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All it Takes for a Teacher is to Know the Children? – An empirical study on increasing child development in Vietnamese preschools

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Extended Abstract

Process-oriented child monitoring (POM) deals with systematic monitoring of the observed learning needs of children in early childhood education by teachers. Between 2017 and 2021, a teacher professional development trajectory was implemented using POM in ethnically diverse preschools in Central Vietnam. This study evaluates the effectiveness of this intervention using a pre- and post-test research design with a treatment and control group. Participants (N=339) in the study were assigned to the treatment or control group by using a clustered-randomized sampling approach. Results indicate that POM is promising in increasing holistic child development. 5-year-old girls show most progression in cognitive functioning and socio-emotional development, while boys at this age indicate advances in socio-emotional development and health behaviors. Further evidence indicates that changes in teaching children from poor households play out much faster on child development, as opposed to what is observed among wealthier households.

Keywords: child-centered teaching; child development; cognitive development; disadvantaged; socio-emotional; Vietnam

Disclosure

Conflict of interest

The authors declare that they have no relevant material or financial interests that relate to the research described in this paper.

Availability of data and material

For replication purposes of this study, the data are available at DOI: 10.13140/RG.2.2.20105.57448.

Code availability

For replication purposes of this study, the STATA-code is available at DOI: 10.13140/RG.2.2.33527.34720

Consent for publication

All stakeholders involved in this study, including the authors, gave informed consent to publish this manuscript without the inclusion of (identifiable) personal data. The data in this study were processed anonymously.

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1. Introduction

Participation in quality education from the early years of life has been promoted by many authors as an effective policy strategy for improved life-time outcomes (among others, Anderson, 2008; Pianta et al., 2009; Heckman et al., 2010; Apps et al., 2013; Claessens et al., 2014; Kautz & Heckman, 2014; Nakamichi et al., 2022). The question remains, however, what kind of interventions effectively achieve good quality early childhood education, leading to higher developmental outcomes for children below age 6. Brunsek et al. (2020), Cassidy et al. (2005) and Vandell & Wolfe (2000), among others, classify quality in early childhood education (ECE) as process or structural quality. Structural quality captures background characteristics and environmental factors wherein ECE takes place, for example, teacher qualifications and years of experience and the teacher-child ratio (e.g. Glewwe et al., 2013; Bauchmüller et al., 2014; Calzada et al., 2015). Process quality then refers to (classroom) dynamics, for example, the interaction between the teacher and the child or between children, or the way the children behave in the classroom environment (Laevers, 2003, 2011, 2012, 2017; Weiland & Yoshikawa, 2013). Brunsek et al. (2020, p.218) argues in this respect that *"structural quality indicators set the stage for the kind of processes that children experience directly, [but] associations between a range of both process and structural quality indicators in ECEC settings and child outcomes have been weak at best."* Glewwe et al. (2013) could also not confirm a causal effects of structural quality indicators (e.g. school infrastructure, pedagogical materials, teacher characteristics, and school organization) on student enrolment and achievement.

Egert et al. (2020, p.2) then again find in their meta-analysis that continuous professional development (CPD) of teachers in preschools that improve the quality of pedagogical processes in ECE (and care) support children's development. The authors conclude that CPD in ECE should rather focus on classroom practices (or process quality), to which instructional goals, learning goals, or teaching materials are matched. These findings are supported by other authors (e.g. Mashburn et al., 2008; Ponitz et al., 2009; Weiland & Yoshikawa, 2013; Early et al. 2017).

Based on the previous literature, a focus on process quality interventions can be deemed justified. We further deepen our understanding on the effectiveness of such process quality interventions in this paper, by looking at a teacher CPD trajectory in using process-oriented child monitoring (POM) as a didactic method (Laevers, 2003, 2011, 2012, 2017). The idea of the intervention is that teachers learn to monitor children's involvement and wellbeing in the classroom. Teachers can then change their instruction methods or activities in the classroom based on (individual and collective reflection on) the (learning) needs of the children. The intervention specifically targets children at-risk of barriers to involvement and wellbeing.

In this paper, we evaluate whether the hypothesis, that a teacher CPD trajectory in POM leads to increased child development, holds. Doing so, this paper contributes to the previous literature in at least three ways. First, child development comprises of a wide range of outcomes. The effectiveness of educational interventions in the early years of life may indeed be expressed in

other outcomes than subject-related test scores. For example, a child who knows how to behave in certain situations, who learns to recognize emotions, or who can perform actions such as pouring water into a cup, are outcomes as important to the teacher as recognizing letters and numbers. There are indeed several learning outcomes that are specific to the young child, which can also be observed in the wide variety of interventions (Stipek et al., 1992; Brunsek et al., 2020; Mondi et al., 2021). In this paper, we look at the effects of applying POM in class on cognitive functioning, motor development, socio-emotional learning, health behaviors, emergent literacy, cultural knowledge and participation, and approaches to learning.

Second, the quality of early childhood education is at the heart of many interventions in OECD and low-and-middle-income-countries (Brunsek et al., 2020; Egert et al., 2018, 2020; Nakamichi et al., 2022). Yet, the evidence base on the best way forward is still limited. While the meta-analysis of Brunsek et al. (2020) and Egert et al. (2020) cover studies on the effectiveness of interventions targeting process quality, the authors can provide only little evidence base on what works for disadvantaged families, especially when these families live in ethnically diverse regions in low-and-middle-income-countries. This paper summarizes the findings of an empirical study on the effectiveness of implementing POM in disadvantaged, ethnically diverse preschools in Central Vietnam. Mondi et al (2021) further argue the general lack of research in the context of public kindergarten, especially when it comes to important domains of child development like socio-emotional learning. Avenues for further program implementation are addressed in this paper.

Third, our study relies on a pre-test and post-test research design with children assigned to a treatment group and a control group as to reveal causal effects. To improve on the comparability between treated and untreated children, we conducted a clustered-randomized sampling approach. Data were collected by a team of trained assessors, using a validated instrument measuring child development in the East Asia and the Pacific region. The survey instrument also includes a parent questionnaire. This allows us to account for important contextual factors of the children's families, for example, educational level or job of the mother, and the socio-economic status of the household.

This paper proceeds as follows. In Section 2, we discuss the intervention under evaluation in this paper; the BaMi-project. Section 3 presents a discussion on data collection and empirical methods. The descriptive statistics are given in Section 4. Section 5 presents the main results. We also evaluate the effectiveness of the intervention by sub-populations observed in the data in Section 6. Section 7 concludes. The limitations to this study are discussed in Section 8.

2. The intervention logic

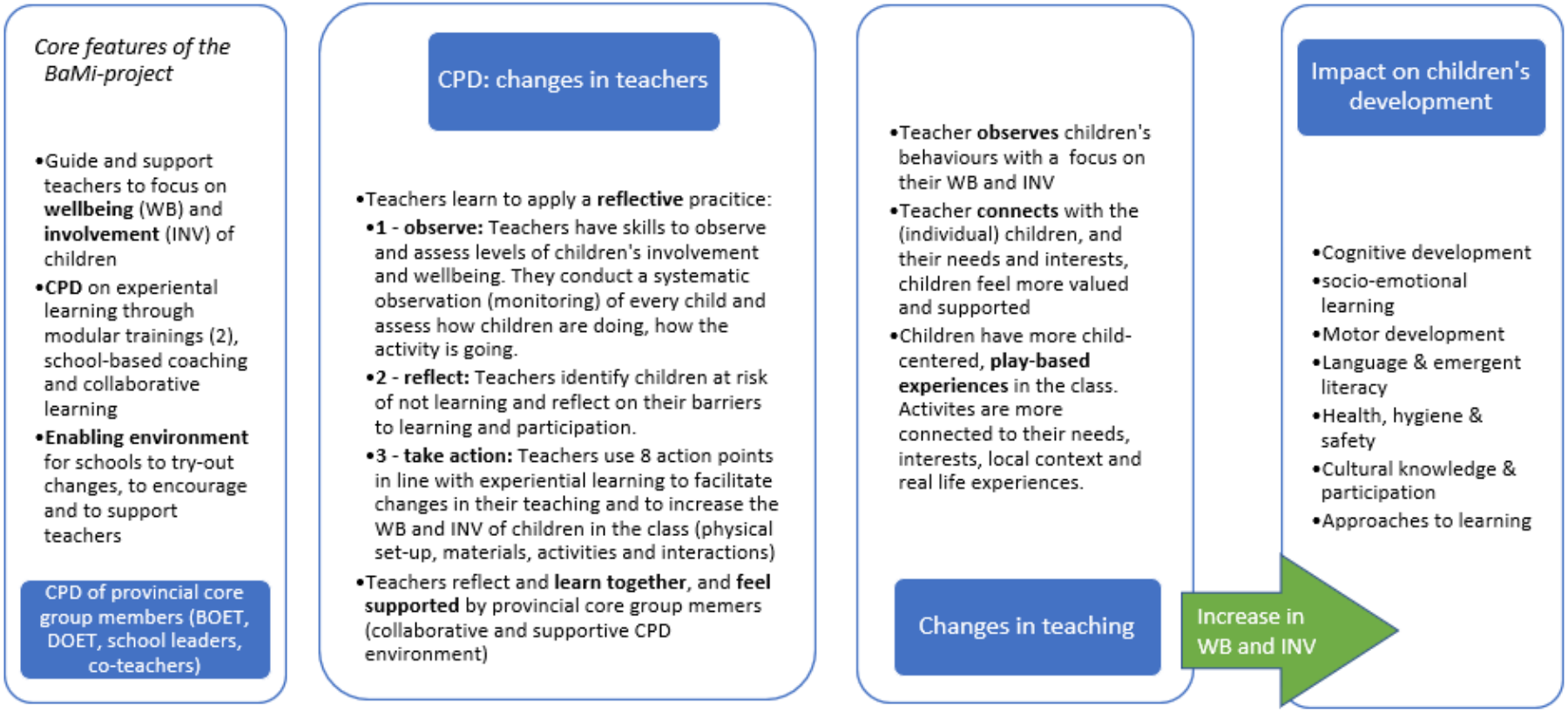
POM is included in the project 'Mitigating Preschool Children's Barriers to Learning in disadvantaged and ethnically diverse districts in Central Vietnam' (short: the BaMi-project). The project ran between 2017 and 2021 and focused on nineteen districts in three provinces in Central Vietnam: Kon Tum, Quang Nam and Quang Ngai. Children from ethnic minority households are overrepresented in these provinces. They pose challenges to teaching in early childhood education

because of their backlog in multiple domains of child development, and teachers are often not sufficiently equipped to deal with these challenges.

Figure 1 presents an overview of the actions taken in the BaMi-project. The figure can be read from the left to the right. The short-term outcomes of the BaMi-project are to increase the quality of teaching skills of teachers in preschools geographically located in the ethnically diverse districts in Kon Tum, Quang Nam and Quang Ngai. To this end, a capacity building trajectory was initiated for provincial core members, namely: the provincial Departments of Education and Training (DOET), the district Bureaus of Education and Training (BOET), and school leaders, co-teachers. The capacity building trajectory focused on continuous professional development in process-oriented child monitoring (POM) (Laevers, 2003, 2011, 2012, 2017). The idea is that the provincial core members can implement POM at scale in the different provinces.

School leaders and co-teachers are also involved in the coaching of the in-service teachers, providing an enabling environment to teachers for using an innovative didactic approach (POM) in their schools. The capacity building trajectory is situated in the box to the left in Figure 1.

Figure 1: Summary of the BaMi-project



Context: Children growing up in disadvantaged and ethnically diverse districts in Central Vietnam.

* Acronyms: Continuous professional development (CPD); wellbeing (WB) and Involvement (INV); the provincial Departments of Education and Training (DOET); and the district Bureaus of Education and Training (BOET).

POM typically focusses on the identification by teachers of levels of involvement in education and wellbeing among children (Laevers, 2011, 2012; Lenaerts et al., 2017). Teachers observe the children, address barriers to children at-risk of not learning, and undertake the necessary action to engage those children again in class. Furthermore, the teachers organize the classroom in corners, learn to use new materials in class, hereby trying to connect more closely to the children's environment. Upon the application of POM in class by teachers, the BaMi-project leads to changes in instruction that impact children's development (Desimone, 2009). The changes induced by the BaMi-project o the teachers' didactics are positioned in the two middle boxes in Figure 1.

We position child development in the box to the right in Figure 1. There are many abilities of young children that evolve over time in preschool. Age is indeed considered an important predictor of development (among others, Contreras & González, 2015). In this paper, we focus on those increases in child development that go beyond age, and that can be ascribed to the introduction of the BaMi-project in the treated schools. We assess different pillars of child development by using the survey instrument EAP-ECDS (East Asia–Pacific Early Child Development Scales) that is proven to be applicable in Asian countries (Rao et al., 2019). As such, we wish not to select what to measure of child development beforehand, because POM meets different (learning) needs of children, and differential impacts on child development can be expected, for example, by gender, or socio-economic status. It then makes no sense to select domains of child development beforehand because those domains can vary from child to

child. Children's needs (of learning) are indeed the most important drivers of what is learned in class (Laevers, 2017).

At the same time, we do acknowledge that the (learning) needs will be age-specific, and therefore captured in the development scales of the EAP-ECDS. Laevers et al. (2011, 2012) argue that POM focusses on children's feelings of 'connectiveness' or 'engagement' with learning, the teachers, the peers. This makes us assume that POM could lead to improved socio-emotional development, which is further hypothesized to impact cognitive development (Heckman & Kautz, 2012; Hanushek et al., 2015; [Blinded for Review]). But POM can also lead to direct impacts on cognitive development in case teachers are able to mitigate barriers to learning of, for example, emergent numeracy and literacy. There are no reasons to assume that motor development would improve because of POM, unless teachers identify important child-specific needs (or interests) in this respect. In summary, having a wide range of indicators of development assessed will also make us understand what is most needed in our selected Vietnamese schools.

3. Data and methods

3.1. Ethics statement

This study relies on a structured questionnaire taken from children in the participating schools. We followed the ethical guidelines for research. First of all, this study was approved by the Ministry of Education and Training (MOET) in Vietnam. They carefully checked the ethical code of conduct of the research and gave written approval to proceed with this study. All children were informed on

the research purposes and goals by an independent interviewer who asked the questions, clarified difficult questions, and who filled in the questionnaire for them. Children were taken out of the classroom to a place where they could freely discuss the questions with the interviewer. Then again, the children voluntary participated in this study. Children could stop the interview at any time. We were given informed consent by the participating schools and the Ministry of Education and Training to anonymously process the data of the children as part of the research. Parents from the children in this study provided their signed consent prior to participation in the questionnaires.

3.2. Sample selection

The pilot study benefits from a clustered-randomized sampling approach using randomly chosen schools and districts from 3 provinces in Central Vietnam. These provinces are: Quang Nam, Quang Ngai and Kon Tum. Then again, for the purpose of this study, seven schools, which consist of the main school and their satellites, were randomly selected in the districts for collecting the data among the same children at baseline and post-intervention. Three of seven schools were assigned to the treatment group, or one school in every district. These schools initiated the BaMi-project in 2017. Four of seven schools were assigned to the control group, having 2 schools from the district in Quang Nam province, and one school per district from the other two provinces. These schools did only receive the BaMi-project as from 2020, allowing us to collect data of the untreated children at a similar pace as the treated children between 2017-2020, without interference of the BaMi-project in the control group.

The school year in Vietnam usually lasts from September until May. The baseline assessment taken from the children for the purpose of this research, took place at the beginning of the school year November 2018. At that time, we collected information of 423 unique 3-year-olds children going to the 7 different rural preschools. These newly enrolled children did not receive an intervention yet within the scope of the BaMi-project. Post-intervention, we collected data of the same children in November 2020. The children are then 5-year-olds and benefitted maximal 2 years from the BaMi project.

The dataset was subject to data cleaning. We dropped 32 children (Kinh) from the sample that are not considered as ethnic minority. Whereas the BaMi-project targeted specifically rural preschools in disadvantaged, ethnically diverse districts, Kinh children rarely occur in the school population. They mostly go to urban preschools. Because preschools have them at very different enrolment rates, our sample would be unbalanced with the Kinh children included. Therefore, we decided to drop them from the sample.

Table 1: Number of children (N=339)

Provinces	Control group	Treatment group	Total
Quang Nam	58	64	122
	47.5%	52.5%	
Quang Ngai	39	57	96
	40.6%	59.4%	
Kon Tum	79	42	121
	65.3%	34.7%	
Total	176	163	339
	51.9%	48.1%	

Then again, post-intervention, we were unable to track back the information on 48 (not Kinh) children, of whom 18 were assigned to the control group, and 30 to the treatment group. We have no selectivity issues regarding the sample attrition and, therefore, ignore sample attrition in further analysis (Appendix A). This leads to a total sample size of 339 unique children in the pre- and post-intervention study or 678 observations (Table 1).

Power analysis reveals that having 176 children in the control group and 163 children in the treatment group, allows us to detect small to moderate effect sizes of minimal 0.28 standard deviations with an error probability of 5% and statistical power of 0.80. This means that we likely will not detect (very) small effect sizes as statistically significant. Further, our calculations also departed from the assumption that the intra-class correlation coefficients (ICC) are close to zero. If the ICC would be larger than expected, then the statistical power of our models will drop below 80%. There are no reasons to believe that very young children's learning processes are strongly influenced by the other children in the class or school, the more because POM departs from the learning needs of the individual child. But we explore the ICC in Section 5, and these analyses confirm that most development scales have an ICC close to zero.

3.3. Empirical methods

The pilot study uses a baseline and post-intervention study, tracking the same children over time. This allows us to compare treated with untreated children over time, controlling as best as possible for unobserved time invariant child-level and

school-level characteristics in a multivariate regression (Angrist & Pischke, 2008). We then may write:

$$Y_{is} = \alpha_0 + \beta_1 D_{is} + \delta_1 T + \theta_1 (D_{is} \times T) + \sigma_s + \varepsilon_i, \quad (1)$$

where Y_{is} denotes the outcome variable child development, D_{is} a dummy variable with 0 the control group and 1 the treatment group, and T a time indicator with 0 the pre-intervention and 1 the post-intervention period. The parameter ε_i denotes the usual standard error, and parameter σ_s accounts for the fact that children in the treatment and the control group are clustered in schools. Further details on sample selection were given in Section 3.2.

The parameter of interest is θ_1, which measures the impact of the BaMi-project on child development. The parameter essentially measures child development in the treatment group post-intervention compared to the baseline study and the control group. We can easily add a vector X_{ij} to Equation (1) to control for several j observed pre-treatment characteristics such as gender, age of the child, weight and height of the child, age of the mother, years of schooling of the mother and indicators of socio-economic status.

4. Descriptive statistics

4.1. Student and household characteristics

The multivariate regression discussed in Section 3.3 benefits from the inclusion of several control variables. The control variables are the characteristics of the children and the households measured in the baseline study. Because they were

measured at baseline, the control variables can be referred to as pre-intervention characteristics. Table 2 presents the summary statistics.

Table 2: Summary statistics of the pre-intervention characteristics of the children and the households

	Control group (N=176)		Treatment group (N=163)			
	Mean	**Std.Dev.**	**Mean**	**Std.Dev.**	**Diff.**	
Child characteristics						
Age	3.5	0.3	3.5	0.3	0.0	
Female	0.443	0.498	0.472	0.501	0.029	
Weight	12.6	1.4	12.7	1.5	0.0	
Height	91.2	4.4	92.0	4.8	0.8	
BMI	15.5	1.1	15.3	1.4	-0.2	
Household characteristics						
Age of mother	31.2	6.1	30.0	5.7	-1.2	*
Years of schooling of mother	7.1	4.0	7.7	4.2	0.6	
Mother is farmer or fisher	0.881	0.325	0.914	0.281	0.033	
Number of children	3.4	2.4	2.5	1.1	-0.9	***
Asset index	-0.483	1.316	-0.681	1.117	-0.197	
Years living in city	21.3	12.3	21.6	12.4	0.3	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).

Children are on average 3.5-year-olds (42 months) at the baseline assessment in November 2018. Almost half of them is female. Weight and height are a little below normal ranges of children of that age. From weight and height, we compute the body mass index (BMI) of the children. An average of 15.5 indicates a healthy weight.

Regarding household characteristics, we mainly look at the mothers, because the mothers' answers to the questionnaires were most complete, and because previous literature already indicated that mothers are most important for the child's educational attainment (Momo et al., 2019). Mothers of the 3-year-olds children are aged on average 30 to 31. They have a family at that age with 2 to 3

children. About 90% of the mothers is a farmer or fisherman[1], and they have had 7 to 8 years of schooling. Most families in our sample are living already 21 years a life in the city.

Then again, the asset index is a standardized variable that was constructed by using principal components analysis on a list of items (assets) that households may or may not have: electricity, radio, television, a telephone, a refrigerator, internet access, a watch, a mobile phone, a bicycle, a motorbike, a car, livestock and a bank account. It also includes two indicators on being owner of a house or owner of agricultural land. The asset index is a relative indicator of household wealth. Households having several assets, are considered wealthier, than households having only few. Households from the treatment group are relatively poorer than households from the control group, but the difference is not significant.

Overall, the pre-intervention characteristics are considered comparable between the treatment group and the control group. This is presented in the final two columns in Table 2 using independent sample T-statistics to estimate the significance level. We find no significant differences on the child characteristics. Regarding the household characteristics, we observe that age of the mother and the number of children in the household are significantly different between de treatment group and the control group. These differences, however, between the two groups are small.

[1] From the questionnaire we cannot disentangle the answers farmer from fisherman. However, whereas mothers are living on average a relatively long period of 21 years in the city, we believe the answer 'farmer' as profession will be given the most.

4.2. Outcome variables

The Viet Nam National Institute of Educational Sciences (VNIES) conducted a questionnaire in selected schools to evaluate the BaMi-project. The questionnaire heavily relied on the EAP-ECDS. The main benefit of the EAP-ECDS, is that it includes a set of validated questions and concepts monitoring the development of vulnerable and at-risk children living in Asian countries (Rao et al., 2019). There are seven early child development scales included in the questionnaire to evaluate the BaMi-project, namely: (1) cognitive development; (2) socio-emotional learning; (3) motor development; (4) language and emergent literacy; (5) health, hygiene and safety; (6) cultural knowledge and participation; and (7) approaches to learning. The competencies assessed and the reliability statistics of each of these scales based on our data are presented Appendix B. Overall, we observe good reliability statistics beyond the convention of 0.7. This strengthens the use of the EAP-ECDS in Vietnam.

Table 3: Mean scores on the outcome variables at baseline

	Control group (N=176)		Treatment group (N=163)			
	Mean	**Std.Dev.**	**Mean**	**Std.Dev.**	**Diff.**	
Unstandardized outcomes						
Cognitive development	3.01	2.92	3.32	3.05	-0.31	
Socio-emotional learning	1.07	1.86	1.42	2.09	-0.34	
Motor development	3.21	1.93	3.43	1.70	-0.22	
Language & emergent literacy	2.03	2.37	2.77	2.94	-0.73	**
Health, hygiene & safety	1.44	2.19	1.96	2.56	-0.52	**
Cultural knowledge & participation	3.19	2.83	3.38	2.66	-0.19	
Approaches to learning	0.11	0.49	0.13	0.55	-0.02	
Total score	14.07	10.53	16.21	10.59	-2.15	*

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).

The mean sores on the scales at baseline, and the standardized mean scores, are presented in Table 3.[2] Children aged 3.5 years have on average low to very low scores on the different indicators of child development. This is in line with the study of Rao et al. (2019). There are significant differences observed between the control group and the treatment group at baseline regarding the unstandardized scales language and emergent literacy. Upon standardization, these differences can be ignored for these scales, but then again appear in two other scales, namely: socio-emotional learning and approaches to learning (not shown in Table 3). The fact that we observe significant differences on a couple of scales should not be worrisome, because we evaluate the progress made on the scales between the baseline and post-intervention study for the same group of children.

4.3. Process-oriented child monitoring instrument

Teachers in the treatment group learn how to conduct a systematic monitoring of the children's involvement and wellbeing (Section 2). At least twice a year, they assess wellbeing and involvement of each child on a 5-point Likert scale. The scores on the levels of wellbeing can be interpreted as follows: level 1 indicates that the child is uncomfortable, anxious and/or disruptive. Children with level 2 show elements of level 1, but less strongly expressed. Then again, level 3 indicates that the child does not show clear negative or positive emotions (neutral). Children with level 5 are like a fish in the water, or fully at ease. Children

[2] Appendix C further elaborates on the pre- and post-intervention scores separated by gender. And appendix D compares the performance of children in the Vietnam sample with performance of children in Cambodia and Vietnam.

with level 4 also show these elements of level 5, but they are less strongly expressed.

Regarding the scores on the level of involvement, the level 1 indicates that the child hardly engages in any activities. He is easily distracted and shows no mental or little activity. Then again, children with level 2 have sporadic, interrupter activity. Level 3 denotes sustained activity by the child, but not absorbed. He acts is a routine matter, without much comfort. Children with level 4 are absorbed by the activity, with moments of intense concentration. Finally, level 5 is given to children who are concentrated and focused, when they show interest, curiosity and even fascination, and when they are intrinsically motivated and open to relevant stimuli.

The teacher conducts a first-class screening at the beginning (October) and a final class screening at the end of the school year (April). In November 2018 of the school year 2018-2019, teachers conducted this assessment for the first time for the children included in the research. The average score on involvement back then was 3.2 with standard deviation of 0.9. Regarding wellbeing, we observe an average score of 3.1 with a standard deviation of 0.9. The second time took place around April 2019 of that same school year. This is then repeated for the school years 2019-2020, and 2020-2021. Because of the COVID-19 pandemic, the measurement got delayed to June 2020 due to school closures in February 2020.

We use the different assessments of children's wellbeing and involvement to calculate the average increase on these indicators over the school years. Table

4 indicates the average increase in the scores on the 5-point Likert scale between the first assessment in November 2018 and another measurement point at a later point in time. It is concluded that children made on average a progression on wellbeing of 0.46 points in the short term (school year 2018-2019), of 0.75 in the mid-term (2018-2019 to 2019-2020) and 0.96 in the long-term (2018-2019 to 2020-2021). Regarding involvement, the scores increase with 0.39, 0.74 and 0.91 in the short term, mid term and long term, respectively.

*Table 4: Average increase on wellbeing and involvement of treated children (N=160) over time**

	Years covered	Average increase	Std. Dev.	Min	Max
Wellbeing					
Short-term	2018-2019	0.463***	0.690	-1	3
Mid-term	2018-2020	0.750***	0.718	-1	3
Long-term	2018-2021	0.956***	0.967	-1	4
Involvement					
Short-term	2018-2019	0.388***	0.644	-1	3
Mid-term	2018-2020	0.738***	0.687	-1	3
Long-term	2018-2021	0.913***	0.934	-1	4

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).
Note: The BaMi project ran between 2017 and 2021. The short-term improvement in wellbeing and involvement is measured between November 2018, the first time the POM instrument was used for the children included in the research, and April 2019; the mid-term between November 2018 and June 2020; and the long-term between November 2018 and April 2021. In the year 2020, the COVID-19 pandemic caused school closures in February 2020. Therefore, wellbeing got only measured in June 2020, when schools were again back open for several weeks.

A paired sample T-test indicates that the average increase in wellbeing and involvement in the short term, mid-term and long-term are significant at 1%-level. As such, children made significant progression on both wellbeing and involvement over time. On the one hand this is promising regarding the potential impact the BaMi-project may have had on child development. On the other hand the data may mask socially desirable biases, because teachers may score

children's wellbeing and involvement higher to validate their teaching efforts. These results should therefore be interpreted with caution.

5. Effects of BaMi-project on child development

The main results are presented in Table 5. The outcome variables are measured as scores on the 5-point Likert scale (points). Full model estimates are included in Appendix D. We estimate three models in Table 4. The first model includes no control variables, while the second model does. The list of control variables can be found in Section 4.1 (Table 2). In the third model we apply a standardization procedure at the district-level of the outcome variables regarding child development. Standardization of the outcome variables at district-level allows us to further account for different contextual or environmental factors across districts. The results are then interpreted as an increase (or decrease) in units of standard deviations (SD) in child development. The final column contains the values of the ICC.

The results indicate that the BaMi-project increased the scores on three development scales. First, the BaMi project increased the scores on socio-emotional learning with 2.2 points (Model 1) significant at 1%-level compared to the control group and the baseline study. These results do not change in Model 2 that includes a set of important control variables like age, gender, and mothers' educational level.

Table 5: Summary of the main results

	Model 1 (points)		Model 2 (points)		Model 3 (SD)		ICC (correlation)	
Cognitive development	0.691		0.713		0.106		0.0160	
	(0.45)		(0.45)		(0.09)		(0.025)	
Socio-emotional learning	2.218	***	2.223	***	0.495	***	0.0662	
	(0.43)		(0.44)		(0.10)		(0.040)	
Motor development	0.016		0.029		-0.046		0.0816	
	(0.20)		(0.20)		(0.10)		(0.063)	
Language & emergent literacy	0.187		0.211		0.040		0.1179	**
	(0.48)		(0.48)		(0.09)		(0.059)	
Health, hygiene & safety	1.213	***	1.223	***	0.312	***	0.1546	***
	(0.35)		(0.36)		(0.10)		(0.066)	
Cultural knowledge & participation	0.138		0.147		0.041		0.0309	
	(0.32)		(0.32)		(0.12)		(0.033)	
Approaches to learning	0.538	*	0.549	*	0.182		0.0206	
	(0.29)		(0.29)		(0.12)		(0.023)	
Total score	5.064	***	5.160	***	0.191	***	0.1094	*
	(1.43)		(1.45)		(0.07)		(0.055)	
Control variables	No		Yes		Yes		Yes	
Obs.	678		678		678		678	
Clusters	339		339		339		339	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).

There is also a significant impact on the outcome variable health, hygiene and safety. The estimated coefficient is equal to 1.2 points significant at 1%-level (Model 1). This coefficient is again robust to including control variables in Model 2.

Another significant effect is found on the outcome variable approaches to learning. Children in the treatment group are increasing their scores on approaches to learning with 0.5 points significant at 10%-level compared to the control group and the baseline study.

Apart from the separate development scales included in our questionnaire, we also present the findings for the total score. Conclusions are then based on all

development scales together. We find that the total score increased with 5.1 points significant at 1%-level. These findings are robust to including control variables.

Considering the results presented in Model 3 our conclusions do not change much. The BaMi-project significantly increases children's development regarding socio-emotional learning (+0.495 SD), and health, hygiene, and safety (+0.312 SD). Also, the total score is again significant, and equal to 0.191 SD. The significance regarding approaches to learning disappears, however, which may be due to lack of statistical power.

The ICC in the final column deal with the association between child development and the schools wherein they are enrolled. Children are nested in the main schools and their satellites, which may drive statistically significant ICC, for example, in case interactions between children matter for learning. We find that most development scales are not subject to significant ICC. Only language and emergent literacy and health, hygiene and safety have significant ICC. Despite the significant ICC, we do not worry much about the implications for statistical power regarding these two development scales. First of all, because of the positive impact of the BaMi project on the health development scale. And secondly, the increase of +0.04 SD in Model 3 regarding language and emergent literacy is close to zero. Even in case of significance – if we would be able to increase in statistical power – such a minor effect can be considered negligible.

6. Heterogeneity of the effects

The BaMi-project can have different effects across sub-populations, for example: boys versus girls, or on children from poor versus wealthier households. In this section, we present these heterogeneous effects in Table 6 and Table 7. Both tables present the effects on the unstandardized development scales and the standardized development scales. We follow the same standardization procedure at district-level as described above.

We can conclude from Table 6 that the BaMi-project yielded larger effects on boys than on girls. The coefficient on the total score is equal to 6.4 points (or 0.259 SD) significant at 1%-level. The increase in the total score of girls of 3.5 points is significant at 10%-level but cannot be withhold upon controlling for contextual differences between districts (0.112 SD).

Consider the development scales in Table 6, we conclude that boys benefitted the most from the intervention in terms of improved socio-emotional learning (+2.7 points or 0.608 SD), and health, hygiene, and safety (+1.7 points or 0.476 SD). Girls, on the other hand, benefitted the most from the intervention in terms of socio-emotional learning (+1.7 points or 0.361 SD) and cognitive development (+1.4 points or 0.236 SD).

Earlier literature indicates lack of consensus on the differential effects across boys and girls (Anderson, 2008; Weiland & Yoshikawa, 2013; Magnuson et al., 2016). The meta-analysis of Magnuson et al. (2016) indicated that boys and girls usually equally benefit from intervention in early childhood education regarding

cognitive development, including measures of foundational numeracy and literacy skills. The authors estimate an effect size approximately equal to 0.2 SD significant at 1%-level. Then again, Anderson (2008) argues that girls benefit more than boys. However, both reviews of Magnuson et al. (2016) and Anderson (2008) are looking far more in the future than our study has done, namely: an average of four years after program implementation to adulthood, respectively. The findings of the study of Magnuson et al. (2016) is therefore closer to our study than the one of Anderson (2008).

Table 6: Effects of the BaMi-project on boys and girls

	Unstandardized Development scales (points)				**Standardized Development scales (SD)**			
	Boys		**Girls**		**Boys**		**Girls**	
Cognitive development	0.101		1.427	**	-0.006		0.236	*
	(0.64)		(0.66)		(0.12)		(0.13)	
Socio-emotional learning	2.662	***	1.677	**	0.608	***	0.361	**
	(0.56)		(0.69)		(0.14)		(0.16)	
Motor development	0.032		-0.245		0.016		-0.117	
	(0.30)		(0.31)		(0.14)		(0.14)	
Language & emergent literacy	0.858		-0.649		0.140		-0.085	
	(0.69)		(0.69)		(0.12)		(0.12)	
Health, hygiene & safety	1.674	***	0.668		0.476	***	0.124	
	(0.50)		(0.51)		(0.14)		(0.14)	
Cultural knowledge & participation	0.454		-0.183		0.158		-0.084	
	(0.43)		(0.48)		(0.16)		(0.18)	
Approaches to learning	0.528		0.545		0.165		0.196	
	(0.40)		(0.44)		(0.17)		(0.18)	
Total score	6.404	***	3.530	*	0.259	***	0.112	
	(2.05)		(2.11)		(0.09)		(0.10)	
Observations	367		311		367		311	
Clusters	185		157		185		157	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***). All models include control variables.

It is rather difficult to assess whether our findings are in line with previous literature. Based on Table 6 we argue that boys are overall benefiting more than

girls, but when looking into the development scales, the coefficients of girls and boys are unequal on some scales. For example, girls make significant progression in cognitive development, while boys do not. And regarding the advances in socio-emotional learning, which was not reported on in the meta-analysis of Magnuson et al. (2016), the difference between girls and boys of almost 1 point is significant at 10%-level. We withhold differential effects across boys and girls with largest benefits for the boys. Because POM puts emphasis on teachers meeting children's individual (learning) needs, we could argue that teachers emphasis on girls' progression in cognitive functioning and socio-emotional development, while they emphasis on boys' socio-emotional development and health behaviors.

In Table 7 we additionally look at the relative wealth of households. We consider the relatively poor as below the median of the asset index, while the relatively rich are above the median. We can conclude from this table that wealthier households benefit less from the BaMi-project than poor households. Children from poor households faced an increase in cognitive development, socio-emotional learning, health, hygiene, and safety, and approaches to learning owing to the implementation of the BaMi-project.

Table 7: Effects of the BaMi-project on children from poor and wealthier households

	Unstandardized Development scales (points)				Standardized Development scales (SD)			
	Poor households		Wealthier households		Poor households		Wealthier households	
	Below median value of asset index		Above median value of asset index		Below median value of asset index		Above median value of asset index	
Cognitive development	1.454	**	-0.008		0.250	**	-0.035	
	(0.65)		(0.65)		(0.13)		(0.13)	
Socio-emotional learning	2.785	***	1.711	***	0.595	***	0.407	
	(0.60)		(0.63)		(0.14)		(0.15)	
Motor development	0.000		-0.198		0.005		-0.102	
	(0.30)		(0.30)		(0.14)		(0.14)	
Language & emergent literacy	0.174		0.252		-0.009		0.091	
	(0.68)		(0.71)		(0.12)		(0.13)	
Health, hygiene & safety	1.549	***	0.941	*	0.396	***	0.241	*
	(0.50)		(0.50)		(0.13)		(0.14)	
Cultural knowledge & participation	-0.059		0.356		-0.022		0.104	
	(0.47)		(0.45)		(0.18)		(0.17)	
Approaches to learning	0.882	**	0.240		0.324	*	0.050	
	(0.42)		(0.41)		(0.17)		(0.17)	
Total score	6.958	***	3.502	*	0.256	***	0.133	
	(2.11)		(2.01)		(0.09)		(0.09)	
Observations	338		340		338		340	
Clusters	169		170		169		170	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***). All models include control variables.
Note: The threshold for defining poor and wealthier households is the median (50%) value of the asset index. The asset index includes a list of items (assets) that households may or may not have: electricity, radio, television, a telephone, a refrigerator, internet access, a watch, a mobile phone, a bicycle, a motorbike, a car, livestock and a bank account. It also includes two indicators on being owner of a house or owner of agricultural land.

To better understand the reason why poor households improved more on the development scales than wealthier households, we plotted the association between the increase in the level of involvement and wellbeing on the POM-instrument in the short-term, mid-term and long-term and household wealth (Figure 2). It is observed that wealthier households improved a little more on the POM-instrument over time than poor households. However, the difference between poor and wealthier households in Figure 2 is never statistically significant. Furthermore, the point of departure in the school year 2018-2019 is

not statistically different for both involvement and wellbeing, meaning that both poor and wealthier households improved wellbeing and involvement at the same pace over time.

Figure 2: Association between the increase in points on the POM-instrument regarding involvement and wellbeing (Y-axis) and household wealth (X-axis)

However, previous literature indicated that we could consider these improvements in wellbeing and involvement among children with a low socio-economic status (SES) as less expected. Observations in those studies (among others, Smith et al., 1997; Duncan et al., 1998; Bradley & Corwyn, 2002; Stevens et al., 2009) point out that low-SES children more often disengage from education, and at an earlier stage in the educational career, than children from wealthier households. Based on the findings in this study, we could argue that changes from the BaMi project in teaching children from poor households play out much faster on child development.

It may also be the case that high-SES children need more complex changes in teaching in terms of child initiated and play-based learning. But we cannot prove that based on our data. If so, this would require support from school policy, such as guidance on curriculum implementation, which proves to be difficult in Vietnam.

7. Conclusion

This paper evaluated the effectiveness of the BaMi-project, an intervention that was implemented in a context of ethnically diverse preschools in Vietnam. The children targeted at in the BaMi-project face a serious backlog in child development. We have shown in this paper that POM is promising in targeting children's backlog at school. Whereas POM departs from the observed needs of children in class, and the teachers' skills to address those needs, we can argue that a CPD trajectory for teachers in using POM is effective in increasing socio-emotional learning, approaches to learning, cognitive development, and health, hygiene, and safety. Furthermore, boys seem to benefit more than girls from using POM, and this conclusion holds true upon controlling for contextual factors. However, girls make significant progression in cognitive development, while boys do not. Another observation is that wealthier households benefit less from the BaMi-project than poor households. We find arguments for the fact that changes from the BaMi project in teaching children from poor households play out much faster on child development; further research could further unravel this observation.

8. Limitations

While this study was carried out with great care, there is still room for improvement in further studies on this topic. First of all, the sample size is relatively small to detect very small significant effects. Whereas this study reports on a pilot study, we could not include more schools or children in the sample. We observe some movements in the data on the scales for language and emergent literacy and cultural knowledge and participation, but we cannot withhold significant effects in the total sample. Second, even though the survey instrument EAP-ECDS is clearly a strength for reasons of using validated questionnaires and comparison with other studies, our research could have benefitted from qualitative research further exploring the mechanisms underlying the estimated, quantitative effects. And finally, besides the heterogeneous effects by gender, we could also withhold significant differences between households' socio-economic status. Children from relatively poor families benefit more from the BaMi-project than children from wealthier households. Several (unobserved) mechanisms are clearly driving this difference in effect size between rich and poor. A likely explanation is that children from wealthier households present with less barriers to learning at school. Again, this child observation does not necessarily hold true, and may be rooted in teacher perceptions. Further research could explore why POM is a better, more effective intervention in preschools with a lot of disadvantaged children.

9. References

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Appendices

Appendix A: Selectivity of sample attrition

Table A: Selectivity of sample attrition

	Control group (N=18)		Treatment group (N=30)			
	Mean	**Std.Dev.**	**Mean**	**Std.Dev.**	**Diff**	**Sig.**
Child characteristics						
Age	3.5	0.2	3.6	0.3	0.1	
Female	0.4	0.5	0.2	0.4	-0.2	*
Weight	12.4	2.7	16.1	15.5	3.7	
Height	89.8	6.0	90.8	15.4	0.9	
BMI	15.2	1.9	15.2	2.0	0.0	
Household characteristics						
Age of mother	27.7	5.5	28.0	5.0	0.3	
Years of schooling of mother	7.9	4.6	7.7	4.7	-0.2	
Mother is farmer or fisher	0.7	0.5	0.6	0.5	0.0	
Number of children	2.1	1.1	2.2	1.0	0.1	
Asset index	-0.9	1.5	-0.1	1.9	0.8	
Years living in city	20.6	11.2	20.5	13.4	0.0	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).

Appendix B: Reliability statistics

Table B: Competencies assessed and reliability statistics of the concepts underlying the East Asia-Pacific Early Child Development Scales (short form) (N=339 children)

Domain	**Competencies assessed**	**Cronbach's alpha (reliability**
Cognitive development	Counting, addition and substraction, short-term memory, concepts and behavioural inhibition, and knowledge of shapes.	8 items, 27 questions, α=0.8839
Socio-emotional learning	Etiquette, social comprehension, emotional recognition, and perspective taking.	6 items, 18 questions, α=0.8961
Motor development	Gross motor skills	4 items, 7 questions, α=0.768
Language and emergent literacy	Expressive language, grapheme knowledge and writing and drawing.	6 items, 22 questions, α=0.9089
Health, hygiene and safety	Hygiene, safety, named body parts, and food safety.	4 items, 11 questions, α=0.8949
Cultural knowledge and	Knows local customs, knows local songs.	4 items, 11 questions, α=0.8469
Approaches to learning	Behavioural inhibition, cognitive flexibility, and engagement.	1 item, 6 questions, α=0.9575

Rao, Sun, Bacon-Shone, Ip, & Becher. (2016)

Appendix C: Mean scores pre- and post-intervention by gender

Table C: Mean scores on the outcome variables pre- and post-intervention and separated by gender

	Control group				Treatment group			
	Male (N=97)		Female (N=79)		Male (N=85)		Female (N=78)	
	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
Cognitive development	2.73	2.66	3.34	3.21	2.93	2.99	3.74	3.07
Socio-emotional learning	1.01	1.89	1.15	1.84	1.14	1.50	1.72	2.56
Motor development	3.22	2.04	3.20	1.79	3.45	1.86	3.42	1.51
Language & emergent literacy	2.02	2.59	2.05	2.09	2.21	2.63	3.37	3.16
Health, hygiene & safety	1.48	2.38	1.39	1.94	1.73	2.67	2.22	2.43
Cultural knowledge & participation	2.88	2.85	3.58	2.77	2.93	2.61	3.87	2.64
Approaches to learning	0.14	0.56	0.08	0.38	0.11	0.44	0.15	0.65
Total score	13.48	11.06	14.78	9.87	14.40	10.31	18.19	10.61
	Control group				Treatment group			
	Male (N=97)		Female (N=79)		Male (N=85)		Female (N=78)	
	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
Cognitive development	9.96	4.59	9.80	3.79	10.28	4.16	11.55	3.46
Socio-emotional learning	4.67	3.81	5.48	3.93	7.46	4.46	7.74	4.36
Motor development	6.27	1.05	6.29	1.15	6.52	0.80	6.26	1.11
Language & emergent literacy	9.82	4.32	11.27	3.98	10.85	4.65	11.99	4.22
Health, hygiene & safety	5.42	3.29	5.80	3.36	7.41	3.11	7.23	3.02
Cultural knowledge & participation	5.74	1.78	6.33	1.13	6.25	1.91	6.42	1.23
Approaches to learning	2.84	2.64	2.90	2.64	3.29	2.66	3.55	2.68
Total score	44.72	15.15	47.86	13.98	52.06	15.35	54.74	13.83

Appendix D: Full model estimates

Table D: Full model estimates

	Cognitive development			Socio-emotional learning			Motor development		
Treatment assignment $\hat{\beta}$	0.312	0.224		0.343	0.139		0.224	0.032	
	(0.33)	(0.36)		(0.22)	(0.27)		(0.20)	(0.21)	
Time $\hat{\delta}$	6.880 ***	1.740		3.960 ***	2.340 **		3.070 ***	0.411	
	(0.32)	(1.09)		(0.27)	(0.96)		(0.16)	(0.40)	
Effect $\hat{\theta}$	0.691	0.713		2.218 ***	2.223 ***		-0.110	-0.096	
	(0.45)	(0.45)		(0.43)	(0.44)		(0.21)	(0.21)	
Age		2.595 ***			0.824 *			1.332 ***	
		(0.53)			(0.47)			(0.18)	
Female		0.673 **			0.546 **			-0.045	
		(0.28)			(0.24)			(0.12)	
BMI		-0.158			-0.218 **			-0.030	
		(0.11)			(0.09)			(0.05)	
Age of mother		0.021			0.078 **			-0.001	
		(0.04)			(0.03)			(0.01)	
YOS of mother		0.148			0.129 ***			0.030	
		(0.04)			(0.03)			(0.02)	
Farmer/fisherman		-(0.34)			-(0.82) *			(0.39) *	
		(0.52)			(0.47)			(0.21)	
number of children		-0.093			-0.331 ***			-0.025	
		(0.10)			(0.09)			(0.04)	
asset index		0.512 ***			0.502 ***			0.150 **	
		(0.15)			(0.13)			(0.06)	
Years living in city		0.003			-0.005			0.012 **	
		(0.01)			(0.01)			(0.01)	
Vietnamese at home		0.134			0.105			-0.375 **	
		(0.42)			(0.32)			(0.15)	
Parents' language assessment		(0.33)			(0.26)			(0.06)	
		(0.33)			(0.26)			(0.13)	
constant	3.006 ***	-5.117 *		1.074 ***	-0.042		3.209 ***	-1.452	
	(0.22)	(2.63)		(0.14)	(2.37)		(0.15)	(1.14)	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).

(Table D: continued)

	Language skills & emergent literacy				Health, hygiene & safety				Cultural knowledge & participation			
Treatment assignment $\hat{\beta}$	0.734	**	0.455		0.521	**	0.332		0.188		0.022	
	(0.29)		(0.37)		(0.26)		(0.29)		(0.30)		(0.30)	
Time $\hat{\delta}$	8.439	***	2.720	**	4.151	***	1.944	**	2.813	***	0.359	
	(0.33)		(1.11)		(0.24)		(0.84)		(0.22)		(0.63)	
Effect $\hat{\theta}$	0.187		0.211		1.213	***	1.223	***	0.138		0.147	
	(0.48)		(0.48)		(0.35)		(0.36)		(0.32)		(0.32)	
Age			2.887	***			1.102	***			1.242	***
			(0.54)				(0.40)				(0.31)	
Female			0.956	***			0.229				0.598	***
			(0.29)				(0.22)				(0.17)	
BMI			-0.237	**			-0.099				-0.173	***
			(0.12)				(0.08)				(0.07)	
Age of mother			0.014				0.074	***			0.019	
			(0.03)				(0.03)				(0.02)	
YOS of mother			0.084	*			0.123	***			0.082	***
			(0.05)				(0.03)				(0.03)	
Farmer/fisherman			(0.34)				-(0.42)				-(0.07)	
			(0.55)				(0.47)				(0.34)	
number of children			-0.146				-0.288	***			-0.069	
			(0.10)				(0.10)				(0.06)	
asset index			0.371	***			0.329	***			0.174	*
			(0.13)				(0.12)				(0.09)	
Years living in city			0.003				0.013				-0.002	
			(0.01)				(0.01)				(0.01)	
Vietnamese at home			-0.177				0.225				-0.125	
			(0.41)				(0.29)				(0.23)	
Parents' language assessment			(0.13)				(0.65)	**			(0.08)	
			(0.36)				(0.26)				(0.20)	
constant	2.033	***	-5.564	*	1.440	***	-3.441	*	3.193	***	0.505	
	(0.18)		(2.85)		(0.16)		(2.06)		(0.21)		(1.79)	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).

(Table D: continued)

	Approaches to learning				Total score			
Treatment assignment $\hat{\beta}$	0.015		-0.124		2.149	*	0.923	
	(0.06)		(0.13)		(1.15)		(1.25)	
Time $\hat{\delta}$	2.750	***	0.626		32.064	***	9.889	***
	(0.20)		(0.54)		(0.97)		(3.78)	
Effect $\hat{\theta}$	0.538	*	0.549	*	5.064	***	5.160	***
	(0.29)		(0.29)		(1.43)		(1.45)	
Age			1.059	***			11.163	***
			(0.25)				(1.88)	
Female			0.118				3.023	***
			(0.14)				(0.99)	
BMI			-0.051				-0.962	**
			(0.06)				(0.38)	
Age of mother			-0.001				0.201	
			(0.02)				(0.13)	
YOS of mother			0.047	**			0.630	***
			(0.02)				(0.16)	
Farmer/fisherman			(0.15)				-(1.02)	
			(0.28)				(1.92)	
number of children			-0.010				-0.951	**
			(0.06)				(0.38)	
asset index			0.143	**			2.166	***
			(0.07)				(0.53)	
Years living in city			0.014	**			0.044	
			(0.01)				(0.05)	
Vietnamese at home			-0.196	*			-0.379	
			(0.20)				(1.42)	
Parents' language assessment			(0.23)				(1.76)	
			(0.17)				(1.17)	
constant	0.114	***	-3.542	**	14.066	***	-18.934	**
	(0.04)		(1.47)		(0.79)		(9.49)	

Significance at 10%-level (*); 5%-level (**); or 1%-level (***).

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