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A meta-analysis of the impact of early childhood interventions on the development of children in the Netherlands: an inconvenient truth?

Ruben Fukkink^{a,b}, Lisanne Jilink^{a,b} and Ron Oostdam^{a,b}

^aCentre for Applied Research in Education (CARE), Amsterdam University of Applied Sciences, Amsterdam, the Netherlands; ^bResearch Institute of Child Development and Education, University of Amsterdam, Amsterdam, the Netherlands

ABSTRACT

Following on from successful early intervention programs abroad, the Netherlands also introduced a number of different programs to tackle educational disadvantage in preschool and early years education. Studies that investigate the effects of Dutch early childhood interventions have been published since 2000. This meta-analytic review study summarizes the findings from 21 experimental comparisons which study some 50,000 children in the period between 2000–2015, with a total of 165 outcome measures. The aggregate effect of early childhood interventions compared with standard preschool and early years groups is not statistically significant. The disappointing results indicate that special early childhood education programs currently offer no added value for the development of young children in the Dutch context over and above regular preschool and early years groups. A focus for Dutch policy is to improve future practice based on scientific evidence around effective approaches to ECEC. Further, the implementation of study designs with more experimental control would strengthen the current knowledge base.

KEYWORDS

early childhood education and care (ECEC); early intervention; developmental outcomes; review; meta-analysis

Introduction

The positive findings of the classic early intervention studies from the United States indicated that investing in young children is worthwhile (Heckman 2006). Subsequent overview studies provided further evidence of the positive effects of early childhood education and care (ECEC) on the development of children (Blok et al. 2005; Burger 2010; Camilli et al. 2010; Gorey 2001; Nelson, Westhues, and MacLeod 2003; Pianta et al. 2009). Evaluations in different countries have shown benefits of early childhood interventions on child outcomes, including European countries, like England, Germany, Northern Ireland, and Scotland (Nores and Barnett 2010).

ECEC frameworks vary significantly across European countries. Countries may vary in their focus on center-based or home-based programs or a combination of these two delivery modes, see for example Fukkink and Blok (2010). Further, these programs show significant differences in structural quality due to different regulations related to the

qualification of educational staff and the maximum number of children allowed per staff member and per group in center-based settings, as a comparative analysis on ECEC throughout 32 European countries showed (Euridyce and Eurostat report 2014). In addition, ECEC practice may show important differences within countries as well. An important distinction is the difference between specific ECEC interventions, which are usually tailored to a specific target population, and general ECEC policy with universal programs which offer services to a very broad target group. The latter programs, which are offered at a national level, may also show local variation in both quality and outcomes (Hall et al. 2013). Finally, policies also show variation in the number of free ECEC hours. To conclude, ECEC is a broad concept which comprises different practices with different structural quality characteristics and, possibly, different process quality and outcomes.

Inspired by the positive results of the first US early intervention programs and European policy (Council of the European Union 2011; Urban 2015), ECEC interventions were also implemented in the Netherlands. In the Netherlands, investments focused on early intervention programs in the preschool and early years phases for educationally disadvantaged children as part of a centre-based approach. The focus of Dutch policy to tackle disadvantage among children at an early stage essentially involves working with an early intervention program, starting in centre-based care with children from the age of around two-and-a-half up to and including early years classes in primary school. These special early childhood intervention groups exist alongside the standard childcare groups and early years classes in primary school. The Dutch situation is therefore characterized by a split system with special early childhood intervention groups on the one hand and standard ECEC on the other.

The introduction of the first ECEC programs in the Netherlands was soon followed by studies into the effects at the level of the child, investigating the development of language skills, numeracy skills, general cognitive development, and socio-emotional development, starting with Veen, Roeleveld, and Leseman (2000). In the Dutch context of a split system, a number of researchers have compared the development of children in standard ECEC and children in early intervention programs to evaluate their effect in reducing developmental delays and educational disadvantages. The first studies (Veen, Roeleveld, and Leseman 2000; Veen, Fukkink, and Roeleveld 2006) investigated the effects in quasi-experimental designs where children from the early intervention groups and a comparison group were often followed from pre-school up to and including early years classes (a so-called prospective research design). Effects of early childhood interventions were also studied using large-scale, national databases (Driessen 2004), where the effects of early childhood interventions were evaluated by relating the educational performance of children in primary schools to their pre-school and early years activities (a so-called retrospective research design; see also Table 1 for an overview). Researchers have drawn different conclusions in their reports and it is therefore unclear what the effects of Dutch early childhood interventions in ECEC are.

Aim of this study

So far, it has not been possible to answer questions regarding the impact of early childhood interventions in a satisfactory manner. We therefore conducted a meta-analysis of all Dutch impact studies in the field of early childhood interventions. The central question

Table 1. Overview of included studies: study design; period; sample size.

Author(s)	Year	Sub-study	Prospective/ Retrospective	Preschool and/or early years education	N
Veen et al.	2000; 2002	1. Program 'Kaleidoscoop' 2. Program 'Piramide'	Prospective	Both	117
de Goede and Reezigt	2001	1. Program 'Kaleidoscoop,' age 2–4 2. Program 'Kaleidoscoop,' age 4–7 3. Program 'Piramide,' age 2–4 4. Program 'Piramide,' age 4–7	Prospective	Preschool Early years Preschool Early years	141
Driessen and Doesborgh	2003	1. Cohort 1 2. Cohort 2 3. Cohort 3 4. Panel	Retrospective	Preschool	37,014
Veen et al.	2006		Prospective	Both	154
Veen et al.	2008		Retrospective	Both	4886
de Jong- Heeringa	2008		Prospective	Both	351
Nap-Kolhoff et al.	2008	1. Primary school, age 5 2. Primary school, age 7	Retrospective	Both	8480
van Schooten and Slegers	2008		Prospective	Preschool	157
de Haan et al.	2013	1. Cohort age 2–4 2. Cohort age 4–7	Retrospective	Preschool Both	156
Karssen et al.	2013	1. Preschool education only 2. Both preschool and early years education	Retrospective	Preschool Both	1476
Bruggers et al.	2014		Retrospective	Preschool	570

of this review is: What impact has been reported in evaluations of Dutch early childhood interventions for the cognitive and socio-emotional domain of young children, comparing special ECEC with regular ECEC? (Research Question 1). We focus here on the intended added value of early childhood interventions. In addition, we explore possible moderators of the impact of Dutch early intervention programs: Which study characteristics correlate with the reported effects at child level? (Research Question 2). We investigate whether the research design, the earlier or later period of early childhood interventions in the Netherlands, and other study characteristics correlate with effects at child level. We investigate these questions through a meta-analysis of Dutch studies which report the impact of early childhood interventions on child development.

Method

Literature search

A broad search was performed in the electronic meta-catalogue PiCarta, which includes many Dutch sources, with the search terms “preschool and early years education; preschool education; early years education; early childhood interventions” (in Dutch: *voor- en vroegschoolse educatie* or *vve*). This search produced 875 hits (May 2015). An additional search was performed in the database of the Social Sciences Citation Index (SSCI) to find publications in English by Dutch authors in this field, in this case using the search profile “preschool* OR prekindergarten or pre-kindergarten OR early childhood education,” combined with “country = Netherlands” and looking for psychological and educational journals in the period between 2000–2015. This

resulted in 335 hits (June 2015). In addition, a number of overview articles of Dutch or European studies (Burger 2010; Leseman and Slot 2014) were consulted to find studies. Using the so-called snowball method, we also searched for studies by reviewing the literature lists of the studies found. Finally, researchers from personal networks were also contacted (see Fukkink, Jilink, and Oostdam 2015).

Inclusion criteria were: (1) “is the publication a (quasi-)experimental study”; (2) “in a Dutch context”; (3) “of an early intervention center-based program.” After scanning titles and abstracts, 14 publications that met all the inclusion criteria remained. These studies were conducted with approval from the coordinating research institutions and funding bodies (e.g. Ministry of Education, Culture and Science); not all reports indicated explicitly that they had received ethical approval. These publications report on a total of 11 separate studies with 21 different quasi-experimental comparisons in which the impact of early intervention programs on child development is evaluated. English and Dutch reports or articles, based on the same original research, were not counted twice. Where publications report on different cohorts and/or different experimental groups, the studies were analyzed separately (see Table 1 for an overview). The unit of analysis in this review was in each case a quasi-experimental comparison between children from an early intervention group and children from a standard group for a specific outcome measure (e.g., language or numeracy).

Coding

All the quasi-experimental comparisons have been coded using a coding scheme in order to describe content-related characteristics of the early intervention programs and methodological characteristics of the studies. However, many of the reports appeared to provide relatively little information on the characteristics that we identified.

For each study, we coded the period in which the data was collected and the year in which it was published. The coding also indicated whether the research report was published as a report or as an article in a peer-reviewed journal. For each intervention, it was specified whether it took place locally or in a broader regional or national context. Wherever possible, it was also specified whether the program involved pre-schools or early years education only, or a combination of the two.

As regards the methodological aspects, we coded whether the study was retrospective (a study where the impact of early childhood interventions is investigated on the basis of data collected after the pre-school and early years period) or prospective (a study where children are followed from the pre-school and early years education period); whether or not the study involved pre-measurement, post-measurement, and/or follow-up; whether or not there was random assignment of children to conditions; and the number of participating children at the beginning and end of the study (including attrition). For each outcome, we coded the developmental domain (language, numeracy, learning ability or general intelligence, and social and emotional development). It was also coded whether the reported statistical data have or have not been corrected to take into account differences between the early intervention group and the control group; the focus of the measurement period (pre-school or early years education); and the period between the end of the early intervention program and the measurement.

Analyses

The effect size for each outcome at child level was determined (Cohen's d). In total there were 165 study outcomes, covering language (46), numeracy (26), general intelligence (18), and social and emotional development (75). A number of studies reported that the early intervention program did not result in statistically significant effects without specifying the statistical data that are required to determine an exact effect size. Since omission of these non-significant outcomes results in a serious bias of the results, it was decided to impute here an estimated effect size of zero; this was done for 36 of the total of 165 outcome measures. Following the rules of Cohen (1988), effect sizes of 0.20 are considered small, effect sizes of 0.50 are medium, and effect sizes of 0.80 or higher are large.

The experimental effects were aggregated – both separately for the four outcome domains (language, numeracy, general intelligence, and social and emotional development) and over all outcome domains – in order to determine the impact of early childhood interventions (Research Question 1). The analyses were performed with the help of a multi-level random effects model (Hox 2010), which reflects the hierarchical structure of the data, the impact measures for each outcome measure (at the lowest level) being nested under experimental comparisons (the intermediate level) and studies (the highest level). In addition, with the help of a multi-level regression model, it was analyzed whether the outcomes are moderated by characteristics of the studies (Research Question 2).

Results

Impact of early childhood interventions on the development of children

Three-quarters of the effect sizes were between 0 and 0.20, i.e., between no effect at all and a small effect. Although there was some variation in the effect sizes found, with both some positive and negative effects, the majority of the values were around zero. The aggregate effect for language, numeracy, general skills, and socio-emotional development is smaller than small for all domains and does not deviate significantly from zero (see Figure 1 and Table 2).

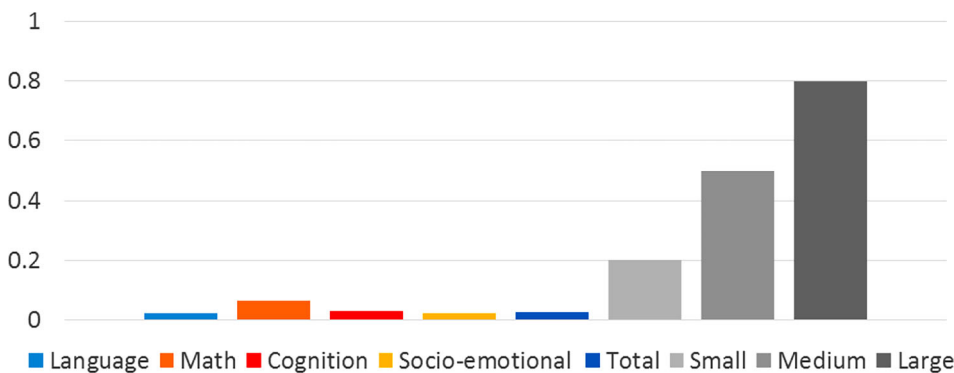


Figure 1. Mean effect of early childhood interventions on language, numeracy, general intelligence, and socio-emotional development of children, compared with small, medium, and large effect sizes.

Table 2. Effect sizes (and standard error) of special ECEC programs by developmental domain.

	Language	Numeracy	Cognition General	Socio-emotional	Total
Number of outcomes	46	26	18	75	165
Effect size (<i>se</i>)	0.023 (0.041)	0.064 (0.058)	0.030 (0.088)	0.022 (0.036)	.026 (0.029)
<i>Random effects</i>					
Study level	0.013 (.008)	0.028 (0.015)	0.011 (0.020)	0.022 (0.036)	0.007 (0.004)
Experimental comparison level	0.000 (0.000)	0.000 (0.000)	0.009 (0.016)	0.001 (0.001)	0.001 (0.001)

Note: None of the effect sizes is statistically significant different from zero.

The mean effect of early childhood interventions hardly changed in an additional analysis of the data following omission of the imputed zero scores (see Method). The aggregate effect in this analysis is 0.035 (standard error = 0.081) instead of 0.026 (standard error = 0.029), a negligible difference of 0.009; in both cases the aggregated effect is not statistically significant. Also after statistical correction of raw effect sizes, which have not been corrected to reflect background differences between the early intervention group and the comparison group (6% of the effect sizes), the mean effect remains in the region of zero.

Moderators of the impact of early childhood interventions

One predictor of the size of the effects is the year in which the study was published: the effects of early childhood interventions are slightly smaller in more recently published publications (see Table 3). The decrease in early intervention effects in the period from 2000 up to and including 2014 is small but the effect is systematic and ‘explained’ 63% of the variance in the outcomes between outcome measures at partial study and study level; the correlation applied to both prospective studies ($r = -.20$) and retrospective studies ($r = -.72$). A second moderator of a methodological nature is correction of the statistical data to reflect background characteristics between the early intervention group and the comparison group. Effect sizes that have not been corrected (this only occurred six times, 3.6% of the total) are on average small and negative (-0.338 , standard error = 0.060). Finally, effects decrease with time once the early intervention program has ended, but this fade-out moderator explained only little variance. A combined model with the three above-mentioned moderators of the reported early intervention effects ‘explained’ three-quarters of the variation in effect sizes; after that, the differences between the effects at study and experimental comparison level were no longer statistically significant (0.001, standard error = 0.001 at study level and 0.001, standard error = 0.000 at experimental comparison level respectively).

Table 3. Moderators (and standard errors) of the effects of special ECEC programs.

	Beta weight (with standard error)	‘Explained’ variance
Publication date of report (from 2000)	-0.018^* per year ($se = 0.003$)	63%
Correction for background characteristics	$+0.338^*$ for non-corrected effect sizes ($se = 0.060$)	38%
Fade-out effect (per annum)	-0.008^* ($se = 0.004$)	0%
Total model (all moderators combined)	–	75%

Note: The explained variance is the variance at study and partial study level compared with an intercept-only model without predictors; An asterisk (*) indicates statistical significance at $\alpha = .05$.

Discussion

The result of this meta-analysis indicates that the effects of Dutch early childhood programs are disappointing when compared with standard early childhood and early years groups. The mean effect of early childhood interventions, as emerges from the quasi-experimental research, is smaller than small and does not deviate significantly from zero. Moreover, the result obtained is robust and reveals a consistent pattern for the various outcome domains, in different research designs, in different periods of early childhood intervention policy, and in publications by different researchers. This zero result indicates that there is no scientific evidence of the positive effects of early childhood interventions on the cognitive or socio-emotional development of children. The impact of early childhood interventions in the Netherlands seems, therefore, in stark contrast to the results of early education programs elsewhere in other western countries.

The results from the Dutch publications reveal a slightly decreasing trend for the effects of early childhood interventions in the period from the turn of the century. The decreasing trend is at least not consistent with the assumption that policy changes implemented from the start of early childhood interventions would have significantly improved the situation. It is not easy to find an explanation for this. Perhaps the added value of early childhood interventions was greater when the first programs were implemented but has subsequently decreased because standard childcare and early years classes have since been working in a more results-oriented way and have taken on the early intervention components themselves, but this remains conjecture (see also Driessen 2012).

Dutch versus international results: an inconvenient truth?

The Dutch results are clearly inferior to those obtained in the successful interventions implemented abroad, such as the first early intervention studies from the United States, to which frequent reference is made in the Dutch debate. The results are also inferior to those obtained in meta-analytical studies into the effects of these mostly European and American programs, which report effect sizes ranging from 'small' to 'medium' (Blok et al. 2005; Burger 2010; Camilli et al. 2010; Gorey 2001; Nelson, Westhues, and MacLeod 2003; Nores and Barnett 2010; Pianta et al. 2009). Without exhaustively listing the differences between intervention programs in the Netherlands and other countries, it is clear that the Dutch early intervention programs are less intensive than the first early intervention programs in the United States. Programs that combine a center-based approach with a home-based approach have shown to be more successful than programs with only a home-based or center-based approach (Blok et al. 2005), but Dutch early intervention programs have not implemented this dual approach. In addition, the Dutch control group appears to be in a better position at the outset than many children and families from the first US studies. In that sense, the margin for success for early intervention in the Netherlands would appear to be narrower than in the US context. Direct application of the Heckman hypothesis (Heckman 2006) and the associated US impact studies to the present Dutch context does, therefore, not seem appropriate. Finally, an important question is whether the Dutch policy fosters high-quality early intervention in practice.

Focusing on structural quality characteristics, Dutch ECEC is characterized by a maximum group size of 16 children with a staff-to-child ratio of 2:16; a minimum number of 10 hours attendance per week; and educational qualifications for staff who work with younger children below bachelor level. These structural quality characteristics seem, broadly speaking, average in a European context, although some countries in Europe certainly have more favorable conditions. Some policy measures and regulations which have been implemented after 2000 may have affected the structural quality of early childhood education: evidence-based programs for either staff or children were still not required; the professional in-service development of staff became less extensive in the context of a relatively low level of staff qualification; and a structural relationship between preschool and primary school was no longer anchored in new educational regulations. The fact is that a national assessment of 5000 locations by the Dutch inspectorate (Onderwijsinspectie 2013) showed instructional support, quality control, and the transition from preschool to kindergarten to be inadequate in most cases (respectively, 57%, 55%, and 54% of all locations).

Implications for research

The outcome of this review study may be inconvenient for some ECEC stakeholders in the Netherlands. But is it an inconvenient truth? The evaluated research on early childhood interventions that we synthesized in this meta-analysis certainly has limitations, and the researchers have been the first to point out the shortcomings of the quasi-experimental research designs used in their reports. The effects of Dutch early childhood interventions have been analyzed in quasi-experimental research designs in which intact groups of children in an early intervention setting were compared with the standard setting. This research always follows the existing ECEC practice, where children have already been placed in early intervention groups when the research gets under way. As a result, unlike in the first US evaluations (Blok et al. 2005), controlled trials with random assignment to conditions, a control group, and a pre-test do not occur.

If one considers only true experimental RCT studies scientifically relevant, then the conclusion is that there are currently no empirical data supporting the current Dutch ECEC policy: true experimental studies are lacking. In our opinion, the quasi-experimental studies, each of which has its strong and weak points, complement each other. In prospective studies, children are monitored intensively during and immediately after the early intervention program; in retrospective studies, children are investigated in very large samples with a long-term perspective. Furthermore, a coherent picture emerges from both lines of study. If one considers quasi-experimental studies adequate to draw scientific conclusions, the conclusion is that there are no empirical data that support the current Dutch ECEC policy: there is no general positive effect in the Dutch quasi-experimental studies conducted. Hence, no matter the exact epistemological view or methodological evaluation of experimental and quasi-experimental evidence, one reaches a similar conclusion: there is no strong support for Dutch ECEC policy.

Implications for practice

In the Dutch context, early childhood interventions have been implemented with much attention to structural characteristics but less attention to process quality; with much attention to methods but less to professional development of the competencies of the

staff; with much attention to developing children's language skills but less focus on other early childhood development domains, including numeracy skills and socio-emotional development; and, finally, with a relatively high degree of attention to segregation rather than integration of young children. As a result, the Dutch early intervention policy may not always be consistent with current scientific evidence around effective approaches to ECEC (Pianta et al. 2009). Recent assessment research has made it clear that the difference in the quality of teaching between the regular and early intervention ECEC is small. There is only a slight difference in favor of the early intervention groups when it comes to the quality of teaching. Moreover, the quality of instructional support is inadequate in both the standard and the early intervention groups, and this applies to the development of language, emergent literacy, and emergent numeracy (Veen et al. 2014). The difference in process quality between early childhood interventions and the comparison group would therefore appear to be too small to have a significant impact on child development.

Our outcomes seem consistent with the outcomes of the review by Camilli et al. (2010), which distinguishes between studies where the effects of a special pre-school program are compared with a control group without intervention and a control group with an alternative curriculum. The latter corresponds to the comparison made between early intervention groups and standard ECEC classes in this study. In the comparison made by Camilli and colleagues between early intervention and an alternative program, just as in this review, the effects of special programs on the development of young children are virtually zero for cognitive and social outcomes. The outcome of the review of Camilli and colleagues and this study therefore raises the same question: do special large-scale programs targeted at children in the pre-school and early years period have sufficient added value compared with standard early childhood education and care to significantly improve the development of educationally disadvantaged young children?

Dutch stakeholders should reconsider the current ECEC practice. Following a systematic approach, like the framework of response-to-intervention (Fletcher and Vaughn 2009) or intervention mapping (Bartolomew et al. 2006), The Dutch ECEC practice should be evaluated systematically to answer the question of how structural and process quality can be improved to increase effects of ECEC on child level. One of the questions that future evaluation should answer is whether the combination of educational qualification levels of staff working with young children below bachelor level and the absence of evidence-based programs for working with children, coupled with the absence of evidence-based training programs for professional development, is unfortunate and may explain the weak ECEC results in the Dutch context.

Disclosure statement

No potential conflict of interest was reported by the authors.

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- * *Studies included in the meta-analysis are marked with an asterisk.*
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