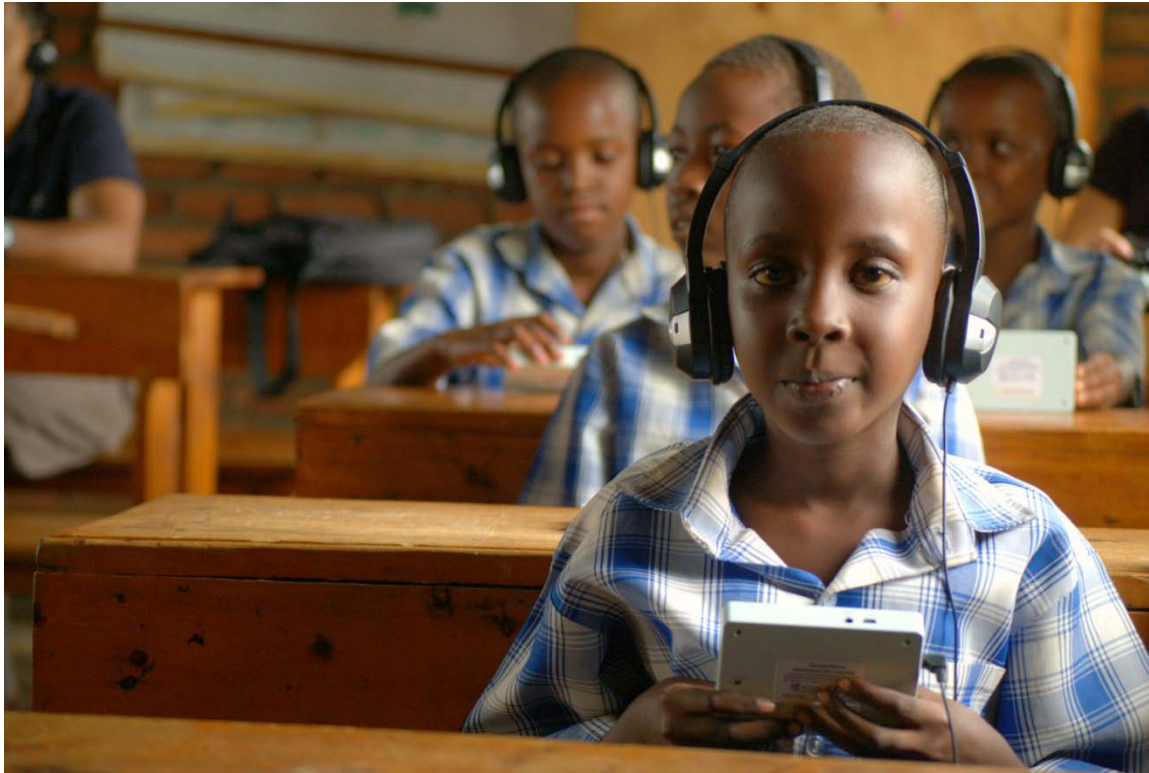




2011 Rwanda TeacherMate Report

Open Learning Exchange

Innovations for Learning



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Abstract

The TeacherMate Differentiated Instruction System was used in Rwanda by 620 students in elementary grades 2 and 3 during the 2011 school year. Although the amount of time students used the TeacherMate system was approximately one third of the recommended time, the results showed an average increase of 36 percentage points among standardized measures of verbal skills for P2 and P3 students using the TeacherMate system over the school year. This compared with average increases of 14 percentage points in each of two control groups. The amortized annual costs per student for continuing such a program are estimated to be US\$4.44. Reasons for these results, recommendations for further improvement in the program and possible next steps are presented.

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Introduction

The Open Learning Exchange (OLE) and Innovations for Learning (IFL) conducted a joint pilot project to evaluate the use of the TeacherMate Differentiated Instruction System in Rwanda during the January 2010 school year. The goal of this project was to test the TeacherMate system's effectiveness in assisting teachers to improve significantly the literacy levels of early elementary level students. This report discusses the outcomes of this basic literacy project, the lessons learned and recommendations for future TeacherMate programs.

Background Information

Implementing Partners

Innovations for Learning (IFL) is a Chicago-based nonprofit organization that has been working to develop innovative educational software since 1993. In 2008 IFL launched its TeacherMate system, a complete supplemental reading and math program for K-2 students. The TeacherMate system provides differentiated instruction to students through individual handheld devices that are synchronized and controlled by a central Content Management System for teachers. The TeacherMate system has been used successfully by over 50,000 students in the United States to improve basic literacy and numeracy.

Open Learning Exchange (OLE) was founded in 2007 to accelerate access to Quality Universal Basic Education by developing and supporting a global network of nation-based entrepreneurial centers that systematically introduce effective innovations for learning and openly share them. Each nation-based center sets their own priorities in a manner that reflects the particular needs and resources of their country. However, they are each responsible for the following: *identifying* key leverage points that can be used to accelerate and scale Quality Basic Education; *demonstrating* effective, applicable learning innovations that can be scaled cost-effectively; *documenting* their effectiveness, or lack thereof; *persuading* their governments to scale those innovations proven to be effective; and *sharing* their experiences and with, and learning from, others around the world.

Rwanda

Over the past decade Rwanda has made incredible progress in its economic growth and development. Infant mortality rates have declined, malaria transmission rates have plummeted, HIV prevalence has stabilized at a relatively low level and is now declining, health insurance now reaches a majority of all Rwandans, and primary school enrollment rates have increased dramatically. These gains have been built on

strengthened institutions and sound governance. Despite these gains, however, Rwanda remains one of the poorest countries in the world, ranking 163 out of 172 countries in terms of human development. Rwanda's strategic response to its many development challenges is guided by its' Vision 2020 master plan, as well as the recently adopted Economic Development and Poverty Reduction Strategy (EDPRS)¹.

Education in Rwanda

"In Rwanda, education is a top priority because we consider it the key for unlocking our development objectives. All studies have shown that investments in human capital have invariably produced high economic returns. We have no doubt that education empowers people, enlightens them, and in the end creates wealth for them."

-President Paul Kagame, 2010.²

In attempting to achieve its ambitious vision of becoming a middle-income country by 2020, the Rwandan government has prioritized education as a key area of investment. In 2009, 19% of the total government budget was spent on education, 65% of which was spent on basic education.³ As a part of Rwanda's commitment to achieving the Millennium Development Goal of "universal education for all," the government introduced a Nine Year Basic Education policy in 2009 to guarantee six years of free primary education and three years of secondary education for all Rwandan students. This policy helped to raise primary level enrollment rates to 93% by 2009. However, this dramatic increase has put a strain on schools and teachers, with class sizes swelling by 20% since 1999 to an average of 68 students.⁴ To accommodate this increase in students, most schools switched to a system with a rotating morning and afternoon shift.

Another recent policy change posing challenges to teachers is the 2009 change to English as the primary language of instruction. Previously, Rwandan teachers were trained to teach in French and Kinyarwanda, and therefore found themselves ill-equipped to make this sudden change. Though several training programs have been implemented to help teachers with this transition, they will need ongoing assistance in improving their English skills.

In light of these recent changes to the education system, Rwanda finds itself in an exciting yet challenging period. While we can already see great improvement in access to basic education, the quality of the education children receive still leaves much to be desired. To ensure that quality improves, teachers will need to develop significantly

¹ Government of Rwanda (2007) Economic Development and Poverty Reduction Strategy, MINECOFIN, Government of Rwanda

² <http://www.mineduc.gov.rw/spip.php?article27>

³ USAID-Rwanda (2011) RFA-696-11-000001 "Literacy, Language and Learning", pg 4

⁴ USAID-Rwanda (2011) RFA-696-11-000001 "Literacy, Language and Learning", pg 5

their skills at helping their students learn. Given this context, innovative approaches such as the TeacherMate system could have a great impact on improving the quality of basic education with students and on increasing the effectiveness and enthusiasm of teachers.

Remera Catholic Primary II School

Remera Catholic Primary I and II are public schools located near to each other in the Gasabo district of Kigali province. Catholic schools in Rwanda are established by churches and then turned over to the government to be run as public schools. Administration is still connected to the church, and therefore public perception is that catholic schools are slightly better than average public schools. Additionally, schools in Kigali tend to outperform rural schools, largely due to the socioeconomic differences that contribute to dropout rates. Due to these slight advantages, and an existing positive relationship with OLE Rwanda, Remera Catholic Primary II was determined to be a good site to pilot the use of TeacherMate.

At Remera Catholic Primary II, in 2011 school was divided into two shifts, a morning and an afternoon shift. Students alternated each day, coming in the morning one day and the afternoon the next. Classes were taught in blocks of 40 minutes. The morning shift lasted from 7:20 to 11:40 a.m. and afternoon from 12:40 to 5:00 p.m. with a twenty minute break in each shift. This meant that students were in class for only 4 hours per day. Teachers however, were teaching for 8 hours. Class sizes were below the national average, yet were still quite large, at around 47 students. Students rotated to different teachers for each subject. English was taught every day for primary level two (P2) and three (P3). Preliminary observations of English classes as well as interviews with teacher trainers revealed that teachers tended to slip back to Kinyarwanda instruction and preferred written instruction to speaking exercises. English classes typically consisted of “traditional” rote instruction with a teacher at the front of the classroom delivering lessons on the blackboard for students to copy and recite out loud. Though there were a limited number of supplementary storybooks, teachers tended to follow the standard national curriculum, which places a heavy emphasis on grammar and vocabulary. Students were given exams at the end of each semester created by the district (Gasabo). A sample of a Primary Level 2 exam is pictured below. Tests like these and the national curriculum determined the priorities of teachers for their students.

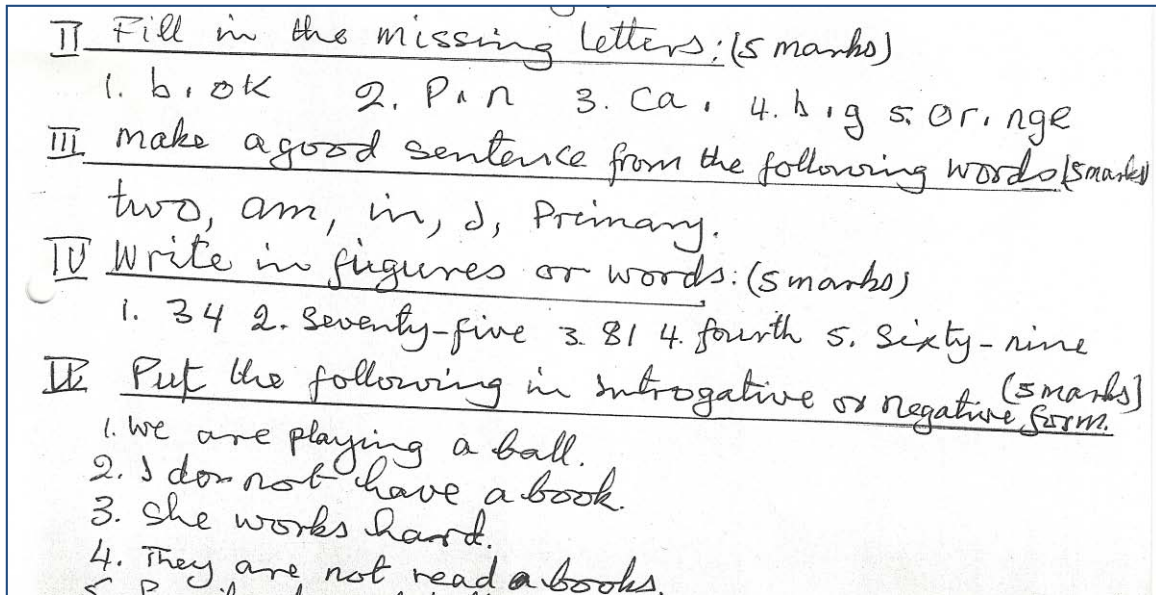


Figure 1: Gasabo District P2 Third Semester Exam

Within this context, the TeacherMate system is perfectly suited to fill some of the current gaps in English literacy instruction. Individualized attention on phonics and reading comprehension currently missing in typical instruction can be provided by the TeacherMate system. This should improve verbal learning and hopefully have a broader influence on teaching and learning.

Rwanda TeacherMate Project

Goals

The goal of the Rwanda TeacherMate (RTM) Project was to provide evidence concerning whether or not Rwandan teachers, with the aid of the TeacherMate learning system, could in one school year help their students increase significantly their basic literacy skills, compared with the conventional methods now used in schools. Though the TeacherMate system was created to improve both early literacy and numeracy, our focus for the 2011 school year was on English literacy due to the relatively short time frame of this project and the unique challenges currently facing English teachers in Rwanda. In addition to measuring literacy skill improvement, we also attempted to examine TeacherMate's effect on students' sense of agency and enthusiasm for learning, and their attitudes towards their teachers.

Methods

The RTM project worked in partnership with Remera Catholic Primary II, a public school located in the Gasabo district of Kigali. All Primary Level 2 (P2) and Primary Level 3 (P3) students used TeacherMates. Remera Catholic Primary II has six classes for P3 and eight

classes for P2 involving approximately 620 students. All of these students are taught by three English teachers, two for P2 and one for P3. With assistance from one teacher trainer, these three teachers were responsible for implementing the use of TeacherMate system in their English classes.

Training

Before the school year started, each of the three English teachers for Primary Level 2 and 3 at Remera Catholic II were given several training sessions in preparation for the new school year. They were given their own TeacherMate to take home and practice with as well as access to laptops. The teachers were advised on basic classroom management techniques for using TeacherMate during their English periods. This included proper storage, charging, daily distribution, and troubleshooting TeacherMate issues. A teacher trainer was available to assist the teachers during the free periods with TeacherMate questions, as well as general computer training.

Content

TeacherMate software has been designed in consultation with leading literacy and math educators and has been independently tested by university researchers. The program has a strong phonics component, which focuses on onset and rime and introduces students to approximately 100 of the basic phonograms in the English language. It also includes sorting and dictation spelling activities to help students develop the skills needed to decode and spell new words. Initial observations and tests confirmed that P2 and P3 students would be at an appropriate level to begin the program at the equivalent of a Kindergarten level in the United States.

In-class Usage

For the 2011 school year starting in January, each student in Primary Level 2 and 3 was given their own individual TeacherMate device to use each day during their English class. Due to the alternating split schedule of morning and afternoon sessions, each device was programmed to accommodate two students, one for each group.

Ideally the students were to use TeacherMates for half of each of their regularly scheduled English periods each day (20 minutes). However due to the heavy demands placed on teachers to cover specific material from the national curriculum, students eventually ended up using the TeacherMates for an average of 40 minutes per week plus a total of 10 nights of home use. Giving the students as much time as possible with the TeacherMates was a challenge that will be discussed later in this report. In the second semester, once students were comfortable using TeacherMate, we began exploring take-home usage to help give the students more time with the device. Students in the afternoon shift were given a TeacherMate to take home and return in the morning. We also added a supplemental class during the lunch break between morning and afternoon shifts. Because of delays in starting students with the TeacherMates the students used the TeacherMate system less than recommended each

week and only for 25 weeks, or approximately 17 hours over the course of the school year. This was roughly one third of the recommended level of use for their school year.

Evaluation

To evaluate the success of TeacherMate at improving students’ basic literacy skills, the test used for this project was adapted from the Early Grade Reading Assessment (EGRA) test developed for Rwanda by the Research Triangle Institute (RTI) and USAID. The test was conducted at the beginning and at the end of the school year. It included six key components of literacy: vocabulary, letter-sound recognition, familiar word recognition, unfamiliar word reading, oral passage reading, and reading comprehension.

Enumerators were recruited from the Kigali Institute of Education and trained based on RTI test administration training. Each exam was administered individually and took approximately 10 to 15 minutes per student. Instructions were provided in Kinyarwanda; the test questions and answers were in English. Four survey questions in Kinyarwanda were added to measure students’ attitudes towards their teachers and their own sense of agency in school. The same group of students tested in January 2011 was given the same test in October 2011. They were chosen to be representative of the entire test and control groups. The sample at Remera I was 38% male and 62% female and at Remera II was 46% male and 54% female.

Remera 1		Remera 2	
P2	50	P2	50
P3	50	P3	50
		P4 (<i>Tested for pretest only</i>)	50
Total	100	Total	150

Figure 2: Sample Sizes for Literacy Assessment

Students were tested in Remera II both as a baseline and as a way to compare the level of students in Remera II at the end of the 2010 school year before TeacherMate usage. The literacy skills of beginning P4 students was expected to be roughly comparable to their literacy skills at the end of year P3 so those data were used as an estimate of “Without TeacherMate” results for the end of P3. To the extent they improved their literacy during their vacation this would reduce the differences found in this project.

Project Outcomes

Literacy Scores

Overall, in Remera II, P2 and P3 students who used the TeacherMate system in 2011 improved in every literacy component significantly more than did the same school's P2 and P3 students in 2010.

Figure 3 shows the different average rates of improvement among P2 and Figure 4 shows the same kinds of improvements for P3 students year over year. The rates of improvement were determined by the difference between P2 and P3 test scores at the beginnings and endings of the year. Three teachers were involved. One of the two P2 teachers was new and the P3 teacher was the same in both years.

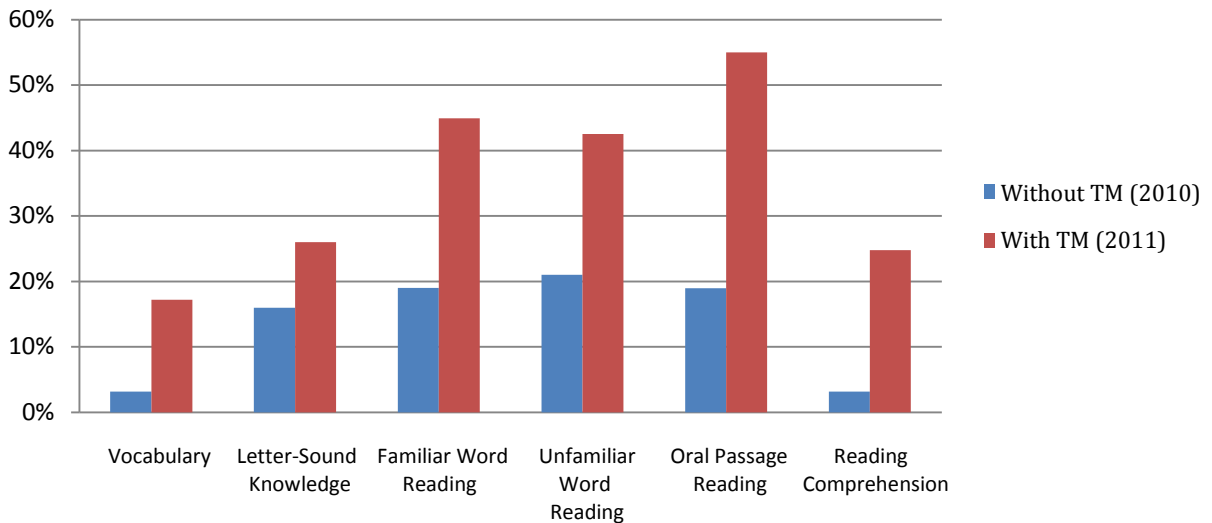


Figure 3: Remera II P2 improvement -2010 (without) and 2011 (with) TeacherMate

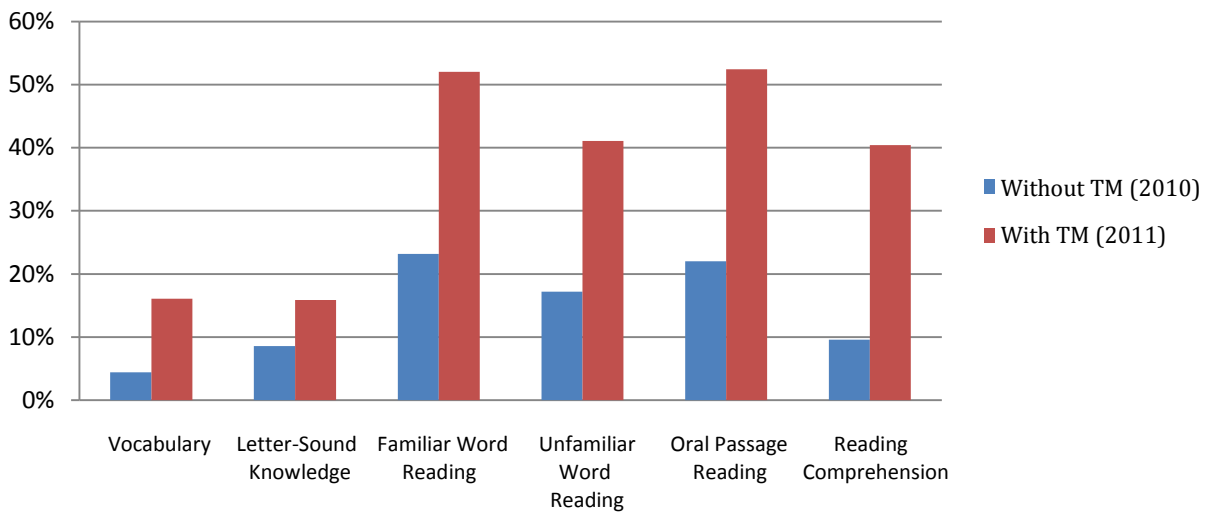


Figure 4: Remera II P3 improvement – 2010 (without) and 2011 (with) TeacherMate

The Project also included Remera I as a control group which followed a traditional classroom approach with no access to the TeacherMate system. These two schools were considered comparable in their student body and effectiveness. Figure 5 shows the test results for those two schools. Except for Vocabulary, the TeacherMate students at Remera II improved at a much greater rate than students at Remera I.

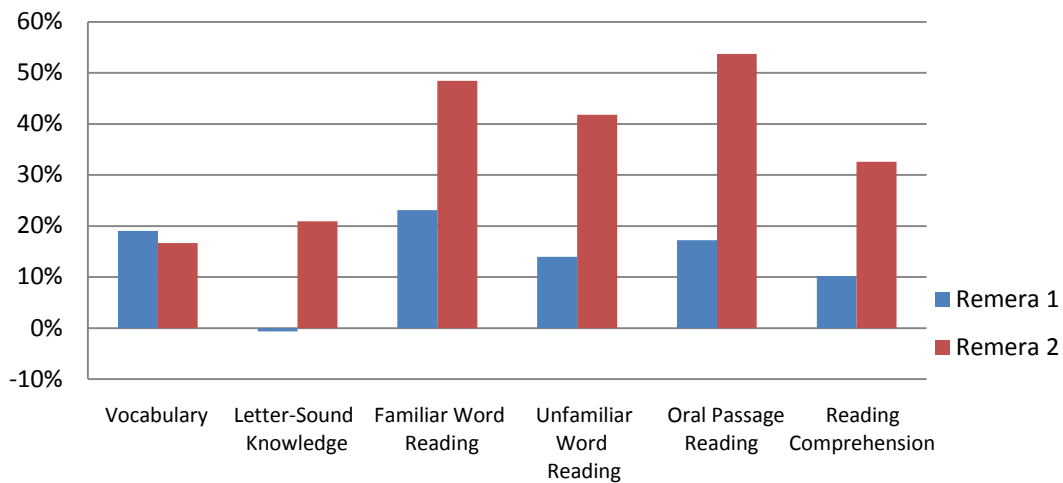


Figure 5: Differences in improvement in 2011 between Remera 1 and Remera 2 schools

To summarize, the results showed an average increase of 36 percentage points among standardized measures of verbal skills for P2 and P3 students using the TeacherMate system over the school year. This compared with average increases of 14 percentage points in each of two control groups.

Further testing would need to be done in order to determine why certain sections outperformed others. However, we can make some guesses based on the components of literacy emphasized in the TeacherMate system compared with the standard Rwandan national English curriculum. For example, TeacherMate students' improvement rates in the Vocabulary section of the test were presumably more comparable to the control group due to the fact that many of the vocabulary terms on the exam were classroom words (desk, chair, pen, etc.). These types of vocabulary words are a major focus of traditional English instruction in Rwanda. Oral passage reading and comprehension is not, which helps to explain why TeacherMate students showed the highest relative percentage improvement in the oral reading passage section.

Survey Results

While literacy improvement rates are a relatively straightforward indication of success, changes in students' attitudes were harder to measure. The following questions were asked to get a sense of students' attitudes towards their teacher's effectiveness, their own abilities, and school in general.

- Q1. Does your teacher help you to learn English?
- Q2. Does your teacher help you when you do not understand something in English class?
- Q3. Do you do get good marks in school?
- Q4. Do you enjoy going to school?

For each question, students were asked to respond using one of the following four choices: "A Lot, A Little, Not A Lot, Not at All". The survey was conducted entirely in Kinyarwanda to ensure that students fully understood the questions and response options. As shown in Figure 2, the overwhelming majority of students responded "A Lot" to each question, therefore making it difficult to determine what impact TeacherMate was having in each area, let alone how accurate and honest the responses were in the first place.

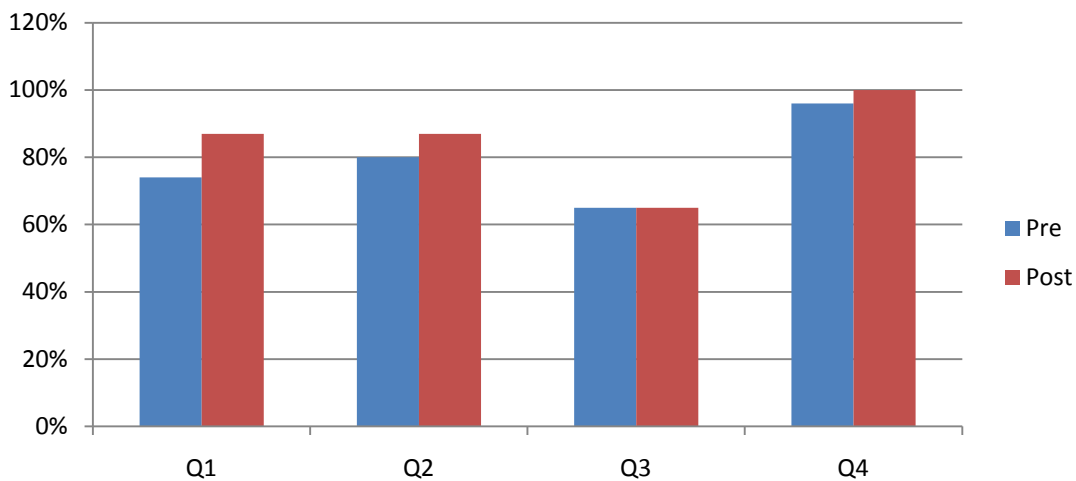


Figure 6: Percent of Remera II students who responded "A Lot" to survey questions

From the results of this survey it is clear that an accurate assessment of attitudes with this age group would require a more in-depth survey and possibly interview with each student.

Observations

In addition to demonstrating the quantitative literacy gains of these students, this report also serves to share the qualitative lessons learned throughout this pilot year. While the test results demonstrate that TeacherMate can be successful in this context, there were several challenges faced throughout the year that can be learned from and applied to future TeacherMate projects in Rwanda and other developing countries.

Teachers

English

As previously mentioned, teachers in Rwanda are currently at a great disadvantage due to the abrupt switch to English as the primary language of instruction. A recent policy change in 2011 set Kinyarwanda as the language of instruction for P1 through P3 thus allowing students some transition period to learn English. However, even specifically designated English teachers are still largely lacking the skills required to teach their students. Due to their own experiences with traditional blackboard instruction, as well as limited speaking skills, English teachers tend to focus on written activities rather than oral ones. Pronunciation in particular is a major difficulty for teachers. This provides a challenge for TeacherMate implementation but also an opportunity to fill a crucial gap in oral pronunciation practice.

Large classes

With class sizes averaging around 47 students, it is quite difficult for teachers to provide individual attention to each student. A major advantage of the TeacherMate system is that each student is able to work at their own pace, even in a large class setting. However, the Content Management System that helps to monitor student progress becomes very difficult for teachers to use when they are responsible for teaching 100+ students. Frequent additions and subtractions to class rosters add further complications to Content Management System tracking. Even by the third semester teachers did not know all of their students' names, partially due to the class sizes, and also in part due to changes in their class rosters. Though RTM staff members helped to sync and update content for this year, the challenges and constraints of working with the Content Management System at such should be considered for upcoming years.

Motivation Levels

Though teachers generally enjoyed using the TeacherMate in their classrooms, they required a great deal of monitoring and assistance to get into a routine of usage. Without a teacher assistant to help and encourage its use, teachers would likely spend more time leaving their students to copy terms from the blackboard. Despite their long workdays, many teachers were enrolled in nighttime training programs and used afternoon free periods and even lesson time to catch up on their own work or to rest.

There was somewhat of an unspoken agreement at the school that the bulk of new material would be covered during morning sessions, with afternoons being more relaxed.

With average salaries of approximately \$100 USD per month, it is understandable that many teachers were focusing their efforts on getting more training to find alternative future positions. Presumably, teacher salaries will need to improve in order for the government's ambitious education reforms to succeed. For TeacherMate programs in Rwanda and other similar countries, it is important for teachers to have support and small incentives (i.e. free computer training sessions).

Curriculum

While the teachers were very enthusiastic about using TeacherMate, they were often worried about falling behind the national curriculum schedule. Certain vocabulary words and grammar concepts needed to be taught each week in order for the teachers to stay on schedule. Though teachers recognized the advantages of TeacherMate lessons over those based on the national curriculum, the semester district exams were a powerful incentive to stay within its confines.

Students

Time

The largest challenge we faced for students was giving them enough time with TeacherMates. Students have only 4 hours in school per day including the time it takes to switch classrooms between periods. Establishing a steady routine of TeacherMate usage was difficult not only because of the curricular restrictions already mentioned, but also because of frequent interruptions in the school calendar (cleaning days, prayer days, preparation for tests, correction of tests, etc.). In this pilot year we made the most out of our limited time by adding opportunities for take-home usage as well as supplemental classes during the lunch period. Ideally future projects could work with schools to build a 20 minute period into the class schedule specifically designated for TeacherMate usage.

Experience with Technology

Compared with students in the United States, Rwandan students have little to no experience with technology. This means that seemingly simple tasks like plugging in headphones need to be explained in detail. In addition, students need to be trained in how to care for their TeacherMate (i.e. do not get it wet, try not to drop them, etc.). However, once these topics were explicitly covered with students, they had no problem comfortably navigating through the TeacherMate software within just a matter of a few weeks. Ultimately the students' lack of experience with technology can become an advantage as the TeacherMate experience is completely novel and exciting to students.

Content

For the most part, TeacherMate activity and story content is quite universal to any student learning to read and write in English. However, some concepts and words were not appropriate for the Rwandan context. Words like “vacuum” and “mailman” were quite foreign to our students. Of course, discussing what these words mean can be an opportunity for learning in itself. Additionally, the USA accent is difficult for Rwandan students to understand. As far as the level of material, the USA Kindergarten level was appropriate for Rwandan P2 students. However, reading comprehension was still quite difficult for our students.

Security

When introducing a valuable technology to a school with limited resources, there is an inherent risk that students might try to steal them. To mitigate this risk, cabinets with locks were placed in each classroom to store the TeacherMates and headphones. A hole in the back of the cabinets allowed power cords to charge the TeacherMates even as they were locked up. As we soon discovered, it is very important for teachers to count the TeacherMates collected after a class before locking them up. Around 20 devices were taken by students when teachers failed to do so. Fortunately, all of the TeacherMates were recovered as students began to realize they had no way of recharging the devices at home. None of the students were trying to sell the TeacherMates; they simply wanted more time to play with them. After implementing formalized take-home sessions, we no longer had this issue, and the devices were returned each morning without a problem.

Recommendations

Based on the previous observations of teachers and students, as well as our own experiences implementing this pilot project over the course of the 2011 pilot year, we can make the following recommendations for scaling up:

TeacherMate Software and Hardware

- Software
 - Develop a more powerful CMS to accommodate 100+ students per teacher (the high number of students often caused CMS to freeze)
 - Align with curriculum so as not to compete with teachers' lessons
 - Add Kinyarwanda instructions to activities
 - Adapt stories for Rwandan context
 - Slow down speed of games
 - Record English with accent closer to Rwandan English to make it easier for students to understand
- Hardware and storage
 - Larger synching and storage boxes for large class sizes
 - Make volume adjustment easier

Expansion of the TeacherMate approach

In light of this pilot project's literacy improvement outcomes, expanding the TeacherMate approach could help to spread this success to a greater number of students. Using TeacherMate in rural areas would require lower cost devices that are able to be powered using solar technology. With the success and enthusiasm students showed in using the devices at home, the TeacherMate could also be used in less formal learning environments in rural communities. The rapid spread of mobile phones in Rwanda indicates that software adapted for use on mobile phones would have a huge impact for students and adult learners alike. With minor adaptations to TeacherMate vocabulary and activities, adults could use it to learn and practice English, most notably teachers working on their pronunciation. As this pilot project has demonstrated, the TeacherMate can have a huge impact in a nascent English speaking environment such as Rwanda. It is now the task of TeacherMate projects going forward to explore the ways that this impact can be scaled throughout Rwanda and in other countries.

Addendum: Cost Analysis

The following is an analysis of the cost of the Rwanda TeacherMate Project conducted during the Rwandan school year, January to November 2011. These costs can be divided between the developmental costs of the Innovations for Learning TeacherMate system, the costs of managing the initial pilot project in Rwanda and the estimated ongoing costs required to sustain the TeacherMate Program over time. For the purpose of this analysis we are considering the cost of developing the TeacherMate learning system to be “sunk costs” and not included in this analysis.

Pilot Project Management Costs

Much was learned during the initial Pilot Project. The main one-time cost for the Pilot Project was the Project Director who was an American and was paid a higher salary than the rest of those involved in the Project. Our assumption is that this cost need not be continued over a long period of time as local educators assume responsible for coordination of the TeacherMate program. However some short-term costs will be a part of the cost of initiating the TeacherMate Program in any new country.

Estimated Ongoing Costs

The estimated amortized costs of sustaining the TeacherMate Program over time are listed below, based on 1800 students and other assumptions which may vary from place to place. For example, the cost of electricity is not included. The Management Cost for each school includes a part-time Project Manager and one full-time in-school Coach. Note that the management costs are greater than those for the TeacherMate learning system. For a spreadsheet to estimate the cost of different assumptions go to: <http://goo.gl/OPIod>

Number of students	1,800
Students/device	6
Number of devices	300
Cost per device	\$50.00
Annual Replacement	20%
Replacement cost	\$3,000
Minutes/week	100
Number of weeks	30
Total hours/student	50
Management cost	\$10,000
Schools Managed	2
Mgmt cost/school	\$5,000
Total annual cost	\$8,000
Cost/student/year	\$4.44
Cost/student/hour	\$0.09

Figure 7: Estimated Amortized Annual cost of a TeacherMate Program

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