Implementing Mother Tongue Instruction in the Real World: Results from a Medium-Scale Randomized Controlled Trial in Kenya

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Research in sub-Saharan Africa investigating the effect of mother tongue (MT) literacy instruction at medium scale is limited. A randomized controlled trial of MT literacy instruction was implemented in 2013 and 2014 as part of the Primary Math and Reading (PRIMR) Initiative in Kenya. We compare the effect of two treatment groups—the base PRIMR program teaching literacy in English and Kiswahili and the PRIMR-MT program, which taught literacy in English, Kiswahili, and mother tongue—in two different language environments. Implementation of the MT program faced challenges because many educators were not speakers of the languages, some communities resisted mother tongue instruction, and some areas were more language heterogeneous. Effect sizes on MT literacy averaged between 0.3 and 0.6 standard deviations. The base PRIMR program also increased MT learning outcomes in some measures but had smaller effects than the PRIMR-MT program in oral reading fluency and comprehension.

Introduction

The majority of children in Kenyan primary schools are reading far below grade level.1 While most children now enroll in school at some point, more than one million Kenyan children of school age are out of school and one in five youths aged 15–24 cannot read (UNESCO 2014). These statistics point to serious deficits in the quality of Kenya’s primary education system, and particularly in its literacy instruction in the early grades.

One of the explanations posited for the difficulties children have experienced in learning to read in Kenya, as in other postcolonial sub-Saharan African countries, is the mismatch between children’s mother tongue and the language of instruction in their schools. In Africa, when children enter first grade, more than half are learning in a language different from the one they speak at home (Ouane and Glanz 2010). Sixty-seven living languages are spoken in Kenya (Lewis et al. 2015). The official language-of-instruction policy states that children have a right to be taught in the “language of the catch-

1 Wasanga et al. (2010); Mugo et al. (2011); Piper and Mugenda (2012).
ment area” in classes (grades) 1–3 (Kenya Institute of Education [KIE] 1992). However, for a number of logistical and political reasons, this policy has rarely been implemented, even after being reaffirmed in the most recent educational white paper (Republic of Kenya 2012) and the new Kenyan education sector plan (Ministry of Education, Science, and Technology [MoEST] 2014). Many Kenyan schools do not use mother tongue as a medium of instruction, despite the national policy (Piper and Miksic 2011; Begi 2014). Children generally learn primarily in Kiswahili and English, which are often their second and third languages, or L2 and L3 (Trudell and Piper 2014). Kenya’s language context has particular language complexities (Schroeder 2013). The orthographic complexity of English (Ellis et al. 2004), in particular, creates a high barrier for primary school entrants with little previous exposure to the language.

The present study uses data from the Primary Math and Reading (PRIMR) Initiative, a project funded by the US Agency for International Development and the UK Department for International Development (DFID) and implemented by the US research firm RTI International in partnership with the Kenyan MoEST. The DFID portion of PRIMR contained a design to examine empirically the challenges and potential benefits of teaching children to read in their mother tongue (MT); the purpose of this study was to use the design of PRIMR’s MT intervention to estimate the causal effect of the MT program on learning outcomes in a medium- to large-scale implementation in settings typical for Kenya.

Among a set of relatively language-homogeneous locations in two counties, the research team randomly assigned school zones to three conditions. One treatment group received the base PRIMR program using English and Kiswahili, which meant teacher training, coaching, and use of printed materials in an intervention format that had been shown to be effective in improving children’s oral reading fluency and comprehension (Piper et al. 2014). The second treatment group received the base version of PRIMR in English and Kiswahili plus additional materials and training in the mother tongue of the zone. This treatment group is referred to hereafter as PRIMR-MT. Finally, control zones received no interventions during the study period, but later received the treatment deemed most effective. The research questions examined in this article are as follows: (1) Did the PRIMR-MT intervention improve literacy skills in mother tongue? (2) Did the PRIMR-MT intervention improve literacy skills in mother tongue more than the base PRIMR program? (3) Did the effects of mother tongue instruction differ across the basic literacy skills between the two treatment groups?

2 One of the coauthors was the PRIMR chief of party (project director) and continued in that role under a subsequent program called Tusome (“Let Us Read”). Another coauthor was the PRIMR deputy chief of party.
Background and Context

According to the national education policy in Kenya, the language of instruction for children in classes 1–3 is the mother tongue, with Kiswahili and English taught as subjects (KIE 1992). English is the language of instruction starting in class 4. In practice, however, most children are taught in Kiswahili and English starting in class 1 (Dubeck et al. 2012). Even in rural locations with relatively homogeneous populations, English is the predominant language of instruction across subjects (Piper and Miksic 2011). The resistance to the usage of mother tongue in Kenya has a variety of reasons, including the prestige placed on European languages, the mismatch between the language policy and the teacher deployment policy, and the fact that the examination at the end of primary school is in English (Trudell and Piper 2014). Having English as the language of examination creates a “wash-back” effect; that is, it has an impact on which languages of instruction are preferred in lower grades (Negede 2000; Benson et al. 2007). Kiswahili has played a somewhat unique and important role in Kenya, with many language communities treating it as an ostensible L1.

The definition of “mother tongue” is widely debated in the educational and linguistic literature. Because the Kenyan context and policy are important aspects of this research, we use here the official definition of the term in Kenya: (1) “the first language that a child learns to express himself/herself in” or (2) “the language of the school’s catchment area” (KIE 2002, 17). This is, of course a complex definition because a child’s first language may differ from the language of the school’s catchment area. From the policy perspective, the second definition is more likely to be applied in terms of educational policy making and planning, although the first definition is almost certainly more relevant to the outcomes of individual students.3

Mother Tongue Instruction and Student Learning

Researchers working in developed-country settings have come to the consensus that children will learn to read most easily in their MT. The interdependence hypothesis states that literacy skills in one language—decoding, for example—transfer into the second and subsequent languages.4 In a study of early grade literacy development among children attending an English-Spanish bilingual immersion school in the United States, for example, researchers found clear relationships between skills in a first and second language (Feinauer et al. 2013). The relationships were stronger for “constrained skills,” such as letter knowledge and sounds, than for “unconstrained” literacy skills, such as reading comprehension. In Malawi, Chichewa reading skills

3 Other important definitions of mother tongue instruction are found in Skutnabb-Kangas (2000) and Benson and Kosonen (2013).
4 Cummins (2001, 2007); August and Shanahan (2006); Ball (2010); RTI International (2011).
and, in a less consistent manner, writing skills at the beginning of the school year predicted those same skills in English at the end of the year (Shin et al. 2015). Other studies from the United States and Canada have supported the hypothesis that early literacy skills transfer across languages. This body of literature suggests that children who first develop strong early L1 literacy skills will more easily acquire the corresponding skills in L2 and beyond.

Despite the popular discourses surrounding language of instruction, literacy learning is not a zero-sum game in which children’s time spent learning one language is detrimental to their skills in another. A study comparing English-Hebrew bilingual children with monolingual children on early literacy tasks found that the bilingual children performed better (Bialystok et al. 2000). In the United States, a large study examining the factors related to language minority students’ success concluded that children should be taught in their first language at least through grade 5 or 6 (Thomas and Collier 1997). The authors also found that students who were in “well-implemented” bilingual classes scored better than students in monolingual classes (15), a conclusion that aligns with the findings of a review by the National Literacy Panel on Language-Minority Children and Youth (August and Shanahan 2006). However, the vast differences in context between developed countries and sub-Saharan Africa, including in the available educational resources, teacher professional development, and provision of instructional materials, mean that this evidence is of questionable utility to African policy makers. Given this lack of evidence specific to sub-Saharan Africa, policy makers across the continent have made very different policy choices regarding mother tongue instruction. Ethiopia, Uganda, South Africa, and Ghana have expanded their mother tongue and local language programs in the early grades, while Malawi’s and Kenya’s recent activities in literacy in the early levels have been implemented outside of earlier language-of-instruction policies.

A number of studies have attempted to address this lack of evidence in the context of sub-Saharan Africa. However, as a group, these previous studies offer incomplete evidence in regard to medium-scale implementation of mother tongue instruction. To our knowledge, no other medium-scale, causal implementation studies have been conducted in the region. In addition, the previous studies that have been implemented compared mother tongue instructional interventions with a control condition rather than comparing with control as well as with an effective non–mother tongue literacy improvement program. The existing studies, while informative, often have methodological or sampling weaknesses, thereby limiting their usefulness to a policy maker considering whether mother tongue instruction would be an effective investment at scale.

5 Cárdenas-Hagan et al. (2007); Goodrich et al. (2013); Bourgoin (2014); Montanari (2014).
An evaluation by Sailors and colleagues of the READ Intervention in South Africa, for example, lacked a pretest and used matching and purposive sampling rather than randomization to treatment groups (Sailors et al. 2010). The findings of the READ study suggest, however, that instruction in children’s home language can positively affect achievement on early grade literacy tasks, a finding that we have further investigated with our study. Several multinational cross-sectional studies have identified associations between mother tongue instruction and student outcomes (Smits et al. 2008; Hungi and Thuku 2010), but such studies did not allow for the attribution of causality. While these studies are again supportive of the general premise that mother tongue instruction is linked to literacy skill development, we strove to address the relationship with the greater methodological rigor allowed by a randomized controlled trial. Critically, many studies did not evaluate the effects of MT instruction in real-world situations. Some required the deep and costly involvement of foreign experts (Walter and Chuo 2012) or expensive materials development. Others had small samples or other issues that made causal inference difficult. For example, a study of mother tongue interventions in three South African provinces showed effects on literacy outcomes, but the intervention was undertaken in only 29 schools (Piper 2009). Despite these methodological issues, the studies cited above, as well as others in the field, yielded information that was useful in the development of various aspects of the PRIMR project, including the design of the teacher professional development model; the content, style, and pacing of the student textbooks; and the new approaches to instructional coaching taught to teachers implementing PRIMR.

We are unaware of any other peer-reviewed studies that address all of the above issues, in addition to comparing MT instruction with a well-designed literacy program undertaken in languages other than the mother tongue. While earlier studies have provided evidence that MT approaches may be beneficial, research that does not address the methodological issues discussed above provides incomplete guidance to policy makers attempting to make decisions regarding language-of-instruction policies in multilingual settings at medium to large scale. That said, the study described here, while analyzing the causal impact on MT, was limited by its geographic external validity and the specificity of the languages and implementation context in which it took place, which means that space remains for additional rigorous research in this area, and our contribution has its own limitations.

Resistance to Mother Tongue Instructional Policies

Mother tongue policies have rarely been implemented as designed in sub-Saharan Africa because of a number of resource constraints, logistical

6 Benson (2000); Hovens (2002); Walter and Chuo (2012); Laguarda and Woodward (2013).
barriers, and resistance from key stakeholders, and these challenges are well documented in the literature. Such policies are often unpopular with parents and teachers in Kenya, as elsewhere in the region. Stakeholder beliefs about and commitment to MT education are critical to programs’ success (Trudell 2007; Jones 2012). Parents and teachers are often concerned about children’s long-run outcomes, including examination performance, higher education access, and employment prospects. In Kenya, more than three-quarters of teachers reported that parents would be unhappy if mother tongue instruction became the norm in their schools (Begi 2014). Parents often believe that success in learning in a non-mother tongue, such as English, is causally related to the time of exposure and therefore want 100 percent of instructional time to be spent in the target language (Brock-Utne 1997; Brock-Utne and Holmarsdottir 2004). In some Kenyan schools, the use of mother tongue by students and teachers is not allowed, despite the national policy (Spernes 2012), and in some cases students are punished for speaking mother tongue at school (Wangia et al. 2014). This resistance to MT persists despite the consistent finding that MT instruction makes it easier for parents, particularly those with low education levels, to be involved in their children’s education.

Even if teachers and parents do support MT instruction, multiple resource constraints make it difficult for teachers to undertake it successfully. First, teachers receive little training on how to teach children in mother tongue. Second, instructional materials are lacking in many languages. Where MT materials do exist, they are often of poor quality or are not treated the same as the other textbooks. One study reported that MT texts in one school were printed in black and white while other texts were printed in color (Jones and Barkhuizen 2011). Additionally, all subject texts were in English rather than in the MT. Such decisions transmit the message to children that their MT is not as important as the other languages. Third, the educational system has a weak infrastructure and low capacity for planning and implementation (Kamwendo 2008; Gacheche 2010). For example, many countries suffer from a conflict between MT policy and teacher assignment policies, which state that teachers may be assigned to posts anywhere in the country, regardless of their language capabilities (Nyaga and Anthonissen 2012; Naom and Sarah 2014).

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7 Bunyi (2005); Khejeri (2014); Trudell and Piper (2014).
8 Muthwii (2004); Jones (2012); Naom and Sarah (2014).
9 Benson (2004); Trudell (2005); Alidou et al. (2006); Brock-Utne and Alidou (2006); Iyamu and Ogiegbaen (2007); Laguarda and Woodward (2013).
10 Iyamu and Ogiegbaen (2007); Kamwendo (2008); Obiero (2010); Jones and Barkhuizen (2011); Mackenzie and Walker (2013); Begi (2014).
11 Muthwii (2004); Iyamu and Ogiegbaen (2007); Kamwendo (2008); Gacheche (2010); Nyaga and Anthonissen (2012); Mackenzie and Walker (2013); Begi (2014).
These logistical and resource constraints become exponentially more difficult in multilingual settings, where children may grow up with exposure to multiple mother tongues (Gupta 1997; Nyaga and Anthonissen 2012). In such situations, teachers generally engage in a great deal of code switching among the various languages of instruction. The result is a complex blend of languages rather than a coherent approach to teaching a series of languages.

Finally, some significant political considerations contribute to the development of language-of-instruction policies, as well as to the degree to which they are implemented (Webb 1999; Wangia et al. 2014). Naming a local language as an official language of instruction—or, conversely, not doing so—can be a powerful political decision. Some stakeholders fear that promoting local languages might deepen ethnic divisions (Skutnabb-Kangas 2001; Gacheche 2010). In the wake of Kenya’s postelection violence in 2007, such concerns typically are at the forefront of discussion about language of instruction. The publication of the white paper on education in 2012 that affirmed Kenya’s mother tongue language policy was met with significant public resistance (Republic of Kenya 2012).

Scaling Up the Use of Mother Tongue in the Early Grades

To summarize the discussion presented above, policy makers in multilingual countries must currently make decisions about language of instruction with incomplete information based on a series of studies that are insufficient to answer the critical question: Is effective mother tongue instruction likely to be successful on a wide scale in multilingual settings in which stakeholders resist mother tongue policies? Many countries across sub-Saharan Africa, from Ethiopia to South Africa to Nigeria to Uganda, have implemented or are attempting to implement mother tongue instruction in primary schools. However, little rigorous evidence is available that addresses how mother tongue instruction works in practice, at scale, as opposed to in theory or in a small pilot program. Building on the foundation of earlier studies of MT literacy instruction, this study aims to help fill this gap by comparing the effects of a medium-scale, high-quality instructional program in mother tongue to the same program delivered only in Kiswahili and English, which, as noted above, generally are Kenyan children’s L2 and L3.

Methodology

Research Design

The goal of these analyses was to determine whether a version of PRIMR that included mother tongue instruction under real-world implementation

12 Brock-Utne and Holmarsdottir (2004); Opoku-Amankwa and Brew-Hammond (2010); Jones and Barkhuizen (2011).

13 Gupta (1997); Ouane and Glanz (2010); Jones and Barkhuizen (2011); Naom and Sarah (2014).
conditions (PRIMR-MT) would lead to greater MT literacy outcomes than the base PRIMR program, in the face of extensive challenges. We therefore used a randomized controlled trial design, allowing for the estimation of the causal effects of the intervention. Our intent-to-treat approach examines the effect of being in a zone assigned to the mother tongue program rather than exposure to a well-implemented non–mother tongue literacy program. Given the challenges facing multilingual countries in implementing such programs at medium scale, the effects of MT in an intent-to-treat design provide more policy-relevant findings and offer better evidence than previous studies as to what outcomes might be expected given the complexities surrounding MT program implementation.

Sites

This study took place in Bungoma and Machakos, two predominately rural counties. These two counties were chosen in part because they were relatively homogeneous in terms of the language spoken as mother tongue and had not been involved in the initial trial of the base PRIMR program. Bungoma County is in the western part of Kenya, bordering Uganda. Agriculture is the main industry in Bungoma, with sugar cane a leading crop. Bungoma is one of Kenya’s largest counties by population and is a thoroughfare for goods transported to and from Uganda. As a result, it has significant migration and is relatively diverse, with significant cultural and linguistic differences between the populations in the majority of Bungoma County and the less accessible communities near Mount Elgon. Bungoma is primarily populated by members of the Luhya ethnic group, of which the Bukusus are a large subgroup. The Lubukusu language selected by the MoEST for the mother tongue experiment covers a relatively large language group in the county, but the Bukusus are one of many ethnic groups in the county. The zones eligible for the mother tongue program were identified as relatively Lubukusu language homogeneous, although PRIMR implementation research suggested that there remained many locations that had significant language diversity.

The second location for the PRIMR mother tongue study, Machakos County, lies approximately 60 kilometers southeast of Nairobi and was Kenya’s first capital in the colonial era. Currently, Machakos is experiencing significant economic growth and a population increase due to its proximity to Nairobi and its focus on technology. It is a hilly region where many families live on small farms, growing maize, sorghum, and millet. Machakos is primarily populated by the Kamba ethnic group, who speak Kikamba.

Language Background

The PRIMR-MT program developed, revised, and distributed reading textbooks and teachers’ guides in Lubukusu and Kikamba. This section pro-
vides background on those two languages. As mentioned, Lubukusu is the language spoken by the Bukusu, who had a population of slightly over 1.4 million in the 2009 national census (Kenya National Bureau of Statistics 2010). Lubukusu is spoken in Bungoma, Kakamega, and Trans Nzoia Counties. It is a Bantu language within the Luhya language group, sometimes called a Luhya dialect (Lewis et al. 2015). Luhyas were the second-largest Kenyan ethnic group in the recent census (Kenya National Bureau of Statistics 2010). The Lubukusu orthography has five vowels, does not mark vowel length, and uses tone to mark verb tense (Schroeder 2010).

Kikamba is the predominant language and Kamba the predominant ethnic group in Machakos, Kitui, and Makueni Counties, with some Kikamba speakers in Kajiado and Taita-Taveta Counties (Lewis et al. 2015). Kikamba is the fifth-largest Kenyan language group, with nearly 3.9 million speakers as of 2009 (Kenya National Bureau of Statistics 2010). Kikamba has seven vowels, with diacritics marking those vowels in a manner similar to Gikuyu, another widely spoken Bantu language in Kenya.

In both Bungoma and Machakos, the majority of children speak the mother tongue at home. According to contextual research done as part of the 2013 PRIMR baseline assessment (see Piper, Kwayumba, and Oyanga [2015] and the Measures section below) of a sample of children who would be participating in the PRIMR-MT study, in Machakos, 90.4 percent of children said they spoke Kikamba at home, while 6.1 percent spoke Kiswahili at home and 5.3 percent of children did not know or did not respond. Bungoma was more language diverse, with a smaller percentage of pupils speaking Lubukusu at home (72.8 percent) and many more pupils speaking Kiswahili at home (32.1 percent). Few children noted that they spoke other languages at home (5.3 percent), suggesting that the area remains predominantly Lubukusu speaking, but the Lubukusu language seems to exist alongside of Kiswahili in more homes than in Machakos. In other words, although both counties were rather L1 homogeneous, the use of language in Bungoman homes was more varied than in Machakos.

The children assessed at baseline also provided data on the languages spoken at school. Results were similar across counties, with 87.0 percent and 79.1 percent of children noting that Kiswahili was used in schools in Bungoma and Machakos, respectively. English was identified as being used by 25.8 percent and 20.9 percent of children in Bungoma and Machakos, respectively, while mother tongue was noted as being used by 29.0 percent and 29.7 percent of pupils in Bungoma and Machakos, respectively. Implementation of the PRIMR-MT program showed that there was a great amount of variation in mother tongue skills even for teachers and Teachers’ Advisory Centre (TAC) tutors randomly assigned to various treatment groups.14 As de-

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14 TAC tutors as described in this article were government employees within the Teachers’ Service Commission; their primary role under PRIMR was to visit teachers in public school classrooms to...
scribed in detail later in the article, one TAC tutor in the Lubukusu treatment group was not a native speaker of the language, and she provided feedback to teachers in another language. Some teachers were speakers of other Luhya languages (of which Lubukusu is one), and implementation in those classrooms was limited by oral skills and vocabulary. These anecdotal examples are evidence for why implementing the PRIMR-MT program in real-world settings was appropriate.

Sample

School zones were randomly assigned to one of three groups. On the basis of the guidance of county-level education officers in Bungoma and Machakos, eligible zones were ones that were identified as primarily populated by Lubukusu or Kikamba speakers. These zones were then randomly selected for the study and then randomly assigned to the base PRIMR program, the PRIMR-MT program, or the control group. All three groups had similarly limited exposure to mother tongue assessments of the sort implemented in PRIMR. The analyses presented here compare the four zones (82 schools) assigned to the base PRIMR program starting in 2014, the eight zones (166 schools) assigned to PRIMR-MT in 2014, and the seven zones (166 schools) serving as controls. Approximately 40 percent of the schools in each zone were selected for the baseline and endline assessments (Piper, Kwayumba, and Oyanga 2015). Twenty pupils were selected using simple random sampling from classes 1 and 2, stratified by sex. Every randomly selected child was tested in English and Kiswahili as well as in either Kikamba or Lubukusu, depending on the county. The tests were locally adapted versions of the Early Grade Reading Assessment (EGRA; see Gove and Wetterberg 2011), an instrument that focuses on initial literacy skills, as discussed further below. Table 1 presents descriptive statistics on the sampled students. At the baseline, the only statistically significant differences between treatment groups were that (1) between the base PRIMR group and the control group for age, the control group was 0.3 year older (P-value < .01) in Machakos; and (2) the base PRIMR sample was 3.8 percentage points more likely to be female (P-value = .03) in Bungoma. The comparison at the endline showed that, in Bungoma County, both base PRIMR and PRIMR-MT were more likely to have books

provide feedback and support. In 2016 the position description and title changed to “curriculum support officer.” We have retained the terminology that was in effect during PRIMR.

Note that there were other treatment groups in the broader PRIMR project, but this study focuses on the analysis from the mother tongue eligible zones assigned to base PRIMR, PRIMR-MT, or control.

The 2013 cohort of schools included another four zones implementing PRIMR. Those schools were not included in this analysis since previous monitoring results showed that impacts in PRIMR increased over time (Piper, Jepkemei, and Kibukho 2015).

The control schools began full implementation of the Tusome intervention in 2015. One of the control zones had a very low percentage of children who spoke Lubukusu at home and was excluded from the analysis to avoid biasing the results.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline (October 2013)</th>
<th>Midterm (October 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Base PRIMR</td>
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<tr>
<td>A. Machakos County, Kikamba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child is in class 1</td>
<td>48.4 (.2)</td>
<td>46.2 (.1)</td>
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<tr>
<td>Child age</td>
<td>7.5 (.8)</td>
<td>7.2 (.1)</td>
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<tr>
<td>Female</td>
<td>49.5 (1.4)</td>
<td>49.5 (.1)</td>
</tr>
<tr>
<td>Books in home</td>
<td>25.1 (3.7)</td>
<td>20.0 (4.6)</td>
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<tr>
<td>Preschool, pre-unit, kindergarten</td>
<td>90.4 (3.6)</td>
<td>83.7 (4.7)</td>
</tr>
<tr>
<td>Mother is literate</td>
<td>90.7 (2.6)</td>
<td>90.1 (2.4)</td>
</tr>
<tr>
<td>Father is literate</td>
<td>87.1 (3.5)</td>
<td>90.5 (2.4)</td>
</tr>
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<td>333</td>
<td>249</td>
</tr>
<tr>
<td>B. Bungoma County, Lubukusu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child is in class 1</td>
<td>52.0 (.5)</td>
<td>50.2 (1.6)</td>
</tr>
<tr>
<td>Child age</td>
<td>8.1 (.1)</td>
<td>8.1 (.1)</td>
</tr>
<tr>
<td>Female</td>
<td>44.8 (1.0)</td>
<td>49.6 (2.2)</td>
</tr>
<tr>
<td>Books in home</td>
<td>14.0 (4.8)</td>
<td>9.1 (3.2)</td>
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<td>Preschool, pre-unit, kindergarten</td>
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<tr>
<td>Mother is literate</td>
<td>93.8 (1.3)</td>
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<td>Father is literate</td>
<td>93.0 (2.3)</td>
<td>93.6 (3.2)</td>
</tr>
<tr>
<td>n</td>
<td>283</td>
<td>183</td>
</tr>
</tbody>
</table>

**Note.**—The table presents means and standard errors (in parentheses) with P-values from T-tests comparing control and base PRIMR and control and PRIMR-MT.

* P < .10.
* * P < .05.
* * * P < .01.
* * * * P < .001.
at home than the control, which likely was an effect of the treatment intervention.

**PRIMR and PRIMR-MT Interventions**

The base PRIMR intervention consisted of four components. First, teachers received teachers’ guides in Kiswahili and English whose content was matched to that of the pupil books. Second, pupils received books in both languages with content for 150 days of instruction. PRIMR produced introductory literacy texts that were longer than the textbooks typically available in schools, and the PRIMR books focused on the five components of reading (phonemic awareness, alphabetic principle, vocabulary, fluency, and comprehension) as well as writing (National Institute of Child Health and Human Development 2000). Because PRIMR was able to produce them at a low cost, the books were allocated at a 1:1 student-textbook ratio, a dramatic improvement over the 3:1 ratio observed in PRIMR schools at the main project’s baseline (Piper and Mugenda 2012). Teachers were also given flashcards and pocket charts to use for the activities in the lessons. Third, all PRIMR teachers participated in a 10-day training focused on the research behind PRIMR’s instructional approach. The training allowed ample time for practice with the lessons found in the teachers’ guides. The 10 days included refresher training given at the beginning of the next two school terms. Fourth, instructional coaching was provided to teachers via the government’s TAC tutors. The TAC tutors received 15 days of training to ensure that they had the necessary foundation to guide teachers through the program.

PRIMR-MT consisted of these same four components. In addition to providing teachers’ guides and pupil books in English and Kiswahili, PRIMR-MT also supplied student textbooks and teachers’ guides in either Kikamba or Lubukusu, depending on the county. These textbooks were developed by a team of international and Kenyan linguists from the nongovernmental organization SIL LEAD; language experts in Lubukusu and Kikamba from Bungoma and Machakos Counties, respectively; PRIMR’s reading experts; and representatives of the MoEST. The design and structure of the mother tongue textbooks and teachers’ guides were very similar to those of the Kiswahili and English materials. The PRIMR-MT teachers received an additional two days of training focused on strategies for teaching in the mother tongue. This training was spread throughout the three term-based training periods, with one day at the end of the first training and then half-day trainings during the next two training periods. TAC tutors in the PRIMR-MT zones were given support on how to supervise literacy instruction in mother tongue. After the random selection and assignment of zones to control, base PRIMR, and PRIMR-MT, no changes were made in the program to accommodate the language ability or preferences of TAC tutors, head teachers, or teachers. This was done in order to test the effectiveness of a mother tongue policy at me-
dium scale, in typical (i.e., not ideal) conditions, and at low cost. As a result, at least one TAC tutor was not a speaker of the local language, and several head teachers and many teachers were not speakers of these languages or actively resisted the implementation of the program, as we describe below.

Measures

As stated earlier, we used the EGRA to measure children’s literacy performance in English, Kiswahili, and the respective local language, either Kikamba or Lubukusu. Our adapted versions of the EGRA included the following measures in the two languages:

- Letter sound fluency: measured the ability to identify the sounds of letters fluently (correct letters per minute, clpm).
- Syllable fluency: measured the ability to understand letters joined to form part of a word and to sound them appropriately (correct syllables per minute, cspm).
- Nonword fluency: measured the ability to decode nonwords fluently (correct words per minute, cwpm).
- Oral reading fluency: measured the ability to read a story fluently (correct words per minute, cwpm).
- Reading comprehension: measured the ability to comprehend reading passages associated with a timed reading assessment (percentage correct on five comprehension items).

Data were collected by a team of 86 assessors who had been engaged in EGRA and Early Grade Mathematics Assessments in Kenya since 2007, 16 of whom undertook the majority of the mother tongue assessments. All of the assessors participated in a week-long training, including a special session for those administering the tests in the mother tongues. For both local languages, interrater reliability measured at the end of training was above 95 percent. Each assessor was trained on ethical treatment of pupils in data collection, and because the EGRA is administered orally to one child at a time, the assessors were easily able to give every child the choice to participate (or not) in the study.

Data Analysis

While the treatment groups were assigned randomly, during the October 2013 baseline, the study team observed differences between the groups (see fig. 1 and app. table A1 for more details on the entire sample). That is, the control group outperformed the two treatment groups at baseline on all five of the key measures, as signified by the black bars in figure 1. Specifically, the control group had statistically significantly higher achievement (see the underlined numbers) than the base PRIMR group in letter fluency, syllable
fluen
cy, nonword
cency, oral read
going.
The con
trol group also had statistically significantly higher perfor-
mance than the PRIMR-MT group for nonword fluency, oral reading fluency, and reading comprehension. The differences in baseline learning outcomes favoring the control group were large enough that statistical corrections were required, but not so large that the samples needed to be redrawn (Institute of Education Sciences, US Department of Education 2014). On the basis of the What Works Clearinghouse guidelines, we saw no systematic reasons that the control group outperformed the treatment groups. A difference-in-difference (DID) analytic strategy assisted in removing the baseline differences in estimating the treatment effect (Murnane and Willett 2011). There were no statistically significant differences at baseline between the base PRIMR and PRIMR-MT groups.

As noted, given the statistically significant differences between the control group and the two treatment groups at baseline, we fit DID models to obtain an estimate of the effect of the PRIMR-MT programs in comparison to the base PRIMR program (Piper et al. 2014). In order to compare learning outcomes over time, we used the method described by Albano and Rodríguez (2012), linear equating formulas, which simply uses the difference in learning outcomes from a set of children given both the pre- and postintervention measures. Linear equating formulas were used to allow for the comparison of scores across time. Note that the overall outcomes were extremely

![Chart showing baseline comparisons between treatment groups (October 2013).](chart.png)

**Fig. 1.**—Baseline comparisons between treatment groups (October 2013). *Note.*—Underlined numbers signify statistically significant differences from the control group.
low, particularly as these baseline scores were obtained at the end of the 2013 academic year. Children could barely read in mother tongue in either county.

Findings

Research Question 1: Did the PRIMR-MT Intervention Improve Literacy Skills in Mother Tongue?

The PRIMR-MT program represents a unique opportunity to evaluate—in a rigorous manner—the impact of a mother tongue literacy intervention in sub-Saharan Africa on pupil outcomes. To answer the first research question, we present the results of the DID models we fit to estimate the causal effect of the PRIMR-MT program on learning outcomes. Table 2 displays our findings. The table shows that the PRIMR-MT program had statistically significant effects in both languages and both grades for letter sound fluency and the percentage of pupils reaching the basic “emergent literacy” benchmarks set by the MoEST.\(^{18}\) The PRIMR-MT program had no statistically significant effect on syllable fluency. For oral reading fluency and reading comprehension, statistically significant effects were found on three out of four combinations of language and grade. For nonword or decoding fluency, the PRIMR-MT program had an effect on Lubukusu outcomes in both classes 1 and 2, but not on Kikamba outcomes for either level. Taken as a whole, these results show that PRIMR-MT improved MT learning outcomes for 16 out of 24 measures. We incorporated into table 2 the results from regression models that included covariates—specifically, whether students spoke the mother tongue of the county at home and whether students spoke Kiswahili at home. The DID results controlling for these variables did not differ substantively from the models without covariates.

To indicate whether the effects of PRIMR-MT differed by language, we present figures 2 and 3. The underlined numbers signify statistically significant differences compared to the control group, and the symbol ❖ indicates statistically significant differences between the two language groups. Figure 2 shows that the effects were similar for the two languages in class 1, although the effect on letter sound fluency was slightly larger for the Kikamba group.

Figure 3 shows somewhat larger differences between Kikamba and Lubukusu in terms of the impact of PRIMR-MT on letter sound fluency and reading comprehension in class 2. The differences in letter sound scores were consistent with the results for class 1, and the differences on syllable fluency, nonword fluency, and oral reading fluency were not statistically significant.

\(^{18}\) Note that the emergent literacy benchmarks of 17 cwpm for Kiswahili and 30 cwpm for English were set in August 2012 by the Kenya National Examinations Council. No benchmarks were set for these two mother tongues, however, so we used the benchmark for Kiswahili, also a Bantu language, as a proxy.
**TABLE 2**

**DIFFERENCES-IN-DIFFERENCES ESTIMATES OF PRIMR-MT AND BASE PRIMR TREATMENT EFFECTS**

**ON MOTHER TONGUE OUTCOME MEASURES, BY CLASS AND BY LANGUAGE**

<table>
<thead>
<tr>
<th></th>
<th>Letter Fluency (clpm)</th>
<th>Syllable Fluency (cspm)</th>
<th>Nonword Fluency (cwpm)</th>
<th>Oral Reading Fluency (cwpm)</th>
<th>Reading Comprehension (% Correct)</th>
<th>Emergent Benchmark (% at Benchmark)</th>
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<tr>
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<td>1.7*</td>
<td>3.6**</td>
<td>3.1**</td>
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<td>(8.6)</td>
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</table>

**Note.**—The Taylor series linearization method was used in calculating the standard errors (in parentheses).

* P < .10.

** P < .05.

*** P < .01.

**** P < .001.
Our second research question focused on whether the PRIMR-MT program had a larger impact on mother tongue literacy outcomes than the base version of PRIMR, a non–mother tongue program taught in Kiswahili and English in these two counties. The research design allowed us to compare the effects of PRIMR-MT not only against the control group, as many evaluations of mother tongue programs have done, but also against a proven literacy program that has worked elsewhere in Kenya to improve learning outcomes in students’ second and third languages.

The results of this analysis are shown in table 2, which presents the impact of PRIMR on mother tongue literacy outcomes. In addition, figure 4 presents the average Cohen’s $d$ effect size of the base PRIMR and PRIMR-MT programs on learning outcomes. The figure shows that PRIMR-MT had effect sizes between 0.37 and 0.56 standard deviations (SD) across the grades and languages. The figure shows more moderate effects for base PRIMR in class 1 Kikamba and Lubukusu and class 1 in Kikamba (0.32–0.35 SD) but a small effect size for class 2 Lubukusu (0.10 SD). For both class 1 and class 2,
and in both languages, the effect of PRIMR-MT was larger than the effect of base PRIMR, although the difference was trivial in class 1 Kikamba.19

Research Question 3: Did the Effects of Mother Tongue Instruction Differ across the Basic Literacy Skills between the Two Treatment Groups?

The sections above have shown that the PRIMR-MT program had an effect on learning outcomes in both mother tongues but also that the base PRIMR program, which had no explicit instruction in MT, also had a moderate effect on mother tongue outcomes. This research question investigates whether the effects of the two programs were different depending on the type of literacy task assessed. Pairwise comparisons showed that the DID effects were not statistically significantly different between the base PRIMR and PRIMR-MT treatment groups for any of the comparisons (by class or language) for letter sound fluency, syllable fluency, or nonword fluency, except for Lubukusu class 2. In general, however, we did find some statistically significant differences between the base PRIMR and PRIMR-MT treatment groups for oral reading fluency and reading comprehension.

19 As noted above, table 2 presents the DID results from models with and without covariates. The results did not differ substantively when covariates were included in the model from when they were not included.
To describe this in greater detail, we present figures 5 and 6. Figure 5 shows the causal impacts of base PRIMR and PRIMR-MT for Kikamba class 2. The magnitude of the effects showed no statistically significant differences for letter sound fluency ($P = .54$), syllable fluency ($P = .76$), or nonword fluency ($P = .75$). For oral reading fluency and reading comprehension, the base PRIMR program had no effect on outcomes, while the PRIMR-MT treatment improved fluency by 7.3 cwpm more than base PRIMR ($P = .01$) and improved reading comprehension by 17.8 percentage points more than PRIMR ($P$-value $< .001$).

For Lubukusu class 2, the pattern was similar to that for Kikamba class 2 except for one task. Similarly to Kikamba, Lubukusu class 2 PRIMR-MT did not show a statistically significant impact above the base PRIMR group for letter sound fluency ($P = .45$) or syllable fluency ($P = .51$). In contrast to Kikamba, Lubukusu class 2 PRIMR-MT had a 4.6 cwpm larger effect over base PRIMR for nonword fluency at the .10 significance level ($P = .09$). For oral reading fluency, the PRIMR-MT group improved reading fluency 4.5 cwpm more than PRIMR ($P = .04$) and improved reading comprehension by 8.2 percentage points more than PRIMR ($P < .01$). In contrast to Kikamba, the Lubukusu class 2 PRIMR-MT program’s effect on nonword fluency was significantly larger than for base PRIMR. In short, with small differences between the languages, the base PRIMR treatment improved

![Fig. 4.—Average effect sizes for PRIMR-MT and base PRIMR on Kikamba and Lubukusu learning outcomes in classes 1 and 2.](image-url)
learners’ skills in letter sounds, with modest effects on syllables and nonword fluency, but had no statistically significant impact on oral reading fluency or reading comprehension in the mother tongue, while the PRIMR-MT program increased oral reading fluency, reading comprehension, and the percentage of children reading at the benchmark.

**Discussion**

The PRIMR mother tongue experiment constituted the first medium-scale, randomized controlled trial to address the question of whether a mother tongue literacy program can be effectively implemented in the practical language realities of a multilingual sub-Saharan African country. Our findings indicated that a well-designed mother tongue program can succeed in improving early grade reading skills, even when stakeholders are resistant to the approach. The PRIMR-MT program resulted in statistically significant improvements over the control group in a number of areas, with particularly strong effects in letter sound fluency (all four language/grade combinations) and reading comprehension (three of four language/grade combinations). These effect sizes ranged from 0.37 SD to 0.56 SD. These program effects also increased the percentage of students in PRIMR-MT classrooms who reached the government benchmarks for reading fluency and comprehension, in comparison with control classrooms.
Our second research question addressed whether there was an advantage to children in literacy learning via a well-designed, research-based program in the local mother tongue as well as Kiswahili and English, versus the same program taught in Kiswahili and English only. This question is of critical importance to policy makers. If there were no relative advantage to MT instruction, then selecting a lingua franca such as Kiswahili as the national medium of instruction would be far cheaper and easier. The literature that we examined on language transfer suggested that the Kiswahili and English literacy program would have some impact on MT outcomes. We found that, in general, there was no difference in the impact on learning outcomes for base PRIMR and PRIMR-MT in the basic decoding skills of letter sound fluency, syllable fluency, and nonword fluency, but students in PRIMR-MT performed better on MT oral reading fluency and reading comprehension (see figs. 5 and 6 above). This was true for class 1 and 2 Lubukusu speakers and class 2 Kikamba speakers. There was no statistically significant difference between the PRIMR and PRIMR-MT program effects for class 1 Kikamba speakers. This might have occurred as a result of the very low outcomes achieved in class 1, although this cannot be the entire explanation, given that Kikamba performance was higher than Lubukusu performance.

Cross-language comparisons paint a complex picture in the PRIMR-MT study. Figure 4 compared the effect sizes for PRIMR-MT across languages and
showed that the Lubukusu effects (0.56 SD) were larger than those for Kikamba (0.37 SD) in class 1 but smaller in Lubukusu (0.48 SD) than in Kikamba (0.52 SD) in class 2. If language homogeneity within the school and community was the driving factor in the effect, then we would have expected the Kikamba results to be larger. More research is necessary to understand how language type and language community characteristics affect MT intervention acceptance and effectiveness. Our research suggests that, in both of these language communities, with varied language homogeneity and quite different language characteristics, children’s learning outcomes in MT can be improved.

Reiterating a key theme of this article, the success of PRIMR-MT in improving literacy outcomes is notable because PRIMR-MT was implemented using a real-world approach. The intent-to-treat identification strategy assigned zones to treatment groups without consideration for the languages spoken by the teachers or TAC tutors, as this arrangement mimicked what would happen at a national scale. This decision led to significant challenges for those communities, at best, and open resistance from them at worst. One of the zonal TAC tutors, tasked with training and supporting teachers in MT, was not a native Lubukusu speaker. She had a basic receptive vocabulary but was unable to speak the language. She supported teachers in Kiswahili rather than in Lubukusu but encouraged the teaching of MT lessons. After two visits to a school in the zone led by this TAC tutor, the program staff found that none of the teachers had used the MT materials because of fears that the non-Lubukusu children would not be able to decode the language and that the school lacked MT-speaking teachers. With some encouragement, however, lessons began to be taught in MT. Two other zones resisted teaching in MT, primarily because the subject would not be examined, and Kenya is an exam-driven education system. During the initial training, one head teacher reported that teachers were unwilling to teach in MT because of the need to focus on “twenty-first-century skills.” That head teacher explained that his resistance stemmed from concerns that during the classroom time in which PRIMR-MT children were being taught Kikamba, wealthy children were learning Chinese, French, and technology skills. The program was not well implemented in that school. Another head teacher noted that mother tongue was not a useful skill in the job market. Each of these implementation challenges likely reduced the overall effectiveness of the PRIMR-MT program from what it would have been in a more ideal and controlled language environment with greater openness toward MT.

Even when teachers were willing to attempt MT instruction, technical implementation issues sometimes interfered. The most complex implementation issue was that some Lubukusu speakers had dialectical differences from the orthographic choices made by the technical team that developed the materials. Although those experts were well-regarded Lubukusu experts and
linguists, there is enough diversity even within the language group to result in differences of opinion on orthographic choices. A common challenge faced by nonnative-speaker teachers teaching Kikamba was their inability to correctly identify the sounds associated with the Kikamba diacritic vowels. One teacher, willing to attempt instruction in Kikamba even though she did not speak it, was observed providing incorrect Kikamba word definitions that changed the interpretation of a story for pupils. The implication of these challenges was that the MT program was implemented less consistently than the English and Kiswahili language programs, which might have reduced the overall effectiveness of the PRIMR-MT program.

Regardless of the language of implementation, the base PRIMR and PRIMR-MT approach focused, at least in part, on letters, letter sounds, and decoding. The results for our third research question were therefore unsurprising. We found evidence for the interdependence hypothesis (Cummins 2001, 2007): students who were taught to decode in English or Kiswahili could also decode in MT. We found no statistically significant differences between base PRIMR and PRIMR-MT students on letter sound fluency, syllable fluency, or nonword fluency. However, we found rather large differences between the two treatment groups when we compared oral reading fluency and reading comprehension (see figs. 5 and 6). In order to do well on these more advanced skills in the MT, students needed more explicit instruction and exposure to MT vocabulary, something they were not receiving in the Kiswahili- and English-only base PRIMR program. Children who were not in the PRIMR-MT group had very minimal oral reading fluency and reading comprehension abilities in the local MT.

There are several other limitations to this study. First, the PRIMR mother tongue intervention was conducted in relatively language-homogeneous counties. While the study did involve teachers, TAC tutors, and students who were not native speakers of Lubukusu and Kikamba, there was less linguistic diversity in these zones than would be faced in some other parts of Kenya, including Nairobi and other cities and towns. Despite its assumed benefits, MT instruction will be very difficult in a setting in which there is no clear MT to use. Second, this intervention covered only the 2014 academic year. With a longer implementation time, the results might have differed. On the one hand, teachers might have become more comfortable teaching in the MT in subsequent years, and improved literacy among students could have increased stakeholder buy-in. On the other hand, parents and teachers alike might have increased anxiety about students’ ability to bridge into English as fourth grade neared, leading to greater resistance to the intervention. Finally, the implementation challenges that the PRIMR-MT program faced potentially resulted in a smaller impact of PRIMR-MT on learning outcomes than would have been faced in a less complex language environment with fewer implementation challenges.
Unlike previous MT interventions, the PRIMR-MT intervention also provided pupils with instruction in Kiswahili and English, the languages of broader communication. There might have been less resistance to the PRIMR-MT intervention than there was in other MT programs that did not provide instructional support in languages of broader communication, therefore, and that might have increased take-up over interventions with different designs.

These analyses did not examine the relative effects of base PRIMR and PRIMR-MT on students’ skills in English, Kiswahili, or mathematics, the subjects that are the major determining factors for parents and community members regarding the perceived effectiveness of an MT intervention. Future analysis of the PRIMR results should examine whether PRIMR-MT or similar programs have an additive impact on learning outcomes in the core subjects. In other words, evidence that MT instruction improves learning outcomes in MT, as presented in this article, is promising. But evidence that MT instruction improves learning outcomes in English or other subjects remains lacking. Although many mother tongue advocates argue that will be the outcome, there is no rigorous evidence that the outcome predicted by theory will be the ultimate result of MT programs implemented in linguistically complex environments such as Kenya. Future research should investigate these critical issues.

**Recommendations**

Several issues plague mother tongue implementation in Kenya. The policy advocating mother tongue instruction in Kenya has been reinforced in several important policy documents (KIE 1992; MoEST 2014). However, mother tongue implementation remains limited (Piper, Schroeder, and Trudell 2015), and in many classrooms, the official time period held for the mother tongue subject is used for other subjects instead (Piper and Mugenda 2012). And as we have noted, even when implemented alongside an English and Kiswahili literacy program, the PRIMR-MT program faced serious technical challenges.

The findings presented here suggest several policy recommendations. First, policy makers should make a final determination of whether mother tongue intervention is the appropriate policy in language-complex Kenya. Without clear direction from the MoEST’s leadership, the policy will continue to be unevenly implemented. The current large-scale Tusome (Let Us Read) literacy program being implemented by the MoEST does not emphasize mother tongue instruction and would need to be adjusted if the MoEST were to decide that MT literacy was a desirable policy outcome, given the resistance to it. In addition, given the influence that examinations have on instructional choices, mother tongue would have to be included in the examinations in order to change instructional behavior. Second, a recent
Kenyatta University study on preservice teacher education showed that teachers are not being well prepared to teach literacy in the lower grades (Bunyi et al. 2011), let alone mother tongue literacy in early grades. Knowing how to speak a local language is not the same as teaching children literacy in that language, and we recommend that if Kenya continues to implement the mother tongue literacy policy, current teachers should be provided with professional development in the subject. The PRIMR-MT program showed that significant effects on learning can be obtained with modest professional development investments, and this will be critical in any scale-up of the PRIMR-MT program. Third, policy makers should determine whether the policy prescription required in Kenya is to implement mother tongue literacy or mother tongue as the language of instruction. The results of the PRIMR-MT program showed how complex implementing a large-scale mother tongue literacy program would be, but a mother tongue language-of-instruction program would be even farther afield from what happens in Kenya’s classrooms. There are very few classrooms in Kenya that predominantly use mother tongue or even Kiswahili for instruction in subject areas such as mathematics, social studies, or science.

Conclusion

The results of this study can inform the design of future research investigating the impact of MT interventions in multilingual settings. Research on MT literacy has suffered from a lack of rigorous designs, from small sample sizes, and from overly idealistic implementation environments and therefore has not been able to test whether MT programs can succeed and deliver the supposed benefits in realistic language environments that are often hostile to MT interventions. The results of this study show that mother tongue literacy outcomes can be improved in Kenya. Interestingly, decoding skills were improved using cross-language transfer from the version of the PRIMR program not utilizing MT instruction; in contrast, MT instruction is required to improve reading comprehension. We recommend that more research be undertaken to understand not only whether MT programs can be successful at a large scale and can overcome resistance to implementation but also whether and how MT programs improve outcomes in other core subjects as well. Being able to definitively answer the question of whether MT instruction enhances students’ ability to learn subsequent languages in settings like Kenya would be integral to building stakeholder support.

In addition to informing research in MT, this study’s results can help policy makers faced with key decisions about language of instruction. On the one hand, these findings are unique in the field of MT education regarding the magnitude of the positive impact of the program in two locations and two languages in Kenya. On the other hand, these findings are an incomplete
support for MT instruction, as we could not definitively determine whether
the intervention had an impact on the other subjects more related to the
measures of quality typically used by parents, or whether the impact on MT
would have been as large if the MT program had not included support to
schools in English and Kiswahili as well. Policy makers should note that the
PRIMR-MT program showed that although children can learn to decode
MT by transferring their skills from other languages, they are not able to im-
prove their fluency and comprehension skills without focused instruction in
reading in that language.

Appendix

<table>
<thead>
<tr>
<th>TABLE A1</th>
<th>DESCRIPTIVE STATISTICS FOR THE ANALYTICAL SAMPLE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Measure</th>
<th>Baseline (October 2013)</th>
<th></th>
<th></th>
<th>Endline (October 2014)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean (SE)</td>
<td>95% Confidence Interval</td>
<td>N</td>
<td>Mean (SE)</td>
<td>95% Confidence Interval</td>
</tr>
<tr>
<td>Lubukusu:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter sound fluency (clpm)</td>
<td>1,000</td>
<td>6.9 (.8)</td>
<td>5.3 8.5</td>
<td>999</td>
<td>15.5 (1.3)</td>
<td>13.0 18.1</td>
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<tr>
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<td>8.4 (1.2)</td>
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<td>13.0 (1.2)</td>
<td>10.5 15.4</td>
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<tr>
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<td>2.6 (.4)</td>
<td>1.9 3.4</td>
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<td>4.9 (.6)</td>
<td>3.7 6.1</td>
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<tr>
<td>Oral reading fluency (cwpm)</td>
<td>1,000</td>
<td>2.6 (.4)</td>
<td>1.8 3.4</td>
<td>999</td>
<td>4.6 (.6)</td>
<td>3.5 5.7</td>
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<tr>
<td>Reading comprehension (%) correct</td>
<td>1,000</td>
<td>.9 (2)</td>
<td>.0 1.2</td>
<td>999</td>
<td>6.2 (.8)</td>
<td>4.6 7.8</td>
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<tr>
<td>Percentage at emergent benchmark</td>
<td>1,000</td>
<td>5.2 (.8)</td>
<td>3.6 6.8</td>
<td>999</td>
<td>12.6 (1.8)</td>
<td>8.9 16.3</td>
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<tr>
<td>Kikamba:</td>
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<td></td>
<td></td>
<td></td>
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<tr>
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<td>11.5 (.9)</td>
<td>9.8 13.3</td>
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<td>16.0 23.9</td>
<td>1,009</td>
<td>22.3 (2.0)</td>
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