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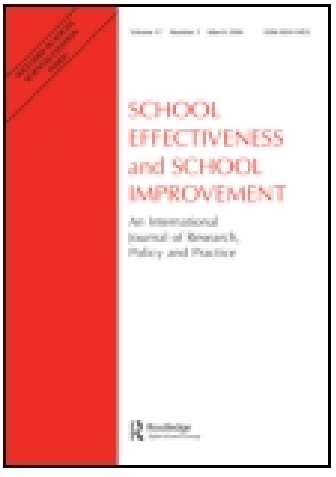

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Targeted versus mixed preschools and kindergartens: effects of class composition and teacher-managed activities on disadvantaged children's emergent academic skills

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Targeted versus mixed preschools and kindergartens: effects of class composition and teacher-managed activities on disadvantaged children's emergent academic skills

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In this study, longitudinal cohort-sequential latent growth modeling was used to determine the effects of (a) socioeconomically mixed preschool and kindergarten classrooms, (b) the implementation of an education program aiming to accelerate socioeconomically disadvantaged children's emergent academic skills, and (c) the amount of teacher-managed academic activities on 3- to 6-year-old disadvantaged children's emergent literacy and math skills ($n = 91$). The results indicate that disadvantaged children in mixed preschool and kindergarten classrooms gained more in literacy and math than disadvantaged children in targeted classrooms. The results also indicate that the use of a special education program to promote disadvantaged children's emergent literacy and math was not effective, probably because of a lack of implementation fidelity. However, the extent to which teachers engaged in the kind of activities that were intended by the education program, in particular frequent initiation and guidance of language, literacy, and math activities, was significantly related to disadvantaged children's outcomes.

Keywords: mixed preschools; class composition; teacher-managed activities; emergent academic skills; disadvantage

Theoretical background

In face of the persistent achievement gap, most industrialized countries provide early childhood education programs to promote the cognitive, language, literacy, and numeracy skills of young children from low-income and minority groups in order to provide them with a fair start in primary school (Organisation for Economic Co-operation and Development [OECD], 2006). Numerous studies have shown that children who attended preschool or educational daycare enter primary school with higher levels of cognitive, language, and math skills and better behavioral adjustment (Anderson et al., 2003; Barnett, 1998; Blok, Fukkink, Gebhardt, & Leseman, 2005; Burger, 2009; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Gorey, 2001; Leseman, 2009; Nelson, Westhues, & MacLeod, 2003; Ramey & Ramey, 2004; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2010). In addition, children seem to show better outcomes in programs of high quality (Bryant, Burchinal, Lau, & Sparling, 1994; Burchinal, Peisner-Feinberg,

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Bryant, & Clifford, 2000; Howes et al., 2008; Mashburn et al., 2008; Peisner-Feinberg et al., 2001). Commonly, two aspects of quality are distinguished (Howes et al., 2008). The first aspect concerns the structural characteristics of the classroom, such as teacher's education, classroom group size, and the adult to child ratio. The second aspect concerns the interaction processes in the classroom, including the social-emotional and instructional support teachers provide to children. Structural quality is considered an essential precondition for process quality, but thought to affect child outcomes only indirectly (Howes et al., 2008). Although the results of high-quality preschool programs for educationally disadvantaged children are generally positive, several questions remain regarding the ways in which early childhood education for disadvantaged children should be provided.

The present study addresses two issues that seem currently relevant given the increased policy focus in several countries on extending early childhood education provisions: Should we concentrate efforts on children most in need or adopt a more universal approach, and, related to this, should we implement special education programs in targeted provisions or focus on improving the quality of early childhood teachers working in universal systems? We report the results of a small-scale intervention study conducted in The Netherlands evaluating the effects of (a) targeted versus universal mixed educational arrangements, (b) the use of a special education program, and (c) actual instruction activities by the teachers regardless of the use of a special program on socioeconomically disadvantaged preschool children's emergent literacy and math skills.

Considering early childhood education, two main types of intervention can be distinguished: universal and targeted interventions. Universal interventions do not concentrate on a specific subgroup, but instead provide care and education for all children regardless of whether they belong to an educationally disadvantaged group or have special educational needs, presumably to benefit all children. Targeted interventions, in contrast, are specifically provided to eligible groups only. In the Dutch context, these targeted groups concern families with non-Western backgrounds and/or weak educational backgrounds. Targeted interventions seem most cost-effective and are thought to yield substantial economic benefits in the long term (Heckman, 2006). Indeed, insofar as universal interventions are to the benefit of all children, it is only through targeted interventions that society can compensate the early educational disadvantages caused by poverty and immigration (Magnuson & Waldfogel, 2005).

However, there may be a major drawback of targeted interventions, not taken into account in the aforementioned argument. Due to the concentration of problems related to poverty and immigration, the educational effectiveness of early childhood education programs serving mainly educationally disadvantaged children may be reduced. Only few studies to date have addressed the effects of socioeconomic, racial, and ethnic-cultural classroom composition in early childhood education programs on cognitive and social-emotional outcomes. Lee, Loeb, and Lubeck (1998) found medium to strong negative effects of a high concentration of children from poor minority families in preschool care and education settings. Schechter and Bye (2007) compared targeted and mixed preschools and reported a clear advantage for the mixed arrangement. In mixed arrangements, the early delay in language development relative to age norms of disadvantaged children gradually decreased, whereas in the targeted arrangement the delay further increased. Henry and Rickman (2007) did not find effects of classroom socioeconomic composition as such on

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disadvantaged children's cognitive and language development; however, they found that these children profited from interaction with more able peers. Mashburn, Justice, Downer, and Pianta (2009) found similar effects of interaction with more able peers on children's language development, but this effect seemed to be limited to children who were already functioning on a high level of language skill. Gormley and Phillips (2005) showed that disadvantaged children benefited more from universal pre-kindergarten programs with a mixed composition than from targeted programs, presumably because of the opportunity to interact with more able peers. Findings in Dutch research suggest that a small share of disadvantaged children in preschool classrooms helps these children to catch up, whereas a high concentration enhances the early education gap (Mayo & Leseman, 2008).

One of the reasons for the suboptimal results of education programs in decreasing the achievement gap in both short and long term, is the lack of implementation fidelity. Several studies reveal large differences between early childhood teachers in providing activities as intended, while working within the same program and having received the same training (Connor, Morrison, & Slominski, 2006; Early et al., 2005; Klibanoff, Levine, Huttenlocher, Vasilyeva, & Hedges, 2006; Meyer, Wardrop, Hastings, & Linn, 1993). Moreover, teacher differences are related to child outcomes. For instance, Connor et al. (2006) found that only when preschool teachers who were working within the same comprehensive program for disadvantaged children spent comparatively more time to language and emergent literacy activities, their children gained in alphabet knowledge, letter-word recognition, and vocabulary. In addition, Justice, Masburn, Pence, and Wiggins (2008) found children participating in classrooms with relatively much time spent on language-learning activities to show accelerated language growth in pre-kindergarten compared to children in a control group. Similarly, Klibanoff et al. (2006) found large differences between teachers in the same preschool system in the amount of math-related talk they initiated in the classroom, with the amount of math talk being strongly related to children's growth in pre-mathematical knowledge and skills. In sum, focusing on the teacher, on what she or he does in the classroom, may provide starting points for improving the quality and effectiveness of early childhood education.

The Dutch preschool system

Pre-primary school education in The Netherlands consists of two interconnected systems, spanning the age range of 2.6 to 6 years of age. Children are admitted to preschools from age 2.6. There is a small, income-dependent fee, and about 60% of the eligible children participate for 2 to 4 half-days per week (about 2.5 hr per day). Educationally disadvantaged children, according to the national educational priority policy defined as coming from families with a non-Western and/or weak educational background, are especially encouraged to participate. At age 4, the vast majority of children, over 98%, start in the kindergarten departments of primary school for 5 days per week (about 5 hr per day). There is no fee, and attendance is compulsory from age 5 onwards. Both preschools and kindergartens implement a basic developmental, child-following approach with ample room for free play, fine and gross motor activities, and creative and expressive work. Especially in inner city areas, in view of the educational disadvantages of part of the participating children, preschools and kindergarten often work with a special education program to

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promote disadvantaged children's language, literacy, and math development. In the preschool system, this development has led to the implementation of "educational preschools" intended exclusively for disadvantaged children, indicated by their parents' educational attainment and cultural background. Since only disadvantaged children are eligible for participation, these educational preschools are an example of the targeted approach. Although the Dutch kindergarten system is an example of a universal childhood education provision, since all children are eligible for participation, some kindergartens are attended almost exclusively by disadvantaged children, mainly because of the location of the school in neighborhoods with high concentrations of minority and low socioeconomic status families.

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The current study

The current study was conducted as an evaluation of the effects of mixing within preschool and kindergarten classrooms serving educationally disadvantaged children. Part of the participating preschool and kindergarten sample implemented a structured education program. Use of the program and creating mixed classrooms varied independently. In addition, detailed observations of teachers' initiation, guiding, and directing of language, literacy, and math activities were obtained in all classrooms. We will answer three questions in this article. First, we will determine whether enrollment in a mixed preschool or kindergarten yields more favorable results in terms of emergent academic skills development than participation in a targeted program. Second, we will assess whether children in preschools and kindergartens working with a special education program show larger gains in emergent academic skills than children in provisions without such a program. Third, related to this, we will assess whether teachers using a special education program initiate, guide, and direct more stimulating educational activities in the areas of literacy and math than teachers without such a program, and determine whether teachers' initiating, guiding, and directing of literacy and math activities promotes children's academic skills development.

Method

Participants

A sample of 91 children was involved in the present study, 48 children (28 boys; 58%) attending 1 of the 14 participating preschool classrooms and 43 children (17 boys; 40%) attending 1 of the 12 participating kindergarten classrooms, all located in a middle-sized town in the western part of The Netherlands (see Table 1 for descriptive statistics).

Only children eligible for extra support within the framework of the national educational priority policy were selected in these classrooms. The present sample, therefore, consists exclusively of children considered educationally disadvantaged, that is, they came from ethnic-minority families where at least one of the parents had a weak educational background or from Dutch families where both parents had a weak educational background (not higher than the junior vocational training level). The mean educational attainment level of parents (preschool cohort 3.4 ($SD = 1.7$); kindergarten cohort 3.2 ($SD = 2.1$)) on a 7-point scale ranging from 1 (*only a few years of primary education at most*) to 7 (*university degree*) indicates an average educational attainment below junior vocational training level.

Table 1. Mean age, sex, mean educational attainment level, and cultural background of parents for the preschool and kindergarten cohort.

		Preschool		Kindergarten	
N		48		43	
Mean age time 1 (*SD*)		3.0	(0.4)	4.3	(0.3)
Boys (%)		28	(58%)	17	(40%)
Mean educational level parents		3.4	(1.7)	3.2	(2.1)
Cultural background parents (%)	Dutch	12	(25%)	6	(14%)
	Moroccan	15	(31%)	19	(44%)
	Turkish	6	(13%)	7	(16%)
	Other/mixed	15	(31%)	11	(26%)

Note: The mean educational attainment level is measured on a 7-point scale ranging from 1 (*only a few years of primary education at most*) to 7 (*university degree*).

Parents of children who met our age criteria were informed about the study and asked for their active informed consent resulting in participation of the majority of eligible children (84% of the preschool and 79% of the kindergarten children).

Procedures

Child assessment

Children were tested three times, first upon entrance in preschool or kindergarten and then on two occasions 1, respectively 2, years later. At all measurement occasions, testing was divided over two sessions of approximately 30 minutes. Children were tested individually by trained research assistants, using laptop computers, in a quiet room at preschool or kindergarten.

The Dutch version of the Performance Indicators in Primary Schools (PIPS; Tymms, 2001), a computerized adaptive assessment of a wide range of emergent literacy and math skills, was used to assess emergent literacy and math skills. Previous research with the PIPS in The Netherlands showed good predictive validity and high reliability (Van der Hoeven-van Doornum, 2005).

Classroom observations

To assess the opportunities for engagement in activities deemed relevant for academic skills development, observations were conducted in all preschools and kindergarten classrooms focussing on six children per classroom who were randomly selected for the observations. Teachers were instructed to carry out their usual activities and routines. The observations by trained research assistants and the first author took 4 half-days of 2.5 to 3 hr in a 2-week period and were conducted shortly before the second round of child assessment. A cyclic interval coding approach was used to observe the target children. A child was observed during 10 seconds. After 10 seconds, the activity the child was engaged in during the preceding interval was coded for type of activity and involvement of the teacher (and a number of other categories not included in the present study). When the coding of a particular interval was completed (which took on average about 40 seconds), a 10-seconds observation of the next child started. The cycles of observing and coding were

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repeated from the start until the end of the morning or afternoon. The coding scheme (see below) was programmed in E-prime (Schneider, Eschman, & Zuccolotto, 2002) and installed on laptop computers. The procedure resulted for the preschool classrooms in a mean number of 209 observation intervals ($SD = 32.2$) in the mornings and 128 ($SD = 19.6$) intervals in the afternoons, which lasted about 1 hour less than the mornings. In kindergarten classrooms, where children spent about 1 hour longer in the morning and 30 minutes longer in the afternoon, a mean number of 349 intervals ($SD = 57.5$) were observed and coded in the morning and a mean number of 209 intervals ($SD = 40.6$) in the afternoon.

To determine inter-rater reliability, assistants coded detailed transcriptions of realistic classroom situations, based on previously made video recordings, which were also programmed in E-prime (Schneider et al., 2002). The coding procedure of the situations was similar to the coding procedure in real-time classroom situations. Assistants coded on average 35 different situations. The inter-coder reliability was satisfactory, with a Cohen's kappa of .80.

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Measurements

Emergent literacy

The emergent literacy skills test consisted of six subtests that were combined in a single score: receptive vocabulary, writing, ideas about reading, letter identification, reading words, and reading sentences. The maximum number of items is 107, but due to the adaptive nature of the test (i.e., after a certain number of errors the subtest at hand is automatically ended and the program continues to the next subtest) not all items were administered to all children. At both measurement occasions, missing scores, all missing at random, were imputed separately for the preschool and kindergarten cohort using the EM method. The percentage of missing scores ranged between 2% and 27%.

Emergent math

Emergent math skills consisted of seven subtests: ideas about math, counting, informal sums, digit identification, shapes, adding and subtracting, and advanced sums. The maximum number of items is 69, and again due to the adaptive nature of the test not all items were administered to all children. Also for emergent math skills, missing scores were imputed separately for the preschool and kindergarten cohort using the EM method. The percentage of missing scores ranged between 2% and 25%.

Teacher-managed activities

After every 10-second observation interval, the activity the child was engaged in during the interval was coded. If two activities were observed during one interval, the activity the child was engaged in longest was coded. In addition, we also coded who initiated and/or was mainly in charge of a particular activity, the teacher, the observed child, or other children.

The activity coding scale was adapted from Howes and Smith (1995). Typical examples of activities were making music and singing, creative and craft activities,

free play, outdoor play, and snack time (the complete coding scheme is available from the first author upon request). In the present study, we focus specifically on activities with a presumed academic content. Composite scores were computed based on the six randomly selected children and aggregated to the classroom level representing the mean percentage of intervals of the total number of observed intervals with teacher-managed activities. The following measures were included in the current study.

Teacher-managed literacy activities. Language and literacy activities such as book reading, language games (examples are thinking of words or names starting with a certain letter), rhyming, introducing and explaining new words, and classroom talk about knowledge topics that were initiated, directed, or guided by teacher were considered teacher-managed literacy activities.

Teacher-managed math activities. Activities involving counting, rank ordering, talk about numbers, quantities or birth dates, use of the calendar, naming geometrical shapes, playing with board games, measuring, comparing, and estimating that were initiated, directed, or guided by the teacher were considered teacher-managed math activities.

Education program

Preschools and kindergartens working with a special education program to promote disadvantaged children's emergent academic skills were compared with preschools and kindergartens without such a program, but providing regular care and education activities. All educational preschools and kindergartens in the current study that implemented a special education program used the program *Taalrijk* (''Enriched Language''). The program provides a curriculum that starts in preschool and continues into kindergarten, using a thematic approach to foster children's language, emergent literacy, and emergent math skills. Themes spanning about 3 to 4 weeks give concrete suggestions to the teachers for sharing time topics, story books to read, and small-group activities with fantasy play materials and special materials for literacy and math development. A core element of the program is the alternation of whole-group and small-group activities, following a cyclic schedule that recommends to organize small-group activities at least twice a week. In addition, a manual gives examples of how to organize an activity, the kind of instruction language to be used, and, especially, the list of words and concepts to be incorporated in the activity. Typical themes are the seasons of the year, animals in the zoo and at the farm, healthy food, injuries and illnesses, dwarfs and giants. Teachers working with the program received 8 half-days initial training focusing on a general sensitive interaction style and working with the manual and providing help with scheduling the activities and introducing ways of monitoring children's development. In addition, licensed trainers visited the classrooms for observation and consultation about four times in a 2-year period to ensure implementation fidelity. Preschools and kindergartens without this education program also provided a mix of child-centred and teacher-managed activities, implemented a regular curriculum of activities which partly overlapped with the Taalrijk activities, used occasionally themes as well, but mostly in whole-group settings and less extensively (for a description of regular preschool education in The Netherlands, see Van Tuijl & Leseman, 2007).

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Moreover, disadvantaged children attended regular preschools for 2 instead of 3 to 4 half-days, that is, 5 versus 7.5 (occasionally) to 10 hours per week (mostly) in educational preschools. Attendance in kindergarten was the same for all children, about 20 hours per week. All preschools and kindergartens had standard equipment of fantasy and construction play materials, special educational materials (e.g., letter boxes, jigsaw puzzles, categorization materials), arts and craft materials, music instruments and outdoor space and equipment for gross motor activities. All preschools and kindergartens had at least one fully licensed teacher (intermediate vocational training level in the preschools, higher vocational bachelor level in the kindergartens). In all preschools and some kindergartens, the teachers were assisted by another teacher or assistant teacher for part of the day, but in preschools and kindergartens working with Taalrijk, these extra teachers were also trained in working with the program. For the present purposes, a dummy variable was created indicating use of the program Taalrijk (value 1) versus the regular curriculum (value 0).

Mixed classrooms

Two types of classroom arrangements were distinguished. The targeted arrangement was characterized by classrooms that consisted in a majority of children who were considered disadvantaged according to official educational policy criteria, based on parents' educational attainment and ethnic-cultural background. In the preschools, targeted groups on average consisted of 83% (range 64% to 100%) disadvantaged children; in targeted kindergarten groups on average 61% (range 48% to 68%) of the children were labelled disadvantaged. In contrast, the mixed arrangement concerned preschool and kindergarten classrooms with a comparatively low representation of disadvantaged children. In preschools, the range was 17% to 57%, in kindergarten 10% to 38%. For the present purposes, a dummy variable was created indicating mixed (value 1) versus targeted (value 0) classroom composition. Some of the mixed preschools and kindergartens used also the special education program, whereas others provided the standard curriculum.

Analysis plan

The study was designed as a longitudinal cohort-sequential study involving three measurement times in each cohort, with two overlapping times for the preschool and kindergarten cohort (around age 4 and 5). Accelerated latent growth modeling (LGM; Duncan, Duncan, & Strycker, 2006), with AMOS (version 17; Arbuckle, 2006), was used to combine the two age cohorts in single models of children's literacy and math development, spanning the age range from 3 to 6 years, estimating the means and the variances of the intercepts and slopes for the dependent variables, and the effects on intercepts and slopes of the predictor variables *education program, mixed arrangement*, and *teacher-managed academic activities* (for short: *teacher activity*). Given the fact that the children were not randomly assigned to program, arrangement, and teacher, and may have differed in initial level of literacy and math skills due to selection, the analysis focused specifically on the slopes of children's development and on the effects of the predictor variables on the slopes. To evaluate model fit, the chi-square (χ^2), the root mean square error of approximation (RMSEA), and the comparative fit index (CFI) were used. As a rule of thumb, a non-significant χ^2 or a ratio of χ^2 and the number of degrees of freedom <2 indicates

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good model fit, RSMEAs below .05 indicate good fit and below .08 reasonable fit, and CFI greater than .95 can be considered a good fit, and values greater than .90 indicate an acceptable fit (Kline, 2005).

Two series of LGM models were tested for emergent literacy and emergent math, respectively. First, growth models were fitted. Regression weights for the intercepts were fixed to 1; regression weights for the slopes were fixed to reflect the actual measurement times. Using the multiple-group option, regression weights for the preschool cohort were fixed at 0, 1, and 2, and for the kindergarten cohort at 1, 2, and 3, respectively. Moreover, the measurement errors of the measures taken at the overlapping measurement times (T2 and T3 for the preschool cohort, T1 and T2 for the kindergarten cohort, respectively), the intercept means and variances, the slope means and variances, and the covariances between intercepts and slopes were constrained to be equal for both cohorts. Nonlinear growth was examined by free estimation of the first measurement weight in the preschool cohort and the final measurement weight in the kindergarten cohort. The model for emergent literacy fitted significantly better when the slope regression weight reflected a quadratic trend. The model for emergent math fitted the linear model best. See Figure 1 for an

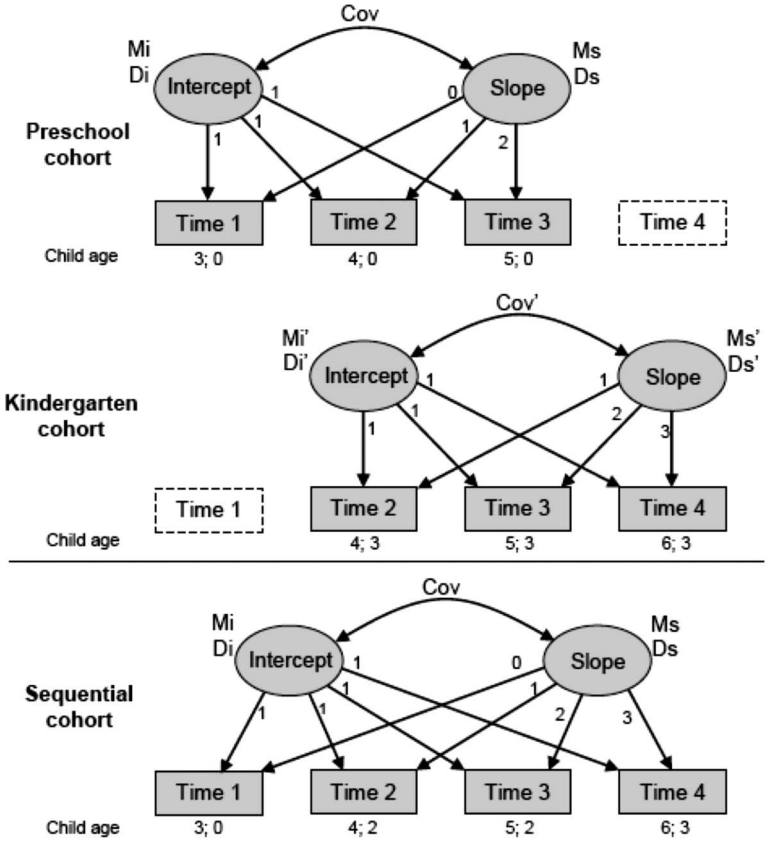

Figure 1. Depiction of the merging of the separate preschool and kindergarten cohort into one sequential cohort.
Note: Mi = Mean intercept, Di = Disturbance intercept, Ms = Mean slope, Ds = Disturbance slope, Cov = Covariance.

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illustration of the combined accelerated latent growth model. Second, the three predictor variables were added to the growth models, keeping the growth part of the models constant. Structural paths from the predictors to the intercepts and slopes, and covariances between the predictor variables were specified.

Results

The correlation matrix and the means and standard deviations of the dependent variables for each age cohort are shown in Table 2 (preschool cohort: above the diagonal; kindergarten cohort: below the diagonal). There were no outliers with a Mahalanobis distance $>.10$. Normality was checked for each variable. The results of first measurement of literacy and math in the preschool cohort appeared to be skewed due to a floor effect (several children scoring zero). However, skewness was within the acceptable range (<3).

Table 3 shows the means and standard deviations of the observed teacher-managed literacy and math activities by age cohort, program, and arrangement. Teacher-managed math activities were quite rare, especially in preschool.

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Table 2. Correlations, means, and standard deviations for literacy and math skills for the preschool (above the diagonal) and the kindergarten cohort (underneath the diagonal).

								Preschool	
		1.	2.	3.	4.	5.	6.	Mean (*SD*)	*N*
	1. Literacy T1	–	.40**	.46**				7.00 (6.68)	47
	2. Literacy T2	.54**	–	.64**				19.10 (9.01)	47
	3. Literacy T3	.29^{+}	.54**	–				28.10 (10.06)	47
	4. Math T1				–	.72**	.65**	5.32 (4.67)	47
	5. Math T2				.73**	–	.73**	12.99 (7.79)	47
	6. Math T3				.70**	.84**	–	26.74 (8.57)	47
Kindergarten	Mean (*SD*)	18.18 (10.30)	37.68 (11.21)	91.25 (42.48)	16.65 (7.62)	31.22 (8.04)	44.13 (9.06)		
	N	43	43	43	43	43	43		

Note: Above the diagonal, the data of the preschool cohort are shown, underneath the diagonal the data of the kindergarten cohort are shown.$^{+}p < .10$; $^{*}p < .01$.

Table 3. Teacher-managed literacy and math activities by cohort, program, and mixed arrangement; mean percents and standard deviations.

			Teacher-managed literacy activities		Teacher-managed math activities	
			M %	*SD*	*M* %	*SD*
Preschools	Program	No	7.4	5.9	0.3	0.5
		Yes	8.5	6.4	1.4	1.2
	Mixed	No	1.7	1.2	0.7	0.1
		Yes	11.5	5.1	1.4	1.6
Kindergartens	Program	No	17.0	6.6	1.4	1.0
		Yes	13.7	2.7	2.1	0.9
	Mixed	No	15.3	2.0	2.8	0.2
		Yes	13.4	4.5	1.4	0.8

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Teacher-managed literacy activities occurred more frequently, but on average not exceeding 17% of the observed classroom time, mostly less. Note, however, that there was overall a considerable range, pointing to differences between teachers. Although use of the education program was meant to enhance the focus on academic content and teacher initiative, observed teacher activities did not significantly differ between classrooms with and without the education program across cohorts ($F_{(1,90)} = .045$, $p < .83$ and $F_{(1,90)} = .015$, $p < .90$, for literacy and math, respectively). In the preschool cohort, a remarkably high percent of teacher-managed literacy activities was found for the mixed arrangement, which may have been coincidental. The overall effect of the mixed arrangement across cohorts was significant for literacy ($F_{(1,90)} = 6.83$, $p < .01$), not significant for math ($F_{(1,90)} = .005$, $p < .95$). The distribution of teacher-managed literacy and math activities was skewed in each cohort and showed some outlier values. For further analyses, therefore, median-split was used to create a dummy variable indicating comparatively high (value = 1) versus low teacher-managed activities (value = 0).

Testing combined growth and structural models

Model selection proceeded in three steps; the results are presented in Table 4. First, for each dependent variable, models were tested in which all structural parameters and all covariances between the predictors were constrained to be equal across the cohorts. As can be seen in the table, the model for literacy did not yield acceptable fit, whereas the model for math fitted the data already reasonably well. Next, models were tested in which all structural parameters (the expected effects of education program, mixed classroom composition, and teacher activity) were allowed to vary between the preschool and kindergarten cohort. This yielded considerably and statistically significant better fit for the literacy model (a decrease in χ^2 of 54.06, with a loss of 9 degrees of freedom), but a smaller, yet significant improvement of the mathematics model (a decrease of χ^2 of 13.86 against a loss of 9 degrees of freedom).

Table 4. Overview of the fit statistics for the fully constrained (Model 0), fully unconstrained (Model 1), and partly unconstrained and trimmed model (Model 2).

Model	Emergent Literacy	Emergent Math
Model 0 All parameters constrained to be equal across both age cohorts	$\chi^2 = 64.57$, $df = 22$ $p = .000$ CFI = .593 RMSEA = .147	$\chi^2 = 34.99$, $df = 22$ $p = .039$ CFI = .943 RMSEA = .081
Model 1 Structural parameter(s) set free to vary between age cohorts	$\chi^2 = 10.52$, $df = 13$ $p = .651$ CFI = 1.000 RMSEA = .000	$\chi^2 = 21.13$, $df = 13$ $p = .070$ CFI = .949 RMSEA = .084
Model 2 – trimmed As the previous model, but with non-significant structural parameters (at $p < .10$) constrained to zero	$\chi^2 = 26.63$, $df = 23$ $p = .272$ CFI = .965 RMSEA = .042	$\chi^2 = 32.40$, $df = 23$ $p = .092$ CFI = .959 RMSEA = .068

Both models had acceptable fit. Finally, the models were trimmed to obtain the most parsimonious solution. Parameters that were not significant on the $p < .10$ level were fixed to zero. As Table 4 shows, this yielded good fit for both models.

Table 5 presents the non-standardized estimates of the models for literacy and math based on the final models. Regarding the growth part of the models, the means and variances of the intercepts and slopes were all statistically significant, indicating that the differences between children in the overall level of literacy and math are substantial, that there is substantial overall growth of literacy and math skills over time, and that the individual differences in the rate of growth are substantial as well. Note that the means, variances, and covariances of the intercepts and slopes and the error variances of the measurements were constrained to be equal for the preschool and kindergarten cohort.

Most interesting for the present purpose are the effects of the predictors on the slopes of literacy and math development, controlling for the intercepts. A remarkable finding, contrary to our expectations, is that there were no significant slope effects of using the education program. However, in line with our expectations,

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Table 5. Means, variances, and covariances for the structural part of the growth only model and parameter estimates of the predictors education program, mixed arrangement, and teacher activity in the final model with covariates.

	Emergent Literacy		Emergent Math	
Structural growth model				
Mean (*SE*)				
Intercept	18.39	(1.04)***	14.96	(0.77)***
Slope	9.76	(1.14)***	11.99	(0.88)***
Variance (*SE*)				
Intercept	44.93	(9.36)***	30.71	(5.35)***
Slope	12.61	(6.29)*	8.32	(2.54)***
Covariance				
Intercept-Slope	17.21	(5.37)**	9.46	(2.65)***
Predictors				
Preschool cohort				
Effects on intercept (*SE*)				
Program	–		–	
Mixed	–		–	
Teacher activity	–		–	
Effects on slope (*SE*)				
Program	–		–	
Mixed	–		2.36	(0.95)*
Teacher activity	–		2.44	(0.88)**
Kindergarten cohort				
Effects on intercept (*SE*)				
Program	–		–	
Mixed	–		–	
Teacher activity	–		–	
Effects on slope (*SE*)				
Program	–		–	
Mixed	6.96	(2.38)***	2.36	(0.95)*
Teacher activity	5.35	(1.08)***	2.44	(0.88)**

Note: $^{+}p < .10$; $*p < .05$; $**p < .01$; $***p < .001$; a dash indicates the parameter was constrained to zero.

Table 6. Standardized estimates of the significant effects on the slopes of literacy and math development.

	Final Model Literacy		Final Model Math	
Effects on Slope	Preschool cohort	Kindergarten cohort	Preschool cohort	Kindergarten cohort
Program	–	–	–	–
Mixed	–	0.62	0.30	0.38
Teacher activity	–	0.52	0.35	0.36

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there were positive effects of both mixed arrangement and teacher-managed academic activities on the slopes of math (both in the preschool and kindergarten cohort) and literacy (only in the kindergarten cohort). The standardized regression weights in Table 6 reveal small to medium effect sizes.

Discussion

The first goal of this study was to determine whether educationally disadvantaged children showed larger gains in emergent literacy and math skills in mixed than in targeted preschools and kindergartens that are attended in majority by disadvantaged children. The results indicate that children in mixed kindergarten classrooms gained more in literacy and math skills than children in targeted kindergarten classrooms. The positive effect of mixed classrooms was for preschool children only apparent in math skills. One of the explanations is that the share of disadvantaged children in the mixed preschool classrooms was bigger than in mixed kindergarten classrooms. Put differently, the mixed kindergarten classrooms in this study had a socioeconomically more balanced class composition than the mixed preschool classrooms. Overall, the results of the current study are in line with previous research showing that educationally disadvantaged children benefit from a more balanced socioeconomic and ethnic-cultural classroom composition, probably through classroom interactions with peers with better expressive abilities and greater vocabularies (Henry & Rickman, 2007; Mashburn et al., 2009; Schechter & Bye, 2007) and perhaps also because a more balanced classroom composition means less workload for the teacher, who can spend more time to instructing and guiding children (Lee et al., 1998).

The second goal of this study was to determine the effect of a special education program on disadvantaged children's literacy and math development. The results indicate that using this program had no detectable effect on children's outcomes. However, before concluding that working with programmed activities is pointless in early childhood education, two findings should be considered. First, based on classroom observations, teachers who were trained in the education program and reported to use the program did not differ from non-trained teachers in providing the language, literacy, and math activities in the classroom that were intended by the program, pointing to a lack of implementation fidelity. Second, we found important differences between teachers in the amount of time they spent on initiating and guiding language, literacy, and math activities with children. Most importantly,

concerning the third main finding of this study, differences between teachers in involvement in language, literacy, and math activities were significantly related to child outcomes. The findings are in agreement with findings in other studies, revealing large differences between teachers working within the same program and with the same educational concept (Connor et al., 2006; Early et al., 2005; Klibanoff et al., 2006; Meyer et al., 1993). These studies similarly underscore the importance of what the teacher does (or does not do) for child outcomes.

Teacher-initiated and guided literacy and math activities occurred rather infrequently according to our observations, yet were significantly related to children's growth in emergent literacy and math in preschool and kindergarten. This finding suggests that even a slight increase in the amount of time spent on these activities might lead to gains in emergent school skills. The reasons why teachers on average spent so little time on literacy and math activities are not immediately clear. Further observations revealed that both in preschool and kindergarten much time was lost to transition activities such as gathering material to start an activity, tidying up after an activity, and awaiting one's turn when choosing an activity on a plan board (De Haan, Elbers, & Leseman, 2011). Furthermore, much time was involved in doing daily care routines such as eating snacks. Thus, inadequate classroom time management, from the point of view of promoting emergent academic skills, is a possible explanation. The large range regarding the time teachers spent on academic activities in the preschool and kindergarten classrooms in this study (preschool: 1% to 16%; kindergarten: 11% to 27%) indicates that some teachers were apparently quite able to invest a considerable amount of time in academic content, whereas other teachers failed to do so. Teachers should be urged to reconsider their daily schedules, to incorporate academic content activities in their curriculum, and to minimize the loss of time due to mere waiting, transitions between activities, and lack of interesting activities. Improving classroom management skills might propel this process.

Another point to highlight is that, according to further observations, nearly all teacher-managed activities were carried out in whole-group settings, despite the fact that in the classrooms working with the education program frequent small-group work belonged to the prescribed activities (De Haan et al., 2011). Presumably, the whole-group setting limits interaction opportunities and may therefore be less effective in stimulating development (Powell, Burchinal, File, & Kontos, 2008). Indeed, the effect of small-group instruction on skill development is reported to be 10 times bigger than instruction in whole-group settings (Connor et al., 2006).

In view of the policy issues raised in the introduction of this article, the present results favor a universal approach to early childhood education, allowing for more balanced classroom composition as compared to targeted programs, while making optimal use of the positive contribution of interaction with peers from non-disadvantaged backgrounds to disadvantaged children's development. The present results suggest that merely adopting an education program, however well designed and theoretically grounded, is perhaps not a powerful enough intervention to change teachers' classroom practices. As the present results support the relevance of teacher-initiated and guided playful academic activities for child outcomes, other strategies to change classroom practice are needed. Strengthening early childhood teachers' professional skills apparently requires more than a manual, a few days of training, and occasional feedback, as was the case with the education program studied here. Critical self-reflection, monitoring if planned activities are carried out, improving

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classroom and time management skills, also by learning from the good practices of colleagues, should be standard procedure in preschools and kindergartens.

Although it is to be recommended to replicate the study with a larger sample size to obtain more robust results, the accelerated LGM analyses conducted in this study were certainly feasible with the current sample size (Nevitt & Hancock, 2004). Note that the children were tested three times and that the preschool and kindergarten cohort were combined into a single sequential cohort with the measurement part of the models being constrained to be equal across both cohorts, which increased the number of data points and decreased the number of free parameters to be estimated, thereby increasing the power of the present analyses (Kline, 2005). In addition, the tested models were not extremely complex. As a matter of fact, the structural part of the models included only three predictors. Future studies should not only include larger samples, but ideally also samples from different geographical areas and ethnic communities to examine the generality of the findings of the current study.

Another limitation of the current study concerns the exclusive focus on one aspect of education quality, namely the amount of teacher-managed language, literacy, and mathematics activities. Given the current interest in academic outcomes, this limitation was justified, but it should be noted that several studies show that other aspects of both *structural* and *process* quality contribute to children's developmental and academic outcomes as well (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Howes et al., 2008; Sylva et al., 2006). Furthermore, more detailed attention should be paid to the quality of the language, literacy, and math input provided in the classrooms, instead of only the quantity as in the current study. Future studies should also include family characteristics, such as parenting practices and the availability of educational materials and activities in the home environment. This is important, because family characteristics like these show large socioeconomic and ethnic cultural differences (Bradley, Corwyn, McAdoo, & Coll, 2001) and are clearly related to child outcomes as well (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Leseman & De Jong, 1998; Scheele, Leseman, & Mayo, 2010).

Another important point to address in future studies are the effects of being in a mixed classroom for non-disadvantaged children. Although a recent study showed that high-status children's language development was not affected by their peers' language skills (Justice, Petscher, Schatschneider, & Mashburn, 2011), more studies are needed to address these effects in more detail and to assess whether there are beneficial effects for these children to be in mixed classrooms surrounded by children from different cultural and socioeconomic backgrounds.

Furthermore, future research should include measures of the actual skill level of peers, for example, by using standardized assessment of language skills or by observing naturally unfolding peer interaction in the classroom to test the hypothesis that disadvantaged children profit from interaction with higher skilled peers in more detail.

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