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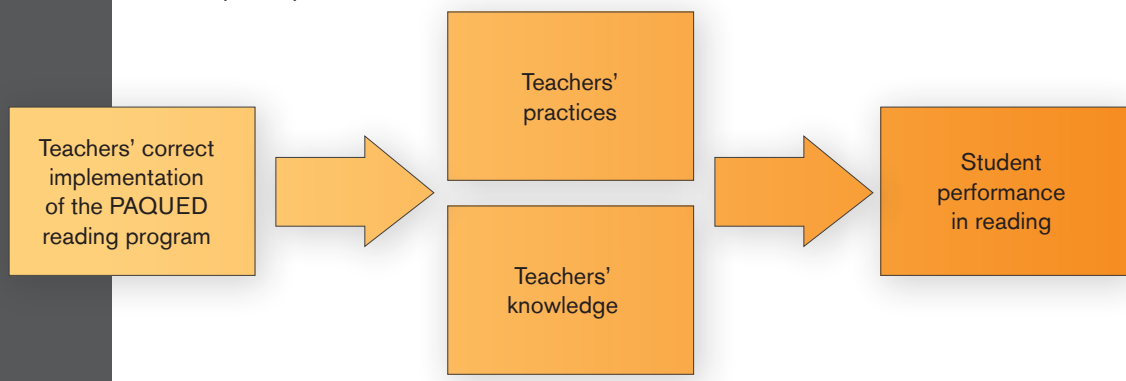
Learning
transforms
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When Teachers Understand What They're Doing, Students Learn

EVIDENCE FROM EDC'S READING PROGRAM
IN THE DEMOCRATIC REPUBLIC OF CONGO

October 2014

EDC's research program in the Democratic Republic of Congo was designed to test a theory of change about teacher knowledge and practice and their effects on student learning. We hypothesized that teachers' knowledge and understanding of good reading instruction is as important to student performance as is following the curriculum. The study explored whether teachers' exposure to a robust reading program changed their knowledge of sound reading instruction and their literacy instruction practices, and whether those changes in teacher knowledge and practice were linked to their students' performance in reading. In other words, did teachers who participated in our research-based, locally-adapted reading program know more about how and why to teach reading after a year of intervention, and did their students have better literacy outcomes than others whose teachers did not participate?



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graph LR; A[Teachers' correct implementation of the PAQUED reading program] --> B[Teachers' practices]; A --> C[Teachers' knowledge]; B --> D[Student performance in reading]; C --> D;
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Teachers' correct implementation of the PAQUED reading program

Teachers' practices

Teachers' knowledge

Student performance in reading

EDUCATION

Box 1: Resources Provided to PAQUED Schools

ALL PAQUED SCHOOLS:

- Weekly Interactive Audio Instruction (IAI)
- Teacher resource guide accompanying the IAI

EXPERIMENTAL SCHOOLS ONLY:

- Two training workshops, one at the beginning of the year and one midway through the year: Comprehensive face-to-face practical training on how to conduct reading lesson activities.
- A teacher's reading activity guide keyed to the lessons and materials
- Teacher read-aloud books (1/week/class)
- Decodable/Leveled texts (1/week/class)
- Dedicated daily teaching time focused on reading
- Weekly peer-to-peer coaching and lesson preparation and school-based learning circles
- Monthly coaching
- Monthly meetings in a multiple-school learning circles

We defined “knowledge of reading instruction” to include knowing how children learn to read, understanding the fundamentals of good reading instruction, being aware of one’s own beliefs about how children learn to read, and reflecting on one’s practice as they learn from their experience, their peers and their coaches.

This study confirms that teachers’ knowledge of how to teach reading and writing contributes substantially to students’ reading performance. Simply asking teachers to change their practices, whether through general instructions or highly-scripted lesson plans, ignores the importance of helping them understand and invest in the pedagogical foundations of the practices they are asked to adopt. Therefore, an effective reading program needs to be accessible, using simple language and incorporating predictable routine, and to give teachers opportunities to reflect on how their students are learning to read and write.

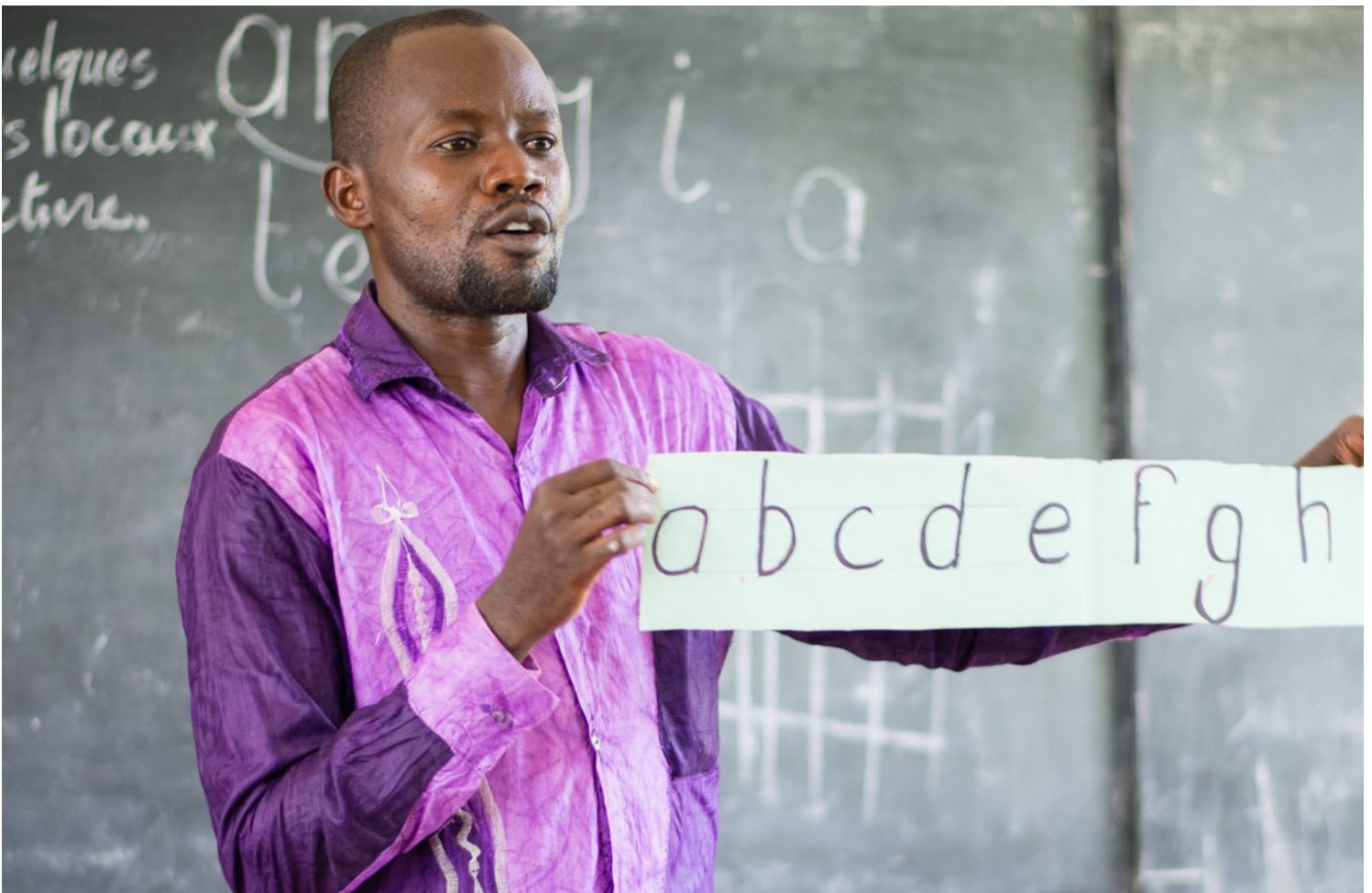
Program context

The DRC faces severe challenges in educating young children. Access to schooling is limited; the primary school enrollment rate is only about 60%. Among those who do enter school, nearly 20% drop out in their first year.¹ While some of the high dropout rate is due to economic and social conditions, particularly poverty, it also relates to the poor quality of education. For instance, nearly a third of government teachers go unpaid, contributing to a high rate of teacher absenteeism and children sitting idle in the classroom much of the time. Rising to meet these challenges, the Ministry of Education, with support from USAID and its implementation partner Education Development Center (EDC), introduced in 2009 a program to improve primary education: the *Project d’Amélioration de la Qualité de l’Éducation* (PAQUED). Between 2009 and 2014, the program reached 3,000 primary schools, 30,000 teachers and 1.2 million students.

In March 2013, PAQUED began to concentrate on improving the reading and writing skills of students in grades 1 and 2 in 45 PAQUED schools. In the belief that the quality of teaching is essential to improving reading performance, the Ministry and EDC undertook a rigorous experiment to test the effects of various program components on teachers’ knowledge and practices and on students’ performance in reading.

The PAQUED reading program aimed to promote the development of teachers’ **understanding** of the literacy learning needs and processes among early grade learners and their **skills** in applying effective instructional techniques and strategies in the classroom. This practice-based approach was designed by EDC to foster teacher change via ongoing application and reflection. The program consisted of a series of structured activities that were repeated weekly so that teachers could practice and master them. It featured a week-long sequence of activities structured into daily lessons. These activities ranged from teaching letters and sounds and how to decode and encode new words, to engaging in word study activities using words taken from the weekly read-aloud, to learning new vocabulary associated with the weekly theme, to students practicing their fluency by reading an appropriately leveled book. The description and instructions for these activities were provided to teachers in a reading activity guide and accompanied with read-alouds and leveled reading materials for students. These materials all drew upon DRC curriculum themes and were designed to be culturally relevant and appropriate to the DRC. Finally, classrooms were equipped with mp3 radios that allowed teachers to air pre-recorded Interactive Audio Instruction (IAI) for one 30-minute lesson each week.

¹ <http://www.rescue.org/sites/default/files/resource-file/2010%20IRC%20DRC%20EDUCATION%20fact%20sheet%20-%20ENGLISH.pdf>.



Theory of change and research questions

Our theory of change was that improved performance of students in reading in the early grades is an outcome of effective teaching. The quality of teaching, in turn, results from teachers' knowledge of effective instructional practices and their application of these practices.

The research questions we wanted to answer about the PAQUED program were:

- How did the reading program affect teachers' knowledge of reading instruction and their literacy instructional practices?
- How did the program affect student performance?
- What is the relationship between (a) teachers' knowledge and practices and (b) student performance?

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Methodology

The 3,000 PAQUED schools all received training in how to conduct lessons and some classroom reading materials (See Box 1). While many of the 3,000 were too remote to visit within the timeframe and budget of the program, in 2013 the program began to provide more school visits from PAQUED staff and inspectors to 618 schools that were relatively accessible to help support them in the use of IAI. For the experiment, these 618 more accessible schools were labeled “IAI only” schools. From among the 618, PAQUED then selected 45 “experimental” schools, which were provided with additional school-based support, two intensive reading program trainings, and group reflection activities to enhance their knowledge of reading instruction and support their adoption of new practices (see Box 1). The experimental schools were distributed evenly among the three provinces where the project was operating: Bandundu, Equateur and Orientale. Thirty-five control schools were also selected from among those in the same regions as the experimental schools (control schools did not receive any PAQUED interventions).

Box 2: Measurement Instruments

- The grade 2 EGRA adapted for the DRC tested only oral and pre-reading skills, because students, nationally, were not intended to be taught to read and write in French in the lower grades. Since the PAQUED reading program was designed to teach French, the EDC tool tested some elementary reading skills in that language.
- The interview of teachers' knowledge of reading and writing instruction included items on their understanding and expectations of how students learn to read and write, which have been shown in other contexts to influence teachers' practices. This interview was only administered at endline.
- The observation tool was used to measure teachers' instructional practice around literacy. It was administered at baseline and endline to track changes in teachers' practice over time.
- Fidelity of implementation tools included the tracking of IAI listenership, teachers' application of the reading program activities, and teachers' participation in professional development activities.

Sample selection: The study was designed as a longitudinal school study² to permit both longitudinal and cross-sectional analysis and comparisons among experimental, IAI-only and control groups. The same teachers participated in the baseline and endline data collection³. Teachers within each school were selected randomly from the PAQUED teacher database. The sample size was computed using an effect size of 0.3 and power of 0.8. There were 105 teachers in each province, evenly divided between grades 1-2, grades 3-4 and grades 5-6.⁴ The students who were tested were randomly selected from the classrooms of teachers who participated in the study.

Measures of student performance: EDC developed a short reading test to measure student performance, defined as the number of:

- Letters read (out of 26)
- High-frequency words read (out of 8)
- Words read in a connected text (out of 26)
- Words read correctly per minute (fluency)

Measures of change in teacher practices and knowledge: We used three instruments. First, to assess teachers' fidelity of implementation of the program (that is, the correct use of its resources) they used a tool developed by EDC to observe directly how teachers used the reading activity guide and the leveled readers. Second, to assess practices, teachers were asked to teach a lesson in which they introduced a new letter or letter-sound relationship. Using a second, more complex assessment tool, also developed by EDC, trained observers documented teachers' practices as they taught this lesson, grouped by component skills: phonemic, phonological and alphabetic awareness; fluency; vocabulary-building; comprehension; and general instructional practices. Third, to measure their knowledge of teaching reading and writing, teachers were interviewed about specific practices and their utility and suitability for teaching reading and writing to grade 1 and 2 students.

2 21 experimental schools, 34 control schools, and 34 IAI-only schools were represented in the sample.

3 The study had some methodological shortcomings. The sample size for student performance on reading was small. An insufficient numbers of IAI-only students were tested to be included in the analysis. Teachers' knowledge was measured only in the endline study, and responses were binary, which limited the ability to nuance the analysis. Teacher attrition rates were high, at 41% for grades 1 and 2, reducing the matched sample size and thus the possibility of detecting statistical differences in changes in teacher performance over time. Though inter-rater reliability was accounted for in tool administration, no inter-rater reliability study was undertaken with enumerators at the training.

4 This report is limited to teachers in grades 1-2, where the most intensive reading instruction took place.

Findings

Improvements in the quality of teaching in the 45 schools participating in the reading program had a positive impact on the reading performance of students in grades 1 and 2. More precisely, **teachers' knowledge of effective reading practices and their faithful application of prescribed instructional techniques and strategies are strongly correlated with improvements in students' reading performance.**

Teachers: Within one year, teachers in the experimental schools improved their reading instruction practices, including letter-sound knowledge, decoding/encoding, vocabulary, fluency and comprehension. **At the end of the year, teachers in the experimental schools had better knowledge of sound literacy instruction than did teachers in the IAI-only and control groups.**

Students: Student performance in the experimental schools in the areas of letter identification, familiar word recognition (vocabulary), and reading of a connected text (fluency) was markedly better than that of students in control schools at the end of the year. **Data analysis shows that students in experimental schools significantly outperformed students in control schools** ($p < .000$). Table 1 displays the results of the sub-tests.

Table 1. Experimental (n=169) and control (n=82) group student performance on sub-tests at endline

Sub-task	Status	Mean	Std. dev.	p-value	Effect size
Number of letters read (out of 26)	Experimental	20.96	5.4	.000	0.73*
	Control	10.20	6.71		
Number of high frequency words read (out of 8)	Experimental	4.39	2.63	.000	0.59*
	Control	1.21	2.005		
Number of words read in a text (out of 26)	Experimental	11.24	9.25	.000	0.54*
	Control	2.22	5.014		
Words read correctly per minute	Experimental	9.80	13.73	.000	0.46
	Control	1.22	3.69		

* large effect size

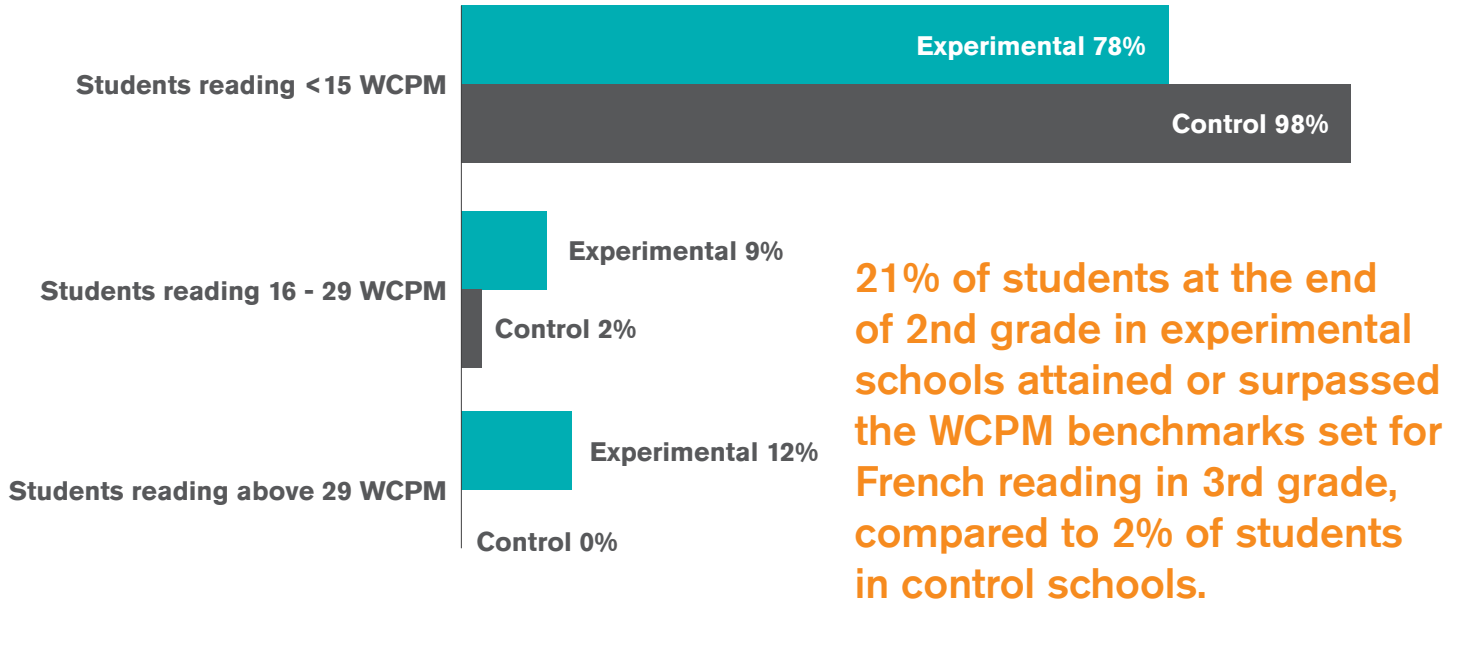
Relative to DRC's provisional fluency benchmarks set in February 2012 for both national language and French, sampled grade 2 experimental students' fluency scores were compared to those set for grade 3. This is because students in grade 1 and 2 are intended to learn to read in national languages, so no benchmarks were set for reading fluency in French for grade 2. The figure below shows the proportion of sampled experimental and control school students who are below the benchmark, at benchmark, and above the benchmark. 12% of grade 2 experimental students read above fluency benchmark for French set for grade 3, 9% read at benchmark and 78% read below the



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benchmark. In contrast to this, only 2% of grade 2 control students showed to read at benchmark for fluency and 98% read below benchmark. These results are noteworthy because it means that **a good proportion of grade 2 students, after only one year of using the PAQUED reading program, were able to attain or surpass the grade 3 fluency benchmark.**

Figure 3. Students' performance in WCPM against national benchmarks set for 3rd grade



Relationships between teacher practices and knowledge and student performance

As noted above, we analyzed the relationships between the practices and knowledge of teachers in experimental schools and the performance of their students on the reading test. We also measured teachers' fidelity of implementation of the PAQUED reading program and analyzed its direct relationship to student performance.

Fidelity of implementation

Critical to testing the PAQUED theory of change was assessing teachers' fidelity of implementation of the reading program, that is: students' participation in weekly IAI lessons, teachers' use of the guide and of reading materials (read-aloud books, leveled readers), and teachers' participation in weekly and monthly continuing professional development events. Table 2 summarizes the degree to which teachers in the experimental schools and the IAI-only schools followed or used the various PAQUED interventions available to them.

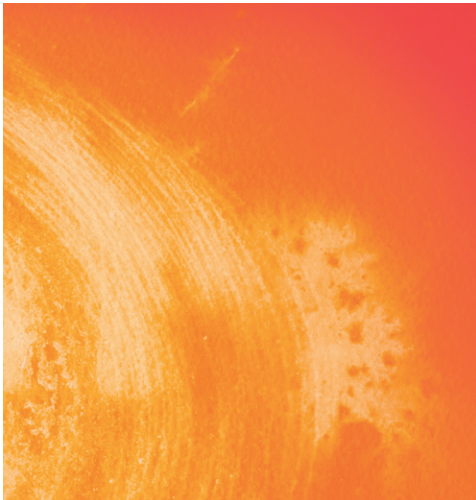
Table 2. Teachers' fidelity of implementation

Experimental (n= 69)						IAI-only (n= 96)	
Use of the guide and reading materials		Participation in Continuing Professional Development		IAI listenership		IAI listenership	
Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
.88	.13	.71	.15	.86	.067	.51	.28

Overall, experimental teachers made good use of the resources offered by PAQUED. One set of these resources correlated significantly with student performance: correct use of the teacher's guide and reading materials. **Teachers' adherence to the guide and reading materials as designed explains 21% of the variation in students' accuracy in the reading of a connected text ($p=.016$, $ES=0.45$) and 23.8% of the variation in their fluency ($p=.021$, $ES=0.48$).** This finding suggests that a key strength of the reading program design lies in the structured and sequenced approach. Teachers could follow the sequence easily, continuously model the same reading strategies for students week after week, and gradually enable students apply those strategies alone or in groups. Students also benefited from the cyclical structure of the program and learned to apply the program's research-based strategies to their own reading. This study has provided significant evidence of the effectiveness of this design, both for enhancing teachers' professional development and content knowledge and also for ensuring student literacy gains.



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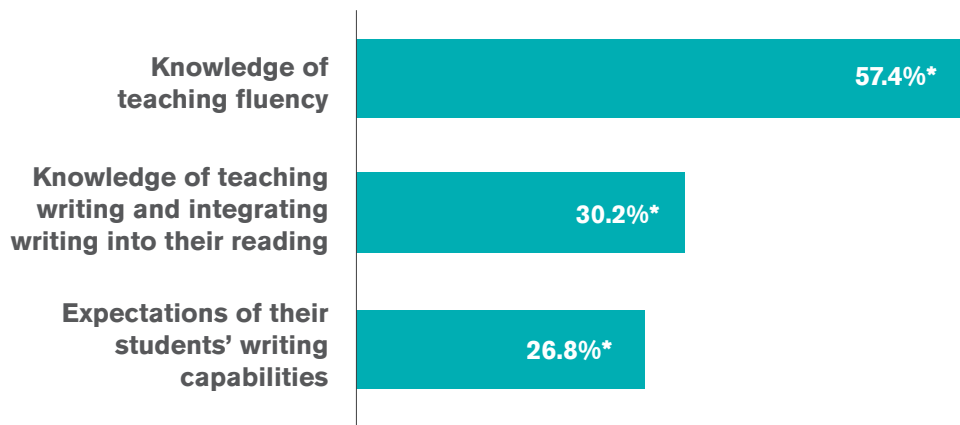


In a short time, teachers could focus less on the mechanics of a practice and more on how to adapt it to their students' needs.

Teacher knowledge

PAQUED's theory of change posits that teachers' knowledge of reading instruction correlates as strongly with student performance as does classroom practice. Analysis revealed that, indeed, **teachers' overall knowledge of effective instructional practices in reading explains 31.3% of the variation in student performance in reading connected text ($p=.045$, $ES=0.48$) and their fluency in doing so ($p=.024$, $ES=0.5$).** This evidence supports the importance of teachers understanding the "why" behind the practices they implement. It also shows that teachers who do understand what they are doing can respond to their students' need and ensure their students improve in their reading skills.

Figure 1. Percent of variance in students' fluency performance (WCPM) explained by experimental teachers' knowledge of reading and writing instruction



*Statistically significant at $p<.05$

What about the PAQUED intervention helped develop teachers' knowledge? Results point to an important benefit of the reading program's repetitive cycle: **In a short time, teachers could focus less on the mechanics of a practice and more on how to adapt it to their students' needs.** In the classroom, this allowed teachers time to observe their student's progress and continuing difficulties. Beyond the classroom, teachers shared their observations with peers and coaches, who helped them articulate what they were learning and build their confidence that they were getting it right. Thus teachers increased their knowledge of what makes for effective instruction and became better teachers. This is supported by linear regression analysis which showed teachers' endline knowledge was positively and significantly linked to their adherence to the reading program activities. Indeed, **14.3% of teachers' overall knowledge of teaching reading was found to be predicted by experimental teachers' fidelity of application of the reading program ($p=.047$, $ES=0.37$).**

In addition, analysis of teacher knowledge survey data found that experimental school teachers had a statistically significant increase in knowledge of research-based instructional practices, following the intervention. This suggests that experimental teachers not only knew more about sound reading and writing instruction than their control counterparts but that this knowledge development could also be attributed in part to their experience with the reading program.

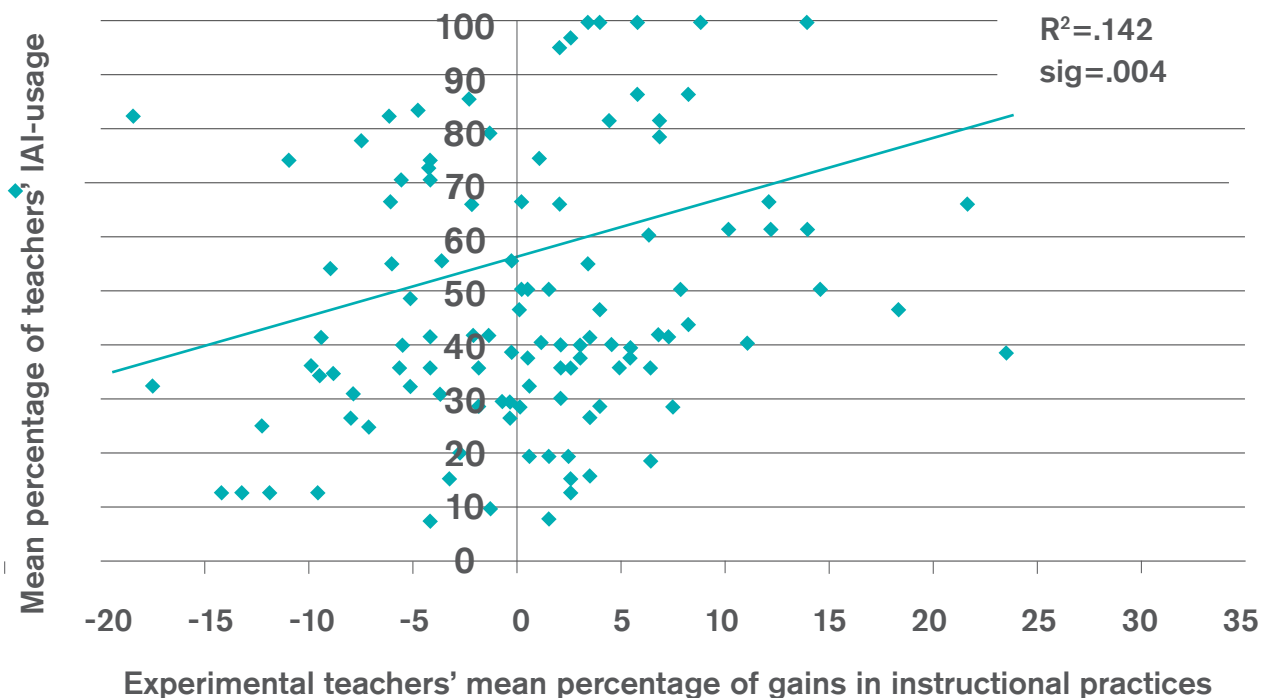
Teacher practices

According to PAQUED's theory of change, significant relationships should appear between teachers' use of the literacy-building practices introduced by the reading program (to teach skills of phonemic, phonological and alphabetic awareness, fluency, vocabulary-building, comprehension, as well as general instructional practices) and improvements in student performance. And indeed, such relationships did appear. For example, linear regression analysis indicated that teachers' vocabulary-building practices were strongly correlated with students' reading performance on three of the four sub-tests: letter recognition, high-frequency word recognition, and fluency. For example, 25.1% of the variance in students' fluency (correct words read per minute) can be explained by a teacher's use of vocabulary practices ($p=0.021$, $ES=0.49$). Such findings indicate that **reading program activities are helping to improve student reading.**

What about the PAQUED intervention helped to influence teachers' changes in instructional practice? Unlike teacher knowledge, **changes in teacher practice were found to be most influenced by their IAI listenership rate and their participation in continuing professional development activities.** IAI listenership played a significant role overall: 14.2% of the variance in teachers' change in overall instructional practices could be explained by their rate of IAI listenership ($p=.004$, $ES=0.37$).

Findings indicate that reading program activities are helping to improve student reading.

Figure 3. Experimental teachers' IAI usage and their gains in instructional practices



Experimental teachers, in just one year, were able to make vast improvements in their instructional practices, and these improvements can be explained by their employment of PAQUED interventions.

Within these overall instructional practices, teachers' gains in practices related to fluency-building, vocabulary-building and comprehension building were also significantly linked to IAI listenership. This suggests that teachers may be transferring the modeled practices embedded within the IAI programs and applying them to their own teaching.

Another item that strongly correlated with changes in teachers' instructional practice was teachers' participation in continuing professional development (CPD) activities and visits from coaches. For example, 18.3% of the variance in teachers gains in general classroom practices could be explained by their participation in CPD ($p=.012$, $ES=-.42$). These practices included the incorporation of group work, teaching monitoring of student work, and the presence of positive encouragement in the classroom.

In addition, experimental teachers showed significant positive changes in instructional practices over baseline and endline. For example, on average, experimental teachers allocated 6.43% more instructional time to fluency-building practices at endline than they did at baseline ($p=0.000$, $ES=0.58$). Teachers also integrated more vocabulary-building practices into their teaching (such as asking their students to make predictions about the content of a text by using clues like title and illustrations) at endline than they did at baseline ($p=0.015$, $ES=0.32$). Improvements in fluency and vocabulary instruction were also significantly more dramatic than those of the control counterparts, who did not show significant instructional practice changes over baseline and endline. Taken together, these results show that **experimental teachers, in just one year, were able to make vast improvements in their instructional practices, and these improvements can be explained by their employment of PAQUED interventions.**



Implications and Conclusions

This study confirms that teachers' knowledge and expectations of how and why to teach reading and writing contribute substantially to students' reading performance. While common approaches to improving reading results in developing contexts -- such as generalized training and highly scripted lesson plans -- ask teachers to change their instructional practices, they often do not take the additional (and, as shown by this study, critical) step of helping teachers to understand and invest in the pedagogical foundations of the practices they are asked to adopt. This study suggests that ensuring that reading training programs are framed in terms of professional reflection and clear enough to facilitate that reflection (rather than frustration), and that they embed frequent opportunities for teachers to reflect on their practice, can make significant additional contributions to the uptake of new approaches and the likely sustainability of improved student results.

How do teachers improve their knowledge? This study suggests that they learn from engaging in professional development activities, including exchanges with their peers, periodic training, and coaching. PAQUED offered a range of professional development pathways, including intensive workshops, peer-to-peer coaching and lesson preparation, monthly in-class coaching, and learning circles formed among neighboring schools. This study also shows that the overall design and approach of the PAQUED reading program contributed highly to teachers' knowledge of what sound reading and writing instruction should look like. This is because the program focused on building teachers' confidence in applying structured reading lessons (including IAI) that repeated themselves from week to week. In applying similar activities week to week, while adding new read-alouds, phonics concepts, and student readers, teachers were able to quickly master a solid model of reading instruction. Once this mastery was achieved, they were able to focus more on the details of what they were doing and on how they were affecting students. Coupled with the weekly reflection in their school-based meetings, this reflective application of the model had a profound impact on teachers' knowledge of reading and writing instruction, and by default on student performance. We argue that this model is cost-effective, as helping teachers improve their knowledge of reading instruction not only has an immediate impact on student performance but also creates long-term positive effects. The PAQUED lessons learned conference called for further expansion of a similarly-structured reading program for DRC, which is already a top priority for the Ministry of Education.

This study also provides an important precedent for further studies. It demonstrates that, despite the logistical and security challenges of work in the DRC, high rates of teacher attrition (which make it difficult to conduct longitudinal studies), and student absenteeism (which reduces intervention dosage), these kinds of rigorous studies can still be undertaken and used to derive important lessons about what works best in the DRC context. Further research can continue to inform reading policy, practical decision making, and the development of materials and tools that respond to the needs and realities of the education system in the DRC.



Teachers' knowledge and expectations of how and why to teach reading and writing contribute substantially to students' reading performance.



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PAQUED's experimental reading program was developed as part of EDC's Read Right Now early grade and youth literacy initiative. Read Right Now is an adaptable, evidence based literacy program for low capacity and resource-lean environments.