & Sarama, 2007). Such activities might therefore work as a transition leverage bridge between ECEC and school settings and be particularly beneficial for children who show a greater need for external structure in learning situations, enduring teachers and subsequently access to learning substance. In the context of the current study, we especially seek to address the degree to which pre-academic activities, that is, a curriculum with some focus on formal learning situations, have a compensating role for later academic achievements in preschoolers at risk.

The Case of Norway

Norway provides a particularly relevant context to test this question, due to the universal and subsidized ECEC program available from age 1, which is attended by 96% of all children the year prior to

school. The teacher:child ratios (1:18 for 3-5-year-olds), with teachers being required to have a tertiary degree in early childhood education, are regulated by law. Moreover, guidelines for staff:child ratios (1:6 for 3-5-year-olds) are almost universally complied with. Thus, in typical cases, one teacher works with two teaching assistants. All centers are required to follow the framework plan (Ministry of Education and Research, 2006), which is a broad set of guidelines for the educational content of ECEC centers, regarding pre-academic stimulation and skills, physical activity, and arts. However, direct instructional activities are rather uncommon, the pedagogy is generally play-based (Samuelsson & Carlsson, 2008), and preschoolers from 3 to 5 years of age usually attend ECEC together in the same groups (Engel, Barnett, Anders, & Taguma, 2015). Although there are no specific requirements for the content of pre-academic activities in the year prior to school entry, it is common for 5-year-olds to spend some time in designated smaller groups a few hours a week for school preparatory activities, with a curriculum or teaching plan designed by the teacher (Gulbrandsen & Eliassen, 2013). However, the content and duration of these group-activities, and the extent to which children are exposed to selected pre-academic activities such as writing, reading, and other structured classroom activities, vary considerably between ECEC centers and can be unrelated to ECEC structural quality features.

The associations between socioeconomic, developmental, and behavioral risks and poor academic performance identified in the US research literature reviewed above, also seem present in Norway. Although Norway is a country with less economic disparity compared to the US, there are reports of considerable socio-economic achievements gaps in adolescence, for instance in PISA-scores, where there is a 75% of a standard deviation difference between students from the lowest and highest socioeconomic backgrounds (OECD, 2016). Such gaps are also related to developmental risk in Norway, and a recent study showed how Norway's universal ECEC scale-up in particular led to improved language outcomes for low-income children (Dearing, Zachrisson, Mykletun, & Toppelberg, 2018). Children performing low on receptive language tests prior to school entry are also in general maintaining a lower score than their peers throughout the first years at school (Lervåg & Aukrust, 2010; Melby-Lervåg et al., 2012). In addition, a Norwegian report finds teacher-rated externalizing behavior problems in primary school to be associated with poorer academic performance (Sørlie, 1998), and children with low levels of cool self-regulation prior to school age tend to be rated lower on academic abilities by their teachers after school entry (Backer-Grøndahl, Nærde, & Idsoe, 2019). This makes it paramount to identify ways in which to ensure positive outcomes for these children, also in the Norwegian context.

While there exists socio-demographic selection into early ECEC in Norway as well (Sibley, Dearing, Toppelberg, Mykletun, & Zachrisson, 2015; Zachrisson, Janson, & Nærde, 2013), it does not seem to be systematic selection into the process- and instructional quality of the centers (Eliassen, Zachrisson, & Melhuish, 2018). Given the relatively homogenous structural quality across centers (Winsvold & Guldbrandsen, 2009), it is unlikely that there should be strong selection into centers with a particularly focus on pre-academic activities. Yet, as is the case with all research on early education programs and child outcomes (Duncan, Magnuson, & Ludwig, 2004) appropriate research designs are needed to account for potential selection effects in Norway as well (e.g., Zachrisson, Dearing, Lekhal, & Toppelberg, 2013).

The Current Study

In this study, we investigate whether exposure to pre-academic activities in ECEC (i.e., teacher reports on activities directed at pre-literacy, -mathematics and -technology skills) would especially boost the school achievements of children at developmental (low receptive language scores), behavioral (high externalizing behavior and low effortful control) or socio-economic (low maternal education) risks in preschool. The aims of the current study were therefore two-fold: To examine the (a) unique and (b) combined impact of the risk indicators and ECEC school-preparatory activities (i.e.,

in a pre-kindergarten period) on teachers' evaluations of children's academic achievements in first and second grade, and second grade scores on national screening tests.

Method

Study and Participants

Data are from the longitudinal Behavioral Outlook Norwegian Developmental Study (BONDS), approved by the Regional Committee for Medical and Health Research Ethics and reported to the Norwegian Social Science Data Services. The parents of 1931 eligible children (6 months of age and with at least one Norwegian speaking parent) were informed about the study through child health clinics in five Norwegian municipalities in 2006 ($n = 433$), 2007 ($n = 529$) and 2008 ($n = 195$). Of these, 1465 (76%) agreed to be contacted, and 1159 (60%) agreed to participate. The retention rate is high, with 98% of families participating at 1 year, 93% at 4, and 82% in first grade (approximately 6 years). Two families left the study at an early stage and according to protocol had their data deleted. Nærde, Ogden, Janson, and Zachrisson (2014) compared the participating families to anonymous records kept by the clinics on the 1931 eligible families to the overall population statistics for Norway, and found few differences between participating and eligible families on indicators such as child gender, birth order, parental age, civil status or foreign birth country of the mother. However, fewer of the participating mothers had only primary education compared with the eligible mothers. Moreover, compared with the general population the participating families comprised more first-borns, as well as more mothers who were married, European-born (see inclusion criteria above) and had higher education.

For the current analyses, we utilized data from the personal interviews with the parents at 6 months and 1 year (see description of the covariates), a language test at 4 years, ECEC teacher reports at age 4, an interview with ECEC teachers at age 5, as well as teacher reports at the end of the first terms of first and second grade (when the children were approximately 6 and 7). The analytical sample for the current study consisted of the 932 children for whom we had obtained a valid school

Table 1. Descriptive Statistics of included variables ($N = 934$).

Variables	*% Missing*	*M (%)*	*SD*	*Min*	*Max*
Outcomes					
Reading, teacher rep[a]	5.69	3.48	1.04	1	5
Math, teacher report[a]	6.33	3.60	0.93	1	5
Reading, screening[b]	45.28	46.12	7.49	11	54
Math, screening[b]	44.96	47.08	8.41	11	55
Reading, critical threshold[b]	45.28	(9.2)			
Math, critical threshold[b]	44.96	(22.8)			
Social skills[c]	5.69	3.23	.41	1	5
Predictors					
Pre-academic activities	0.0	0.00	0.21	−0.74	0.46
Externalizing behaviors	31.2	1.26	0.30	1	2.53
Receptive language	11.48	40.13	11.04	10	75
Effortful control	13.3	0.75	0.19	0.15	1
Low maternal education	0.9	(8.7)			
Covariates (measured at 6 mo)					
Boys	0.0	(51.7)			
Preterm birth	1.93	(7.8)			
Older siblings	0.8	(60.5)			
Non-western immigrant	1.0	(5.6)			
Western immigrant	1.0	(6.3)			
Single parent household	0.8	(4.0)			
Birth cohort 2006	0.0	(38.5)			
Birth cohort 2007	0.0	(45.0)			
Birth cohort 2008	0.0	(16.5)			

[a]Average 1st and 2nd grade.
[b]2nd grade.
[c]1st grade.

identifier in first grade; comprising 81% of the original sample (see Table 1 for more descriptive information about the sample).

Variables

Outcome Variables

Late fall, towards the end of the first semesters of first and second grade, the teachers rated their children on the academic competence subscale of the Social Skills Improvement System Rating Scales (SSIS-RS; Gresham & Elliott, 2008). For the current analyses, we included two items capturing the teacher's rating of the children's performance in reading and math, respectively. The children were rated in terms of expectations for the grade level (for reading and math) on a 5-point scale (1 = the lowest 10% of class, 2 = the next lowest 20%, 3 = the middle 40%, 4 = the next highest 20%, 5 = the highest 10%). Gresham and Elliott (2008) argue that there is high stability in how teachers place children in the broad performance levels of the responses. Moreover, a meta-analysis of 73 studies found an over-all correlation of .63 between teachers' ratings of student performance and standardized test scores (Südkamp, Kaiser, & Möller, 2012). We use the average of the first and second grade ratings in reading and math, respectively, to get a more reliable measure of the children's performance in early school age than what one single rating would be. The first and second grade ratings were correlated .66 for reading and .59 for math.

We also included screening tests of reading and math from second grade. The screening is issued by the Norwegian Directorate for Education and Training, and was used as a formative assessment by teachers in the spring of second grade to detect children with low proficiency (information available in Norwegian only: http://www.udir.no/eksamen-og-prover/prover/kartlegging-gs/). Thus, the screenings are designed to be most sensitive to performance at the lower range, and the results are therefore positively skewed. Nevertheless, the results from the screenings (which took place in April) and the teacher ratings (which took place in November the previous year) were correlated at .60 and .61 for reading and math, respectively. We also include the dichotomous measure of whether children were below or above the critical threshold as defined by the test developers, which reflects the intended use of the screening.

In our robustness checks, we included the first grade teacher rating of children's social competence. We used the mean score of the full social competence scale from SSIS-RS (SSIS-RS; Gresham & Elliott, 2008).

Predictor Variables

Pre-academic activities were measured by a scale consisting of 6 items from a telephone interview with the teacher in each ECEC center responsible for the school preparatory activities in the center. The interviews were conducted in all known centers attended by children in the study in the last year prior to school entry, by the end of the spring term. Thus, in some cases, three interviews were conducted with centers for three consecutive years, if there were children in the center participating in the study and starting school the following fall. The interview questions included teacher ratings about the extent to which they emphasized various aspects of school-preparatory activities. For the purpose of this study, we only included questions about activities with a clear pre-academic content. This included questions of the degree to which (1 = not much, 2 = some, 3 = a lot) the group worked systematically with the following pre-academic activities: (1) Stimulation of language and concepts, (2) letters and reading, (3) playing with script and writing, (4) being able to write their own name, (5) numbers, amounts and shapes, and (6) use of information and communication technology and digital tools. A Confirmatory Factor Analysis (CFA) was performed and indicated a good fit: CFI = .969, TLI = .948, RMSEA = .035, with standardized factor loadings ranging from .3 to .5. Based on this model, factor scores were saved out in Stata 13 (StataCorp, 2013). This provided information on each individual's placement on the latent factor (DiStefano, Zhu, & Mîndrila, 2009), weighted according to factor loadings and thresholds. This composite was used as a continuous predictor.

Externalizing behaviors were measured at 4 years by childcare teacher ratings using the complete Caregiver-Teacher Report Form (C-TRF) of the Child Behavior Checklist for Ages 1.5-5 (Achenbach & Rescorla, 2000). As there are no Norwegian norms, we used a raw mean score for our analyses instead of T-scores. We used the full externalizing scale for our analyses, which was correlated .86 and .96 with the attention problems and aggressive behaviors subscales, respectively. These two subscales were correlated .69 (.77 after correcting for attenuation of the two subscales with alphas of .88 (attention) and .91 (aggression), by dividing the observed correlation by the square root of the product of the two scale reliabilities). Cronbach's alpha for the full externalizing scale was .94.

Child receptive vocabulary at 4 years measured by the Norwegian version of the British Picture Vocabulary Scale II (BPVS-II; Dunn, Whetton, & Burley, 1997), which consists of 12 of the 14 original sets, each with 12 subtasks (Lyster, Horn, & Rygvold, 2010). Of the 945 children tested, data for 14 children were deleted because of administration or punching errors. Ninety-three children should have been tested on set 1, so missing on set 1 was estimated using the set 2 scores. Moreover, 2 children were tested on an extra set and given a somewhat higher score, while 9 children should have been tested further, and were credited a lower score than they should have. Given these small numbers, this should not influence the distribution. We used a centered BPVS-II raw sum score in our analyses.

Effortful control at 4 years were measured by a battery of 4 effortful control tasks, based on Kochanska, Murray, Jacques, Koenig, and Vandegeest (1996) and Mawby (2007). In the shape task, children were presented with 12 cards and asked to name smaller shapes that were consistent or inconsistent with surrounding larger shapes (scores ranged from 0 to 6, $\alpha = .88$). In the circle task, children drew along the line of a pre-drawn circle three times (for training, as slowly as possible, and as fast as possible; scores ranged from 0 to 6, $\alpha = .87$). In the whisper task, the children were presented with 12 cards with easily recognizable objects and were instructed to whisper the names of the objects (scores ranged from 0 to 12, $\alpha = .99$). In the gift delay task, children had to face a wall and not speak or turn around, while the test leader pretended to wrap a surprise gift by making noises with the cellophane paper (scores ranged from 0 to 10, $\alpha = .73$). After each task score was divided by the maximum score, a total mean score between 0 and 1 was calculated (see Backer-Grøndahl, Nærde, Ulleberg, & Janson, 2016, for more details).

Low maternal education was defined as less than complete high school (> 12 years) education (0 = no, 1 = yes).

Covariates

We included the following child-related covariates: *Child gender* (Boys = 1), *preterm birth* (>3 weeks before term date). To account for selection into ECEC, we included a number of family- or site-related covariates reported at 6 months of age (i.e., prior to ECEC entry) previously found associated with ECEC utilization (Zachrisson, Janson, et al., 2013). These included whether the child was *living with siblings* (0 = no, 1 = yes), the *mothers' years of education* (in all analyses not testing mother's education as key predictor), whether both the child's parent had *non-western or western immigrant background* (0 = no, 1 = yes), and whether the child lived in a *single-parent household* (0 = no, 1 = yes).

Statistical Analyses

A major concern when estimating associations between ECEC factors and school outcomes is that there are unobserved differences between schools or the ECEC centers attended by children in the school's catchment areas, or between children selecting into particular ECEC center, thus estimates may be biased (e.g., Duncan et al., 2004). We therefore attempted to account for differential selection by comparing children within schools, yet with different histories of school preparatory activities, by estimating within-school fixed-effects models. The fixed-effects models estimate whether within-school differences in teacher rated outcomes or results on the screening test vary as a function of within-school differences in experiences of school preparatory activities prior to school entry (Allison, 2009). The within-school fixed-effects models by design account for bias due to unobserved

differential selection into schools (which in effect would refer to unobserved differences between catchment areas for the schools).

The data structure was complex. Children were from three birth cohorts, and were clustered in both ECEC centers and in schools. While we had indicators of ECEC centers and schools, we did not have indicators of the separate classrooms in either of these. However, as data on school preparatory activities were collected separately for each cohort in the study, there could be within-center/school variability in these activities across cohorts. We therefore explored the intra-class correlations of our two outcomes (reading and math) for three separate nesting variables; (1) ECEC center, (2) ECEC center by cohort (i.e., by computing unique ECEC identifiers for each birth cohort of children), and (3) school. ECEC center by cohort explained approximately 5% of the variance in reading and math. Both ECEC center across birth cohorts and school explained less than 1% of variance in the outcomes. For the within-school fixed-effects models, the fact that the within-school variability in teacher rated outcomes were approximately the same as between schools allowed us to use schools as unit of analysis for these models (Allison, 2009), while the rather low ICC at ECEC by cohort level, combined with the fact that the 932 children attended 342 different ECEC by cohort groups, lead us to ignore nesting at the ECEC level.

Because teacher reports and tests were taken from 3 cohorts of children, and taken at the same time for all children in each cohort, we adjust analyses for dummies for birth year and quarter of birth throughout the year.

For all analyses, we estimated effect sizes. We used partial correlation (r_p) which can be calculated from each coefficient's corresponding t-value, using the formula $r = \sqrt{t^2/(t^2 + df)}$.

Missing Values

Rates of missing data for our analytical sample can be seen in Table 1. We used the ice program for multiple imputation (MI) in Stata 14 to estimate 20 sets of missing values (StataCorp, 2013), based on all variables in Table 1 and auxilliary variables related to sampling (site, birth cohort). Interaction terms were generated prior to imputation.

Results

Descriptive Analyses

Descriptive results for all variables included in the analyses are displayed in Table 1. Of particular note is that the mean teacher rating of the outcomes reading and math were slightly above the scale median of 3 on the 5-point scale (3.49, and 3.58, respectively). While the reading and math screenings were skewed as expected, the percentages of children below the critical thresholds were 9.2 and 22.8, respectively. The school preparatory activities measure is a factor score, with the metric reflecting variance in the strongest factor indicator (stimulation of language and concepts).

Teacher Rated Reading and Math – Main Effects and Interactions

In our first set of analyses, we tested whether differences between children in their average teacher rated performance (across 1st and 2nd grade) within each school varied as a function of differences in experiences with pre-academic activities in ECEC the year prior to school entry. We also included the main effects of the key child predictor variables. As we display in Table 2, there was a moderate association between pre-academic activities and teacher rated reading ($r_p = .08$), which was statistically different from zero. The same was not true for teacher rated math ($r_p = .04$). All child level predictors were associated with both teacher rated reading and math, with effect sizes comparable across the two outcomes, ranging from $r_p = .09$ for the association between effortful control and reading, to $r_p = .18$ for the association between language and both reading and math ratings.

Table 2. Within-school fixed effects estimates of the associations between ECEC pre-academic activities and teachers' evaluations of child reading and math ($N = 932$).

Models	Reading			Math		
	r	*est*	(CI)	*r*	*Est*	(CI)
Main effects						
Pre-academic activities	.08	.43*	(0.09, 0.76)	.04	.17	(−0.13, 0.46)
Externalizing behaviors	.15	−.65***	(−0.92, −0.37)	.14	−.56***	(−0.82, −0.30)
Language	.17	.18***	(0.11, 0.25)	.18	.16***	(0.10, 0.23)
Effortful control	.09	.55**	(0.15, 0.94)	.10	.55**	(0.19, 0.92)
Low maternal education	.12	−.47***	(−0.74,−0.21)	.11	−.41**	(−0.64, −0.17)

Note: All analyses are adjusted for covariates, gender, preterm birth, number of siblings, western and non-western non-Norwegian background, maternal education, single parent household, age at testing at age 4, birth year and birth quarter.
*$p < .05$.
**$p < .01$.
***$p < .001$.

As a next step, we tested the assumption that pre-academic activities mattered more for children with less favorable starting points for learning (i.e., more externalizing behavior, poorer language and effortful control, and mothers with less than completed high-school education). We therefore tested the interaction terms between these four predictor variables and pre-academic activities in separate models, with otherwise the same covariates as used in the main effect models, for each teacher rated outcome. Across the eight models, two approached statistical significance when predicting reading ratings; externalizing problems and effortful control (results not tabled). For the first of these, the estimate for pre-academic activities was .44 (CI = .09, .79), for externalizing problems was −.66 (CI = −.95, −.38), and for the interaction term was −1.70 (CI = −3.50, .09). For illustration, this interaction is displayed in Figure 1(a). It shows that for children with low levels of externalizing problems (1 SD below the mean) the teacher rated reading performance is unrelated to level of pre-academic activities. However, for children with high levels of externalizing problems (1 SD above the mean), children who experienced high levels of pre-academic activities are rated nearly 30% of an SD higher on reading. For effortful control, the estimate for pre-academic activities was .44 (CI = .10, .78), for effortful control was .59 (CI = .17, 1.02), and for the interaction term was −1.66 (CI = −3.44, .12). As displayed in Figure 1(b) for effortful control, children with low levels (1 SD below the mean) were rated about 30% lower in reading when having experiences with low levels of pre-academic activities compared to those having experienced high levels. For children with high levels of effortful control, there were no differences in teacher ratings of reading as a function of pre-academic activities.

As a final analytical step for teacher ratings, we wanted to test the specificity of the associations and interactions reported above for academic achievement. One possible alternative explanation to the buffering of such activities on academic achievement for children with externalizing behavior would be that children who had the exposure would be more skilled or controlled in their behavior in the classroom. This could bias teachers towards rating them higher on achievement compared to less well-behaved counterparts. In an attempt to account for this, we re-estimated all the models described above, but used a measure of social competence, rather than achievement as outcomes, keeping in mind that our measure of school preparatory activities was restricted to pre-academic activities. If these models yielded similar results as those estimated for achievement, this could either be due to such a bias, or to spill-over effects from the academic to the social domain. In either case, school preparatory activities were unrelated to social competence. This was true both in the main effect model and when adding the interactions, the effect sizes were essentially null. It therefore seems like the results reported above are specific for academic achievement.

Screening Tests for Reading and Math

We then tested similar models as those described above but included results from the screening tests in reading and math in second grade as outcomes (both as continuous scores and

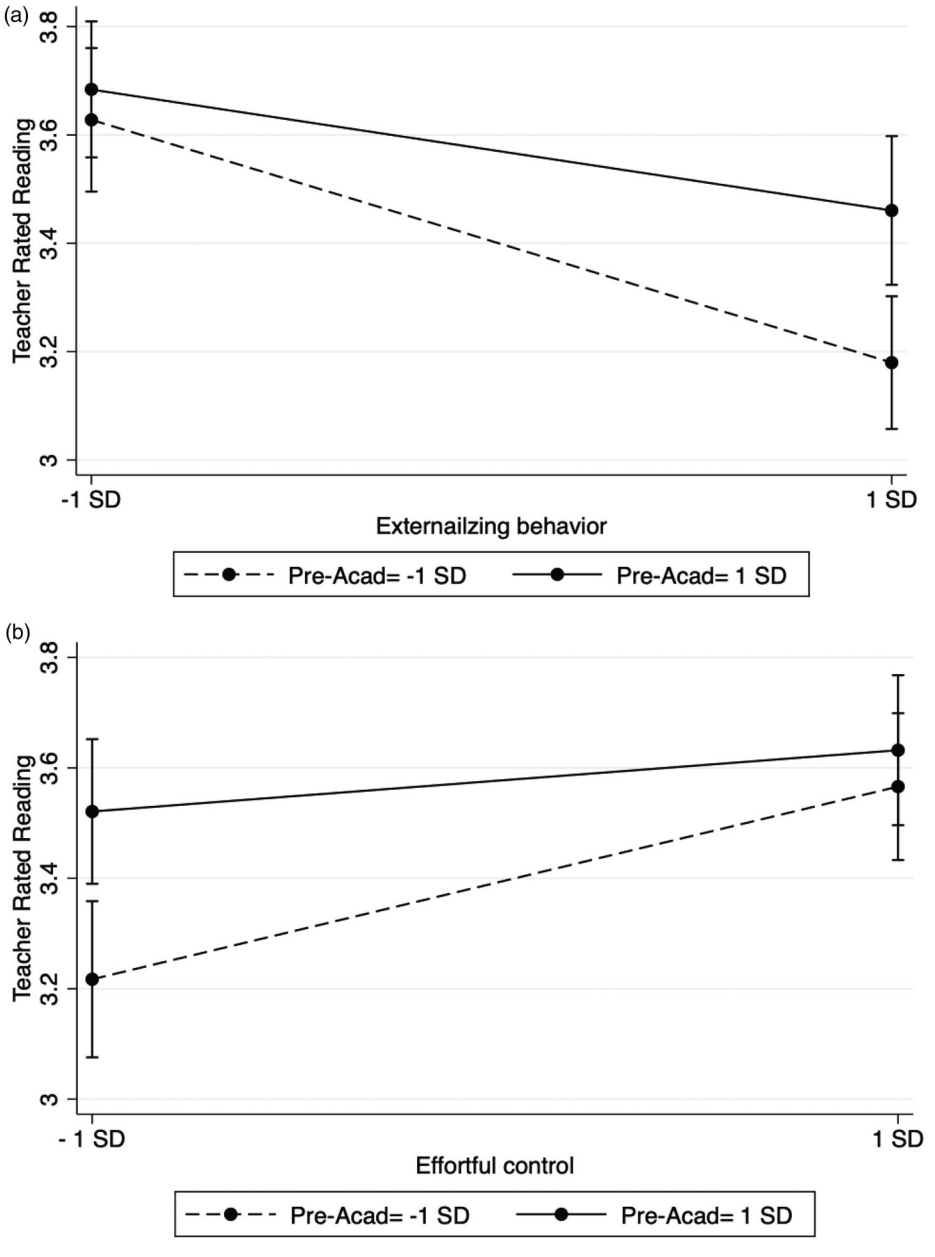

Figure 1. Interactions of pre-academic activities and externalizing behaviors (a) and Effortful control (b) predicting teacher rated reading.

dichotomous scores indicating critical levels of performance). In none of these models, testing main effects or interactions, pre-academic activities were associated with test scores (results not tabled). However, all the child level predictors were associated with test scores in predictable directions, and with effect sizes slightly smaller than those we reported for teacher rated outcomes. It is notable, however, that these screenings were designed to identify children at the lowest range of performance, and thus the scores at higher levels are not reliably measured.

Discussion

In the present study we found that, within the primarily play-oriented Norwegian ECEC curriculum, children attending centers emphasizing structured pre-academic activities in the year prior to school entry were rated more advanced in reading, but not in math, by their teachers in the first two years in school. Moreover, children who at 4 years were rated by their ECEC teachers as having more externalizing behaviors, scored lower on the language and effortful control tests, and those who had mothers with low education were rated less advanced in both reading and math. The within-school fixed-effects models revealed that high emphasis on pre-academic activities in ECEC did only close the gap in teacher rated performance in reading for children with externalizing problems or low levels of effortful control. However, although our robustness checks indicated that our findings were not a function of halo-effects (that children with externalizing problems who were exposed to more pre-academic activities were better behaved in the classroom, and thus more liked by their teachers), when using the screening tests in reading and math in second grade as outcomes, pre-academic activities were no longer associated with early academic achievements in school, either on overall or for the children at risk.

The Overall Role of Pre-Academic Activities and Early Risk for Later Achievements

Our emphasis on pre-academic activities in ECEC in the year prior to school entry was in part motivated by recent suggestions by Duncan and Magnuson (2013), that curriculum should be a potential venue for exploring variations in outcomes of ECEC. This is in line with prior findings of positive relations between academic content in preschool and in kindergarten and student learning (Claessens et al., 2014; Jenkins et al., 2018). Our main effects models showed overall a small, but statistically significant, association between pre-academic activities in ECEC and teacher rated reading, but not math. This finding should be interpreted both in light of the fact that most of our items addressing pre-academic activities addressed literacy related items (e.g., emphasis on letters and reading, playing with script and writing), with only one item on math (numbers, amounts and shapes). Moreover, anecdotal evidence suggests that first grade teachers in Norway heavily emphasize literacy in first grade. Thus, as the academic emphasis in both ECEC and first grade is on literacy, stronger associations for this outcome seem reasonable. Importantly, pre-academic activities were not associated with screening tests in reading and math in second grade. The reasons for this could be that these screenings are intended to identify children at the lowest range of performance, and that the teacher reports although crude still capture a broader range of academic performance. In any instance, the inconsistent findings call for cautiousness in our conclusions about the role of pre-academic activities in Norwegian ECEC.

A premise for our study was that the preschoolers at risk would on average be rated lower by their first- and second-grade teachers on academic performance. This was indeed the case in our data, and is consistent with previous reports (e.g., Arnold et al., 2012; Beitchman et al., 2001; Gray et al., 2014; Heckman, 2006). Even if the risk predictors were not significantly associated with screening tests in reading and math in second grade, the associations were in predictable directions and with effect sizes close to those for the teacher rated outcomes. Thus, we argue that these early risk factors should be considered to be of practical importance (McCartney & Rosenthal, 2000).

Pre-Academic Activities – A Potential Boost for Some

Our most important finding was that pre-academic activities in ECEC might be particularly beneficial for the future teacher ratings of reading skills of children who struggle with externalizing behaviors or low effortful control as preschoolers. This was not explained by a halo-effect. Nevertheless, no interaction effects were found when examining screening tests of reading and math in second grade. This leads us to speculate about probable mechanisms behind our inconsistent findings.

Pre-academic activities in ECEC may familiarize children with the school setting and the content, and thus provide more extensive opportunities for children who potentially have more problems adapting to the teaching context of school. A probable candidate mechanism for explaining these associations is self-regulation (e.g., Blair, Ursache, Greenberg, & Vernon-Feagans, 2015) also in Norway (Backer-Grøndahl et al., 2019). Previous research has found that self-regulation skills mediate the associations between behavior problems and achievement (Montroy et al., 2014), and we find here that both children with externalizing behaviors and low effortful control benefit from pre-academic activities in ECEC. Our results suggest that a curriculum including structured pre-academic activities can be a particularly efficient educational transition bridge for preschoolers with such behavioral risks.

This does not mean that the problem behaviors do not need to be targeted, but it might speak to a need to consider domain specific interventions addressed at both the behavioral risks and the related academic risks. While ECEC programs specifically addressing social skills training prevent externalizing problems (Schindler et al., 2015), this does not necessary translate to academic outcomes (Bierman et al., 2008). In fact, we find that pre-academic activities were not predictive of the children's social skills, indicating that one gets better at what one practice. Thus, interventions involving structured academic teaching activities could be an intervention objective contributing to closing the educational gap between preschoolers with and without behavioral risk, more specifically. Our results, seen in conjuncture with those of Schindler et al. (2015), suggest that a curriculum with some emphasis on structured pre-academic activities combined with social skills training, may be a fruitful way to avoid an unfavorable educational cycle for these children (Arnold et al., 1999).

Our results must be considered in light of the pedagogical context of ECEC in Norway. The Nordic pedagogy has a particular emphasis on child-initiated activities and play and de-emphasis on direct teacher instructions (Engel et al., 2015; Samuelsson & Carlsson, 2008). What is rated as strong emphasis on pre-academic activities in this context may very well be rather common in many preschools in, for instance, the U.S. In Norway such structured activities are usually restricted to a few hours per week in the last year prior to school entry, so the vast amount of time children spend in ECEC is dedicated to other and often child-initiated types of activities. Since most children in Norway spend the full day, five days a week, in one ECEC center, the pre-academic activities they participate in are most likely the ones that take place in the center. Yet, Norwegian ECEC teachers are well educated, with a three-year tertiary (i.e., College-equivalent) degree in early childhood education, in relatively small groups and with low child:staff ratios. Their work is guided by the broad curriculum description called the framework plan (Ministry of Education and Research, 2006), which emphasises a holistic approach to early childhood development, but specifically points to early language development as crucial, while emphasising informal learning situations. It is therefore likely that the ECEC centers reporting strong emphasis on pre-academic activities in our study do so in a more formalized, school-like, manner, while the skills developed by the children are based on skills aquired in a fairly stimulating but play-based general learning environment. A recent study of observed quality in approximately 200 Norwegian ECEC classrooms, using the Infant Toddler Environmental Rating Scales Revised (ITERS-R; Harms, Cryer, & Clifford, 2006), found the average observed quality, and scores of language related subscales, to be only moderate (Bjørnestad & Os, 2018). Notably, the narrow between-class standard deviations in ITERS-R score also indicate that few centers excel in general language stimulation. A study using the same data did not find any association between ITERS-R score and cognitive skills in 3-year-olds (Eliassen et al., 2018). Although these studies were of younger children than those in our study, this may indicate that children in Norwegian ECEC centers experience somewhat limited general academic stimulation apart from what takes place in the preschool activities. Thus, admittedly interpreting beyond our data, we suspect that what takes place in the preacademic activities captured in our data deviates considerably from the children's experiences in ECEC outside of that setting.

Finally, the lack of findings for the screening tests of reading difficulties in second grade could be explained by the combination of the expected direction of the effect and the nature of the measure. A

measure that does not capture the higher range of reading abilities, makes it difficult to detect effects that closes the gap between children at risk and not. However, the inconsistent finding could also be that this pre-academic boost is weak, and potentially is limited to a short transition period from ECEC to school, as the screening tests took place six months after the last teacher ratings (in the first semester and the last semester of second grade, respectively).

Limitations

A number of limitations apply to our study. Some of both the main predictor measures (externalizing problems and pre-academic activities) and the outcomes measures (academic performance) are based on teacher reports, not observations or test-scores, although taken from three different time points (ages 4, 5, 6 and 7). Especially for pre-academic activities, the telephone interview used admittedly vague categories, asking for the extent to which teachers emphasize such activities. In other words, the structured pre-academic activities were not clearly specified and measured. The activities were not part of a specific curriculum, and might therefore have been structured differently in each child care center. Consequently, the proportionate part of these activities could not be measured as thoroughly as desired. Moreover, the approach did not allow for any measurement of the fidelity of the activities included.

In a recent review, it was suggested that there should be a stronger emphasis on measuring the content of instruction and teaching practices in ECEC, as well as on how children's learning more specifically is facilitated by their teachers, the interactions that the children encounter and the materials provided to them in this context (Burchinal, 2018). An observational measure of instruction would most likely provide a more accurate measure of what the pre-academic activities looked like and how these were implemented. If these reports actually reflect variability in degree of pre-academic activities, a better measure would probably have yielded stronger and/or more precise estimates. If teachers' responses reflect something else (e.g., general attitudes towards instruction or teacher-initiated activities), we may over-emphasize the role of specific pre-academic activities. Nonetheless, such attitudes are likely to be reflected in the teachers' daily interactions with children, which in that case does not change the finding that some structured pre-academic activities can be of value for children with externalizing behaviors or low effortful control. Likewise, our main outcomes are teacher-rated academic performance. Despite our robustness checks against halo-effects, it is a limitation that the screening tests of academic achievements did not reveal the same results. At the same time as these formal tests are limited in their range. Caution is therefore called for until future studies can confirm whether the interactions effects are weak or just limited to a certain achievement range or short transition period from ECEC to school. Although it should be noted that we do not know how the children at risk would have scored if they had no experience with the pre-academic activities. Notable strengths of our data are the large sample size, the longitudinal nature of our data, the relatively low attrition, and the context of universal access, subsidized ECEC attended by virtually all children in Norway, subject to the same framework plan. Moreover, the within-school fixed effects estimation-techniques, strengthens our confidence that the reported results are not likely to be a function of selection processes.

Conclusion

The current results show that structured pre-academic activities prior to entering school might be a predictor of the initial reading levels in school when children have displayed externalizing behaviors and low effortful control as preschoolers. However, the findings were inconsistent and only found for teacher-reported reading skills and not for screening tests of reading skills six months later, towards the end of second grade. Despite limitations related to the measurement of the pre-school activities in the present study, the results suggest that literacy-based pre-academic activities might provide an academic boost in the transition to school for preschoolers at risk. Effectively, it also points to the

potential implication of such a curricular strengthening added to the play-based curriculum approach common to most ECEC centers in Norway. Overall, the current findings imply a need for a broader intervention approach that addresses both the behavioral and educational risks typically co-occurring in this group of children. Further studies that test the robustness of this pre-academic boost or whether it is limited to a short transition period from ECEC to school are thus called for. Findings of both the potentials and the constraints of broader universal curriculum components should inform ECEC practice and policy.

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References

Achenbach, T., & Rescorla, L. (2000). *Manual for the ASEBA preschool forms & profiles. An integrated system of multi-informant assessment*. Burlington, VT: University of Vermont Department of Psychiatry.

Allison, P. D. (2009). *Fixed effects regression models*. Thousand Oaks, CA: SAGE.

Arnold, D. H., Kupersmidt, J. B., Voegler-Lee, M. E., & Marshall, N. A. (2012). The association between preschool children's social functioning and their emergent academic skills. *Early Childhood Research Quarterly*, *27*(3), 376–386. doi:10.1016/j.ecresq.2011.12.009

Arnold, D. H., Ortiz, C., Curry, J. C., Stowe, R. M., Goldstein, N. E., Fisher, P. H., … Yershova, K. (1999). Promoting academic success and preventing disruptive behavior disorders through community partnership. *Journal of Community Psychology*, *27*(5), 589–598. doi:10.1002/(SICI)1520-6629(199909)27:5<589::AID-JCOP6>3.0.CO;2-Y

Backer-Grøndahl, A., Nærde, A., & Idsoe, T. (2019). Hot and cool self-regulation, academic competence, and maladjustment: Mediating and differential relations. *Child Development*. doi:10.1111/cdev.13104

Backer-Grøndahl, A., Nærde, A., Ulleberg, P., & Janson, H. (2016). Measuring effortful control using the children's behavior questionnaire–very short form: Modeling matters. *Journal of Personality Assessment*, *98*(1), 100–109. doi:10.1080/00223891.2015.1056303

Beitchman, J. H., Wilson, B., Johnson, C. J., Atkinson, L., Young, A., Adlaf, E., … Douglas, L. (2001). Fourteen-year follow-up of speech/language-impaired and control children: Psychiatric outcome. *Journal of the American Academy of Child and Adolescent Psychiatry*, *40*(1), 75–82. doi:10.1097/00004583-200101000-00019

Belsky, J., Vandell, D. L., Burchinal, M., Clarke-Stewart, K. A., McCartney, K., Owen, M. T., & NICHD Early Child Care Research Network. (2007). Are there long-term effects of early child care? *Child Development*, *778*, 681–7701. doi:10.1111/j.14678624.2007.01021.x

Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., … Gill, S. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI program. *Child Development*, *79*(6), 1802–1817. doi:10.1111/j.1467-8624.2008.01227.x

Bjørnestad, E., & Os, E. (2018). Quality in Norwegian childcare for toddlers using ITERS-R. *European Early Childhood Education Research Journal*, *26*(1), 111–127. doi:10.1080/1350293X.2018.1412051

Blair, C., Ursache, A., Greenberg, M., & Vernon-Feagans, L. (2015). Multiple aspects of self-regulation uniquely predict mathematics but not letter–word knowledge in the early elementary grades. *Developmental Psychology*, *51*(4), 459–472. doi:10.1037/a0038813

Bub, K. L., McCartney, K., & Willett, J. B. (2007). Behavior problem trajectories and first-grade cognitive ability and achievement skills: A latent growth curve analysis. *Journal of Educational Psychology*, *99*(3), 653–670. doi:10.1037/0022-0663.99.3.653

Bulotsky-Shearer, R. J., & Fantuzzo, J. W. (2011). Preschool behavior problems in classroom learning situations and literacy outcomes in kindergarten and first grade. *Early Childhood Research Quarterly*, *26*(1), 61–73. doi:10.1016/j.ecresq.2010.04.004

Bulotsky-Shearer, R. J., Fantuzzo, J. W., & McDermott, P. A. (2008). An investigation of classroom situational dimensions of emotional and behavioral adjustment and cognitive and social outcomes for Head Start children. *Developmental Psychology*, *44*(1), 139–154. doi:10.1037/0012-1649.44.1.139

Burchinal, M. (2018). Measuring early care and education quality. *Child Development Perspectives*, *12*(1), 3–9. doi:10.1111/cdep.12260

Burchinal, M., Kainz, K., & Cai, Y. (2011). How well do our measures of quality predict child outcomes? A meta-analysis and coordinated analysis of data from large-scale studies of early childhood settings. In M. Zaslow, I. Martinez-Beck, K. Trout, & H. T (Eds.), *Quality measurement in early childhood settings* (pp. 11–31). Baltimore: Brooks Publishing.

Casillas, A., Robbins, S., Allen, J., Kuo, Y.-L., Hanson, M. A., & Schmeiser, C. (2012). Predicting early academic failure in high school from prior academic achievement, psychosocial characteristics, and behavior. *Journal of Educational Psychology*, *104*(2), 407–420. doi:10.1037/a0027180

Catts, H. W., Herrera, S., Nielsen, D. C., & Bridges, M. S. (2015). Early prediction of reading comprehension within the simple view framework. *Reading and Writing*, *28*(9), 1407–1425. doi:10.1007/s11145-015-9576-x

Choi, J. Y., Elicker, J., Christ, S. L., & Dobbs-Oates, J. (2016). Predicting growth trajectories in early academic learning: Evidence from growth curve modeling with Head Start children. *Early Childhood Research Quarterly*, *36*, 244–258. doi:10.1016/j.ecresq.2015.12.017

Claessens, A., Engel, M., & Curran, F. C. (2014). Academic content, student learning, and the persistence of preschool effects. *American Educational Research Journal*, *51*(2), 403–434. doi:10.3102/0002831213513634

Clements, D. H., & Sarama, J. (2007). Effects of a preschool mathematics curriculum: Summative research on the building blocks project. *Journal for Research in Mathematics Education*, *38*(2), 136–163. doi:10.2307/30034954

Curby, T. W., Brown, C. A., Bassett, H. H., & Denham, S. A. (2015). Associations between preschoolers' social–emotional competence and preliteracy skills. *Infant and Child Development*, *24*(5), 549–570. doi:10.1002/icd.1899

Dearing, E., McCartney, K., & Taylor, B. A. (2009). Does higher quality early child care promote low-income children's math and reading achievement in middle childhood? *Child Development*, *80*(5), 1329–1349. doi:10.1111/j.1467-8624.2009.01336.x

Dearing, E., Zachrisson, H. D., Mykletun, A., & Toppelberg, C. O. (2018). Estimating the consequences of Norway's national scale-up of Early Childhood Education and Care (beginning in infancy) for early language skills. *AERA Open*, *4*(1), 2332858418756598. doi:10.1177/2332858418756598

Denham, S. A., Bassett, H. H., Mincic, M., Kalb, S., Way, E., Wyatt, T., & Segal, Y. (2012). Social-emotional learning profiles of preschoolers' early school success: A person-centered approach. *Learning and Individual Differences*, *22*(2), 178–189. doi:10.1016/j.lindif.2011.05.001

Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science*, *318*(5855), 1387–1388. doi:10.1126/science.1151148

DiStefano, C., Zhu, M., & Mindrila, D. (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment, Research & Evaluation*, *14*(20). Retrieved from http:/pareonline.net//getvn.asp?v=14&n=20

Doctoroff, G. L., Greer, J. A., & Arnold, D. H. (2006). The relationship between social behavior and emergent literacy among preschool boys and girls. *Journal of Applied Developmental Psychology*, *27*(1), 1–13. doi:10.1016/j.appdev.2005.12.003

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., … Japel, C. (2007). School readiness and later achievement. *Developmental Psycholology*, *43*(6), 1428–1446. doi:10.1037/0012-1649.44.1.217

Duncan, G. J., & Magnuson, K. (2013). Investing in preschool programs. *Journal of Economic Perspectives*, *27*(2), 109–132. doi:10.1257/jep.27.2.109

Duncan, G. J., Magnuson, K. A., & Ludwig, J. (2004). The endogeneity problem in developmental studies. *Research in Human Development*, *1*(1-2), 59–80. doi:10.1080/15427609.2004.9683330

Duncan, G. J., & Sojourner, A. J. (2013). Can intensive early childhood intervention programs eliminate income-based cognitive and achievement gaps? *Journal of Human Resources*, *48*(4), 945–968. doi:10.3368/jhr.48.4.945

Dunn, L., Whetton, C., & Burley, J. (1997). *The British picture vocabulary scale* (2nd ed.). London, UK: nferNelson Publishing Company.

Eliassen, E., Zachrisson, H. D., & Melhuish, E. (2018). Is cognitive development at three years of age associated with ECEC quality in Norway? *European Early Childhood Education Research Journal*, *26*(1), 97–110. doi:10.1080/1350293X.2018.1412050

Engel, A., Barnett, W. S., Anders, Y., & Taguma, M. (2015). Early childhood education and care Policy review Norway. Retrieved from http://www.oecd.org/norway/Early-Childhood-Education-and-Care-Policy-Review-Norway.pdf

Geoffroy, M. C., Cote, S. M., Giguere, C. E., Dionne, G., Zelazo, P. D., Tremblay, R. E., … Seguin, J. R. (2010). Closing the gap in academic readiness and achievement: The role of early childcare. *Journal of Child Psychology and Psychiatry*, *51*(12), 1359–1367. doi:10.1111/j.1469-7610.2010.02316.x

Gray, S. A., Carter, A. S., Briggs-Gowan, M. J., Jones, S. M., & Wagmiller, R. L. (2014). Growth trajectories of early aggression, overactivity, and inattention: Relations to second-grade reading. *Developmental Psychology*, *50*(9), 2255–2263. doi:10.1037/a0037367

Gresham, F., & Elliott, S. N. (2008). *Social skills improvement system (SSIS) rating scales*. Bloomington, MN: Pearson Assessments.

Grimm, K. J., Steele, J. S., Mashburn, A. J., Burchinal, M., & Pianta, R. C. (2010). Early behavioral associations of achievement trajectories. *Developmental Psychology*, *46*(5), 976–983. doi:10.1037/a0018878

Gulbrandsen, L. P., & Eliassen, E. (2013). *Kvalitet i barnehager - Rapport fra en undersøkelse av strukturell kvalitet høsten 2012* (Quality in childcare - Report from a study of structural quality Fall 2012. Report 1/13). Oslo, Norway: NOVA.

Hamre, B. K. (2014). Teachers' daily interactions with children: An essential ingredient in effective early childhood programs. *Child Development Perspectives*, *8*(4), 223–230. doi:10.1111/cdep.12090

Harms, T., Cryer, D., & Clifford, R. M. (2006). *Infant/toddler environment rating scale - Revised edition (ITERS-R)*. New York: Teachers College Press.

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, *312*(5782), 1900–1902. doi:10.1126/science.1128898

Herbers, J. E., Cutuli, J. J., Supkoff, L. M., Heistad, D., Chan, C.-K., Hinz, E., & Masten, A. S. (2012). Early reading skills and academic achievement trajectories of students facing poverty, homelessness, and high residential mobility. *Educational Researcher*, *41*(9), 366–374. doi:10.3102/0013189X12445320

Jenkins, J. M., Duncan, G. J., Auger, A., Bitler, M., Domina, T., & Burchinal, M. (2018). Boosting school readiness: Should preschool teachers target skills or the whole child? *Economics of Education Review*, *65*, 107–125. doi:10.1016/j.econedurev.2018.05.001

Kochanska, G., Murray, K., Jacques, T. Y., Koenig, A. L., & Vandegeest, K. A. (1996). Inhibitory control in young children and its role in emerging internalization. *Child Development*, *67*, 490–507. doi:10.1111/j.146778624.1996.tb017747.x

Lekhal, R., Zachrisson, H. D., Wang, M. V., Schjølberg, S., & von Soest, T. (2011). Does universally accessible child care protect children from late talking? Results from a Norwegian population-based prospective study. *Early Child Development and Care*, *181*, 1007–1019. doi:10.1080/03004430.2010.508558

Lervåg, A., & Aukrust, V. G. (2010). Vocabulary knowledge is a critical determinant of the difference in reading comprehension growth between first and second language learners. *Journal of Child Psychology and Psychiatry*, *51*(5), 612–620. doi:10.1111/j.1469-7610.2009.02185.x

Li, W., Farkas, G., Duncan, G. J., Burchinal, M. R., & Vandell, D. L. (2012). Timing of high-quality child care and cognitive, language, and preacademic development. *Developmental Psychology*, *49*, 1440–1451.

Love, J. M., Harrison, L., Sagi-Schwartz, A., Van Ijzendoorn, M. H., Ross, C., Ungerer, J. A., … Chazan-Cohen, R. (2003). Child care quality matters: How conclusions may vary with context. *Child Development*, *74*(4), 1021–1033. doi:10.1111/1467-8624.00584

Lyster, S. A. H., Horn, E., & Rygvold, A. L. (2010). Ordforråd og ordforrådsutvikling hos norske barn og unge. Resultater fra en utprøving av British Picture Vocabulary Scale, Second Edition (BPVS II). [Vocabulary and development in Norwegian children and youth. Results from a test of the British Picture Vocabulary Scale, Second Edition]. *Spesialpedagogikk*, *9*, 35–42.

Magnuson, K., Duncan, G. J., Lee, K. T. H., & Metzger, M. W. (2016). Early school adjustment and educational attainment. *American Educational Research Journal*, *53*(4), 1198–1228. doi:10.3102/0002831216634658

Magnuson, K., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review*, *26*(1), 33–51. doi:10.1016/j.econedurev.2005.09.008

Mawby, D. (2007). *Effects of effortful control, age, gender on aggression and pro-social behaviour in early childhood* (Unpublished postgraduate diploma thesis in psychology). Swinburne University of Technology, Melbourne, Australia.

McCartney, K., & Rosenthal, R. (2000). Effect size, practical importance, and social policy for children. *Child Development*, *71*(1), 173–180. doi:10.1111/1467-8624.00131

McClelland, M. M., Acock, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related skills on academic trajectories at the end of elementary school. *Early Childhood Research Quarterly*, *21*(4), 471–490. doi:10.1016/j.ecresq.2006.09.003

McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, *43*(4), 947–959. doi:10.1037/0012-1649.43.4.947

Melby-Lervåg, M., Lervåg, A., Lyster, S.-A. H., Klem, M., Hagtvet, B., & Hulme, C. (2012). Nonword-repetition ability does not appear to be a causal influence on children's vocabulary development. *Psychological Science*, *23*(10), 1092–1098. doi:10.1177/0956797612443833

Melhuish, E. C. (2011). Preschool matters. *Science*, *333*, 299–300. doi:10.1126/science.1209459
Ministry of Education and Research. (2006). *Rammeplan for barnehagens innhold og oppgaver*. [Framework plan for the childcare's content and mission]. Retrieved from http://www.regjeringen.no/upload/kilde/kd/prm/2006/0005/ddd/pdfv/282009-rammeplanen.pdf
Montroy, J. J., Bowles, R. P., Skibbe, L. E., & Foster, T. D. (2014). Social skills and problem behaviors as mediators of the relationship between behavioral self-regulation and academic achievement. *Early Childhood Research Quarterly*, *29*(3), 298–309. doi:10.1016/j.ecresq.2014.03.002
Nærde, A., Ogden, T., Janson, H., & Zachrisson, H. D. (2014). Normative development of physical aggression from 8 to 26 months. *Developmental Psychology*, *50*(6), 1710–1720. doi:10.1037/a0036324
NICHD ECCRN. (2002). Child-care structure → process → outcome: Direct and indirect effects of child-care quality on young children's development. *Psychological Science*, *13*(3), 199–206. doi:10.1111/1467-9280.00438
OECD. (2016). *PISA 2015 results (Volume I). Excellence and equity in education*. Paris: OECD Press.
Raver, C. C. (2002). Emotions matter: Making the case for the role of young children's emotional development for early school readiness. *Social Policy Report*, *16*(3), 3–18. Retrieved from https://www.cde.state.co.us/cpp/emotionsmatter
Rimm-Kaufman, S. E., & Pianta, R. C. (2000). An Ecological perspective on the transition to kindergarten. *Journal of Applied Developmental Psychology*, *21*(5), 491–511. doi:10.1016/S0193-3973(00)00051-4
Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly*, *15*(2), 147–166. doi:10.1016/S0885-2006(00)00049-1
Rogde, K., Melby-Lervåg, M., & Lervåg, A. (2016). Improving the general language skills of second-language learners in kindergarten: A randomized controlled trial. *Journal of Research on Educational Effectiveness*, *9*(sup1), 150–170. doi:10.1080/19345747.2016.1171935
Samuelsson, I. P., & Carlsson, M. A. (2008). The playing learning child: Towards a pedagogy of early childhood. *Scandinavian Journal of Educational Research*, *52*(6), 623–641. doi:10.1080/00313830802497265
Schindler, H. S., Kholoptseva, J., Oh, S. S., Yoshikawa, H., Duncan, G. J., Magnuson, K. A., & Shonkoff, J. P. (2015). Maximizing the potential of early childhood education to prevent externalizing behavior problems: A meta-analysis. *Journal of School Psychology*, *53*(3), 243–263. doi:10.1016/j.jsp.2015.04.001
Sibley, E., Dearing, E., Toppelberg, C. O., Mykletun, A., & Zachrisson, H. D. (2015). Do increased availability and reduced cost of early childhood care and education narrow social inequality gaps in utilization? Evidence from Norway. *International Journal of Child Care and Education Policy*, *9*(1), 1–20. doi:10.1007/s40723-014-0004-5
Sørlie, M.-A. (1998). *Mestring og tilkortkomming i skolen*. [Mastery and insufficiency in school] (NOVA Ed.). Oslo: NOVA.
StataCorp. (2013). *Stata statistical software: Release 13*. College Station, TX: StataCorp LP.
Südkamp, A., Kaiser, J., & Möller, J. (2012). Accuracy of teachers' judgments of students' academic achievement: A meta-analysis. *Journal of Educational Psychology*, *104*(3), 743–762. doi:10.1037/a0027627
Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*, *84*(6), 2112–2130. doi:10.1111/cdev.12099
Winsvold, A., & Guldbrandsen, L. (2009). *Kvalitet og kvantitet—kvalitet i en barnehagesektor i sterk vekst* [Quality and quantity—Quality in a child-care sector in rapid growth]. Oslo: NOVA.
Zachrisson, H. D., Dearing, E., Lekhal, R., & Toppelberg, C. O. (2013). Little evidence that time in child care causes externalizing problems during early childhood in Norway. *Child Development*, *84*(4), 1152–1170. doi:10.1111/cdev.12040
Zachrisson, H. D., Janson, H., & Nærde, A. (2013). Predicting early center care utilization in a context of universal access. *Early Childhood Research Quarterly*, *28*(1), 74–82. doi:10.1016/j.ecresq.2012.06.004