

Inadequate Teacher Content Knowledge and What to Do About It

Policy Brief: June 2023



Executive Summary

This policy brief summarizes research on measuring and improving the content knowledge of primary math teachers in Morazán, El Salvador.

First it shows that the average teacher does not adequately master the content she or he is supposed to teach. As this is problematic for education quality, the study then analyzes one possible form of in-service teacher training to address this situation.

As summarized in Figure 1, the study has two sequential parts. In the first part we measure to what degree teachers master the content they are explaining in the classroom. Based on an exam containing typical questions of the Salvadorian curriculum we conduct a representative teacher assessment in Morazán. We find that the teachers on average are only able to answer 47% of the questions correctly.

In the second part, the study tests whether a five-months in service teacher training program mainly based on computer assisted learning (CAL) can improve content knowledge. Here we use an experimental evaluation method. The participating teachers are divided into two

groups, one receiving the training and one not. After the training, a second exam with all teachers reveals that the teachers receiving the training significantly improved their content knowledge. However, a follow-up third exam, conducted one year after the training, shows that the improvement in content knowledge did not persist.

Overall, the study reveals the problem of inadequate teacher content knowledge in El Salvador and concludes, that a relatively brief training program helps in the short run but is not enough to persistently improve the situation.

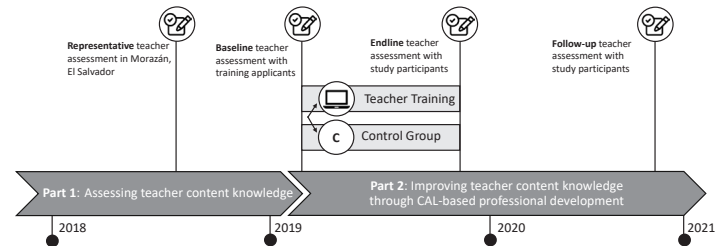


Figure 1: Timeline of the study

David, Participant of the teacher training

"I have been teaching mathematics since 2012 and I often had problems conveying the materials. In Consciente's teacher training, I began to learn each exercise, lesson and module in an appropriate way and with good didactics - from the comfort of my home with my laptop. It was not easy, but the satisfaction I felt at the end of each of the activities always motivated me. When I came home from school, my wife already knew that I would have little time for her and would spend the evening in front of the computer. But she understood that my learning was important because my students deserve a good education. ¡Mil gracias, Fundación Consciente!"



175 teachers participated

4 months of training

16 learning modules

8,656 hours of self-study

Teacher content knowledge in Morazán

For the first part of our study, 224 math teachers from 107 public primary schools participated in an exam-type assessment. The test covered concepts from grades 2 to 6 of the official curriculum. Figure 2 presents the results for selected example items. The average teacher is able to answer 47 percent of grade two to six questions correctly, and performance is poor across all tested subject domains. Learning shortfalls are most apparent in Data, Statistics and Probability (27% correct answers) and Geometry and Measurement (36% correct answers). Many teachers not only struggle with the more advanced items pertaining to grade six, but even with items covering the basic materials from grades two and three. While most teachers can handle basic operations such as additions or subtractions, less than half can convert meters to kilometers, about a third can add two fractions, and only one in four can retrieve information from a descriptive chart.

These results are particularly striking given that 97 percent of the teachers in our sample possess a university degree. Hence, despite 13 to 17 years of formal education, most primary school teachers are confronted with the daunting task of teaching many

contents they are seriously struggling with. Given these results it is clear that enhancing the content knowledge of teachers is an indispensable precondition for better schooling in El Salvador. The rest of the study is about the implementation and evaluation of a specific in-service teacher program that aims at such an improvement.

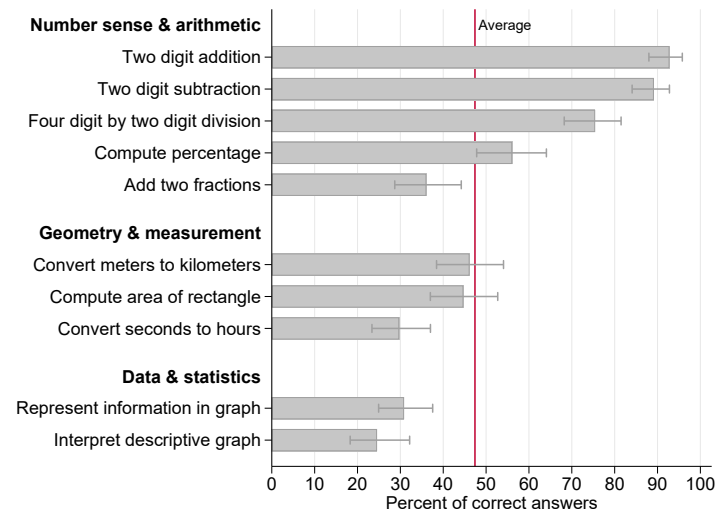


Figure 2: Content knowledge of math teachers in Morazán, El Salvador

The teacher training program

The program consisted of two elements:

Self-Studying: 16 study modules covering selected contents of the Salvadoran primary school math curriculum were designed. In an initial meeting, participants received a laptop equipped with the learning software. Teachers had to complete one module per week, corresponding to a workload of four to eight hours, and then took a short assessment administered by the software. Since module completion had to be accomplished outside working hours, teachers received a small monetary compensation for it.

Monthly Workshops: At these workshops, participants submitted the work they accomplished on the previous four self-studying modules and their learning progress was evaluated. During the workshops, expert teachers recapitulated key concepts and addressed teachers' questions. Meetings were scheduled for half a day and, as they took place during work hours, teachers were only compensated for travel expenses.

The evaluation approach

To evaluate the impact of the program on teachers' math performance, we set up a randomized controlled trial. This established experimental evaluation method consists in randomly splitting up the participants in two groups. Concretely, in our study the first group (87 teachers) are doing the program and the other half – the control group – does not. Before, shortly after, and one year after the

program, teachers were administered a comprehensive math assessment. A comparison between the results for the two groups allows us to check, whether the program caused an improvement in teacher content knowledge over time.

Evaluation results

Main results: We find that immediately after the intervention, the program had a significantly positive effect (see Figure 3). Program teachers outperformed their peers from the control group by 5.5 percentage points. However, one year after the program, this effect largely disappeared. The improvement in content knowledge, unfortunately, was not really persistent.

The data shows significantly different immediate effects of the program among several dimensions. For example, older teachers were significantly less perceptive than their younger colleagues. For all sub-analyses, however, we find the same and substantial deterioration in program effects after 12 months. How do these findings compare to other studies? The evidence base on the long-term sustainability of teacher training programs is still surprisingly scarce. The few studies that exist confirm that achieving persistent effects through teacher training programs is challenging.

Cost effectiveness: An important question is whether to improve education outcomes, CAL-programs for teachers are more cost-effective than such programs delivered directly to students. A unique feature of this study is that we can directly compare our findings with the findings

from our earlier, student-centered CAL intervention, also implemented in Morazán. Based on our results, we simulate the long-term cost effectiveness of our teacher intervention and compare it to the cost-effectiveness of the remedial CAL lessons we experimentally evaluated earlier. Our findings indicate that an annual retention rate of at least 55 percent among treated teachers is required so that the CAL training with teachers would be more effective than CAL lessons with students. As we observe a retention rate for teachers of only 28 percent, the long-term effectiveness of this specific teacher program is lower than that of the student intervention.

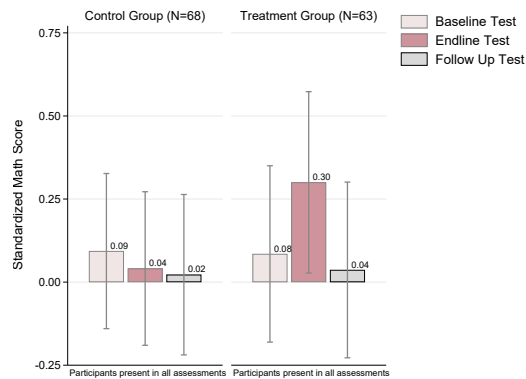


Figure 3: Effect of intervention on math scores



Lessons learned and recommendations

According to our results, inadequate content knowledge of teachers is a real problem in Morazán. To improve on this could potentially have considerable benefits for raising the quality of education. Our intervention with a CAL-based in-service teacher training showed promising results in the short run and the feedbacks from our qualitative surveys were favorable; however, the program proved to lack persistency. Future interventions should aim at improving on this. Based on our results, possible future programs to increase content knowledge of teachers could go in the following directions:

- Aim for depth instead of breath: Do not try to be too encompassing but concentrate on a small number of particularly important topics and include frequent repetitions.
- Refreshers: After the main program include one or two short refresher courses in the next year or even in the next two; use these additional meetings to discuss the experience of the teachers working with the concepts in the classroom.
- Include didactics: Motivate teachers to learn the

content by using the workshops to directly show interactive, innovative ways to teach these concepts.

- Consider alternatives to CAL for older teachers as they might be challenged by technologically advanced methods.



About Consciente

Consciente is an NGO committed to making high-quality education accessible to everyone. To pursue this goal, we run three programs:

- **The Scholarship Program** promotes equal access to education irrespective of socio-economic background.
- **The Education Innovation Program** improves the quality of education in local schools. This program includes the computer assisted teacher training program.
- **The Sustainability Education Program** promotes the discussion of important social and environmental issues.

About the Evaluation

The impact evaluation was conducted by researchers from the Department of Economics (Chair: Aymo Brunetti) and the Institute of Sociology (Chair: Ben Jann) at the University of Bern. It was financed with a grant by the *IMG Stiftung* and the *Faculty of Business, Economics and Social Sciences* at the University of Bern.

This policy brief is based on a detailed evaluation study published online in May 2023, see:

Brunetti, Aymo, Konstantin Büchel, Martina Jakob, Ben Jann & Daniel Steffen. 2023. Inadequate Teacher Content Knowledge and What to Do About It: Evidence from El Salvador. *Journal of Development Effectiveness*: 1-24.

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