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Adjusting content to individual student needs: Further evidence from an in-service teacher training program[☆]

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ABSTRACT

Adapting instruction to the specific needs of each student is a promising strategy to improve overall academic achievement. In this article, I study the impact of an intensive in-service teacher training program on reading skills offered to kindergarten teachers in France. The program modifies the lesson content and encourages teachers to adapt instruction to student needs by dividing the class according to initial achievement. While assessing impact is usually difficult due to the presence of ability bias and teacher selection, I show that in this context, a value-added model that controls for school and teacher characteristics constitutes a legitimate strategy to estimate the treatment effect. Results show that all students benefiting from the program progressed in reading skills at the end of the year. Besides, weaker students progressed faster on less-advanced competences (such as letter recognition), while stronger students improved their reading skills. This suggests that teachers adjusted content to students' needs. Finally, a cost-effectiveness analysis reveals that the program is approximately three times more cost-effective than reducing class size in France.

The existence of large variation in teacher quality is indicative of the central role that teacher plays in the overall performance of an education system. The most reliable studies suggest that a one standard deviation increase in teacher quality raises student performance by at least 9.5% of a standard deviation,[1] a magnitude that is equivalent to a 5- to 10-year increase in teaching experience[2] or to

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[1] 9.5% is the effect found by Rivkin, Hanushek, and Kain (2005), and 10% by Rockoff (2004), using a different strategy, correcting for overestimation due to measurement error. Using simple teacher fixed effect, the literature review provided by Nye, Konstantopoulous, and Hedges (2004) gives effects from .26 to .46. Applying the same naive strategy on my data, I find consistent effects from .19 to .39, depending on the cognitive measure used.

[2] Hanushek (1971), Rockoff (2004), or more recently Harris and Sass (2011) all provide estimations varying from 1% to 2% of a standard deviation per year of experience. As we will see, I provide a slightly smaller estimation of the teacher experience effect (around 0.9%), maybe because experience is less meaningful in preschool than in primary school. Note that, for comparison matter, I report the experience effects per year, although this is probably not the most meaningful way. Most authors are able to identify a nonlinear relationship in which the experience effect is strongest during the first years and reaches a cutoff year above which experience is not predictive anymore. Due to lack of power, I am not able to implement such a model.

a class size reduction of 4–5 children.[3] Giving the right incentives, selecting the right teachers, and providing them with the right skills are all being investigated as potential ways to improve teaching in both developed and developing settings. The latter solution – pre-service and in-service teacher training – has been widely studied in developed countries. Teacher-training programs are appealing because, when effective, they are potentially a cost-efficient and lasting strategy to enhance student achievement.[4] Available empirical results are not always consistent, however, and the literature is still unable to reach consensus on the effectiveness of teacher training.

Four main challenges plague the literature on teacher training. First, it has proven difficult to isolate the causal effect of training from the effect of selection into training (teacher selection) and the effect of assignment of trained teachers to students (student selection). Second, isolating the effect of training from other policies implemented at the same time is sometimes challenging. Third, the vast diversity of teacher training programs – in term of content, nature, level, intensity, or even quality – renders difficult any sort of general statement on the effectiveness of such policy; a more refined approach is needed to parse what may be effective from what is not. Fourth, as mentioned, while teacher training programs are cheap when compared to programs that directly target students, they have only little effect on them (typically around 10% of a standard deviation). Lack of detection power has affected the quality of some studies.

This article alleviates some of these concerns. Results are based on a non-randomized empirical settings whereby treatment schools benefiting from the program are designated by the school district managers and the control schools are selected by the research team based on some school level characteristics. With precise data at the student level collected at baseline and endline, it is possible to use value added models to contrast the progress observed in treatment schools with the ones observed in similar control schools. Such design is potentially undermined by (1) selection bias (from teacher, school or even parents) and (2) by students naturally[5] progressing at different pace. While data at the teacher and school level are used to address the first difficult, I show that in this context – hereby when the treatment group is originally weaker than the control group – and under some (restrictive) assumptions, a value added model simply controlling for baseline test scores (VAM 1) give a low bound of the true treatment effect and should be preferred to a difference in differences model (VAM 2).

The results indicate that well-defined and intensive pedagogical training (based on explicit teaching, phonological awareness,[6] and small group tracking), well-monitored, when applied to one specific subject (reading) during one specific period of teaching time (when pupils start reading lessons, around 5 years old) is instrumental in improving kindergarten children's short-term reading achievement. I find an overall treatment effect of 15.3% of a standard deviation with results varying from no effect on the dimensions not stimulated by the program (vocabulary, comprehension) up to 44% of a standard deviation in decoding (non-lexical reading). A back-of-the-envelope cost-benefit calculation gives 12.5 € per percentage point of standard deviation gain: less cost-effective than a similar experiment run in England (see Section 2), but still much less expensive than my assessment of a class size reduction policy implemented in France (between 36 and 48 € per s.d.).

While a 15.3% of a standard deviation effect may seem small in magnitude, a 12.5 € per percentage point gain is arguably a very cost-effective strategy. In comparison, class size reduction programs have been reported to increase student performance from +2.2% to +3% of a standard deviation per child in French primary schools (Bressoux et al., 2009; Bressoux & Lima, 2011; Piketty & Valdenaire, 2006), for a cost of about 107 € per child, or 36–48 € per percentage point of standard deviation gain[7]: all being equal, the program evaluated here is hence at least three time more cost-effective than a class-size reduction program.

Equally important are the heterogeneous effects found by initial achievement. Since the training program was based on an explicit teaching pedagogy implemented on four groups of initial achievement (tracked group), one of the expectations was that the program would help teachers instruct at the right level. Heteregeneous effect by initial achievement shows that initially weaker-performing students progressed faster on less-advanced competences (letter recognition, phonological awareness), while initially stronger-performing students progressed faster on more-advanced competences (reading and-non reading skills). These results suggest that the training programs have indeed helped teachers adjust content to all students' needs. Such results echo those found in a very different context by Banerjee, Banerji, Duflo, Glennerster, and Khemani (2010); Banerjee, Cole, Duflo, and Linden

[3] This is based on a class size effect estimated between 2.2% and 3% per additional pupil in class (Bressoux, Kramarz, & Prost, 2009; Bressoux & Lima, 2011; Piketty & Valdenaire, 2006). Note, however, that this estimate is clearly larger than the one found with STAR data (1.7).

[4] Training one teacher "treats" many students at once, and if "good" teaching practices are employed throughout the teacher's career, these practices may have an effect on several generations of students.

[5] Naturally in the sense that their progresses are not triggered by different schools or students but may be influenced by other unobserved factors such as nature (weak students naturally progress faster for instance) or parents.

[6] To simplify, I will use phonology and phonological awareness interchangeably and define the concept as the ability to hear, repeat, mix, and decompose sounds, and to link them to graphemes. I will also regroup under the term "phonological awareness" concepts such as phonics (the ability to link sounds to graphems) or phonemic awareness (the ability to mix sounds), which are not necessarily equivalent but closely related. To match the wording of some other authors, I will sometimes use the term "code-related skills," which regroup both phonological awareness and letter recognition.

[7] This is an approximate assessment of the overall cost of the reduction of one pupil per class in primary school. It is based on an average net monthly teacher salary of 2323 € in France, multiplied by two to account for social contributions, and then multiplied by 12 months, to which I add an administrative cost of 15%. Since in my data set, class size is in average composed of 25 students, a reduction by 1 student is equal to $(2323*2*1.15*12)/24-(2323*2*1.15*12)/25 \approx 107$€ .