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Key Strokes to Brush Strokes:

Computer Assisted Learning to Raise Mandarin Skills among China's Ethnic Minorities

REAP Brief #117





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The past two years have been unusually dry, and times are tough for Mr. Ma, who struggles to sustain his family of six by growing wheat and chili peppers on a small plot of land. The Ma family lives in Xunhua County in the mountains of eastern Qinghai Province. Mr. Ma identifies himself as a member of the Salar ethnicity, and like many ethnic minorities in China, his primary language is not Mandarin Chinese.

“The cost of sending my children to school is rising every year,” says Mr. Ma, “but I can’t leave the farm because I don’t have contacts in the city and my Mandarin is no good.” The Salar speak a Turkic language that is not commonly used outside their home area in eastern Qinghai. Mr. Ma encourages his son, Xiao Ma, to be diligent in his studies so Xiao Ma can have a brighter future.

However, Xiao Ma’s grades are slipping. He says he does not like his primary school, a ramshackle collection of brick buildings over three kilometers away. To make matters worse, another teacher just left the school for a job in the city, leaving the remaining five teachers to teach three or more subjects each to over 300 students. The task is especially daunting given the language barrier. With little to no formal training and spotty Mandarin themselves, the teachers must try their best to teach lessons in Mandarin to students who only recently have started learning the language.





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The language barrier: China's ethnic minority students struggle to compete

Mr. Ma and his son are representative of many ethnic minority families in China that have not been able to take advantage of China's rapid economic growth. They inhabit isolated areas deep in the Chinese hinterland. The sheer distance these areas are from urban centers makes migrating to cities for work infeasible for many ethnic minority families—a major source of income growth for the majority Han population. Language and cultural differences further complicate such a move.



Officially, China is made up of 56 nationalities: one majority nationality, the Han, and 55 minority groups. Ethnic minorities number over 100 million, or nearly 9% of China's total population.

For minority students, the language barrier is a major problem. Typically, they only begin learning Chinese partway through primary school, and they rarely speak the language at home. Their parents are more likely to be illiterate and cannot support their children in learning how to read or write in Mandarin. Furthermore, local schools frequently lack properly qualified bilingual teachers—if they have sufficient teachers at all!

The language barrier hinders academic achievement among minority children when school curricula emphasize mastery of Mandarin. In no small part due to the language barrier, ethnic minorities in China often lag behind their rural and urban Han Chinese counterparts in many important measures, including standardized testing, high school and college matriculation rates, and employment in key industries.



China's rural ethnic minorities are among the most disadvantaged groups of students in the country.



Ethnic minorities often have their own languages, dialects and written scripts.



Inability to speak and read fluent Mandarin places ethnic minorities at a disadvantage in the job market. Here, an employment board entirely in Chinese.

What are the implications if the language barrier is not addressed?

The barriers that ethnic minorities face—lack of Mandarin ability, poor teachers, and few educational resources—risk keeping these communities permanently behind. As they grow older and enter the labor force, ethnic minority youth will require proper schooling and sufficient Mandarin skills to compete with majority Han peers. Without better educational resources and remedial care, the ethnic minority children of today will be like their parents and grandparents—less able to contribute to and benefit from China's economic growth.

Can computers help overcome the language barrier?

What can be done to improve Mandarin language acquisition among ethnic minority students?

Previous REAP studies in Beijing have demonstrated that providing remedial care in the form of Computer Assisted Learning (CAL) has a significant positive impact on the academic performance, self-confidence, and self-efficacy of migrant students. In another study, third and fifth graders in rural Shaanxi schools also saw a notable improvement in their standardized math test scores, especially among the most economically disadvantaged students. A similar CAL program that targets Mandarin language acquisition could help ethnic minority students improve their facility with the language and serve as an important teaching aid for understaffed schools.

Despite the promise of CAL, it is very difficult to find examples of computer based instruction in ethnic minority schools. REAP has identified four main components to this problem. First, hardware is expensive. Rural minority school administrators struggling to serve a decent lunch to their students have few resources to invest in computers for their schools. As a consequence, ethnic minority students have the lowest access to computer technology at school in the entire country. Second, the software suites that are necessary for computer based learning are also expensive and hard to come by. Third, even if software were affordable, little of it

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exists that could help rural students keep pace with the national curriculum and none are designed for the bilingual needs of ethnic minority students. Finally, even if suitable hardware and software were available, there are very few qualified instructors that can teach computer based content or manage the upkeep of the equipment. Together these factors mean that computers and computer based learning remain out of reach for rural minority students.



Discarded computers and computer parts piled in the corner of a poor primary school in China.

Bringing CAL into ethnic minority classrooms

In 2011, with support from the ADOC 2.0 Foundation and Acer, Inc., REAP launched a rigorous efficacy trial to measure whether or not CAL can help ethnic minority students improve their Mandarin skills. Our objectives in doing so were three fold:

Intellectual objective: Provide clear, quantitative evidence about the linkage between CAL programs and the educational performance of ethnic minority children.

Policy objective: Demonstrate whether computer assisted learning programs lead to better educational outcomes and that such programs, if successful, should be scaled up in areas where Mandarin acquisition is a problem.

Educational objectives: Develop a curriculum (and training manual for teaching the curriculum) for a computer assisted learning program for China's ethnic minority youth.

In preparing the intervention we were careful to develop components that addressed each of the factors that we believed were preventing computer based instruction and learning from reaching rural ethnic minority students.

- Hardware: 240 new laptops donated by the Acer Corporation
- Software: A suite of fun, educational games with enough interactive lessons for one semester
- Curriculum: Lessons pegged to the national primary school curriculum in Chinese
- Protocol: A step-by-step protocol designed to allow any teacher to run the CAL program “out of the box”

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To conduct our intervention we randomly selected 52 ethnic minority schools in Qinghai Province. We then randomly divided this sample into 26 intervention schools and 26 control schools. The intervention schools received, on average, eight desktop computers courtesy of Acer, Inc. In these schools we arranged for third grade students to participate in two hours of shared time on computers in their school computer room (two students per computer). The computers were installed with game-based remedial Chinese language learning software.

Mandarin CAL by the numbers:

- 26 ethnic minority primary schools
- 1887 third graders
- 240 computers
- 2 hands-on sessions per student per week
- 2 game-based math learning software suites, pegged to the national Chinese and math curricula
- 24/7 technical support

During their sessions on the computer, students listened to animated lessons and played educational computer games that involved solving problems at varying levels of difficulty. The lessons were carefully pegged to the national curriculum in Chinese. Before launching the intervention, REAP staff trained the supervisors in each intervention school to manage weekly CAL sessions. A comprehensive handbook on how to run the sessions was also made available to them. In control schools, no aspects of this intervention were undertaken—they were to serve as a basis of comparison for the schools that received CAL.



REAP launched the CAL intervention in March 2011.



1 - The Hardware (and installation)



2 - The Software (two game-based educational suites)



3 - The Curriculum

4 - Protocol (training and instruction manual)



...And launch!





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Promising Results

In June 2011, the REAP team conducted an evaluation survey for the program and then “crunched the numbers” on student outcomes after the CAL intervention. What did we find? CAL raised Chinese (as well as math) test scores in our treatment group.

Two 40-minute CAL math sessions per week for thirteen weeks increased the student standardized Chinese scores by 0.11 standard deviations (Fig. 1). This impact is significant, comparable to—indeed, in many cases exceeding—the effects of much more costly and complicated interventions such as reducing class sizes and providing extracurricular tutoring. Another useful way to think about this effect is that a 0.1 standard deviation improvement is roughly equivalent to one semester’s worth of learning. When placed in that context, thirteen weeks of CAL improved test scores as if the intervention students had attended over a semester’s worth of school more than the control students. Remarkable!

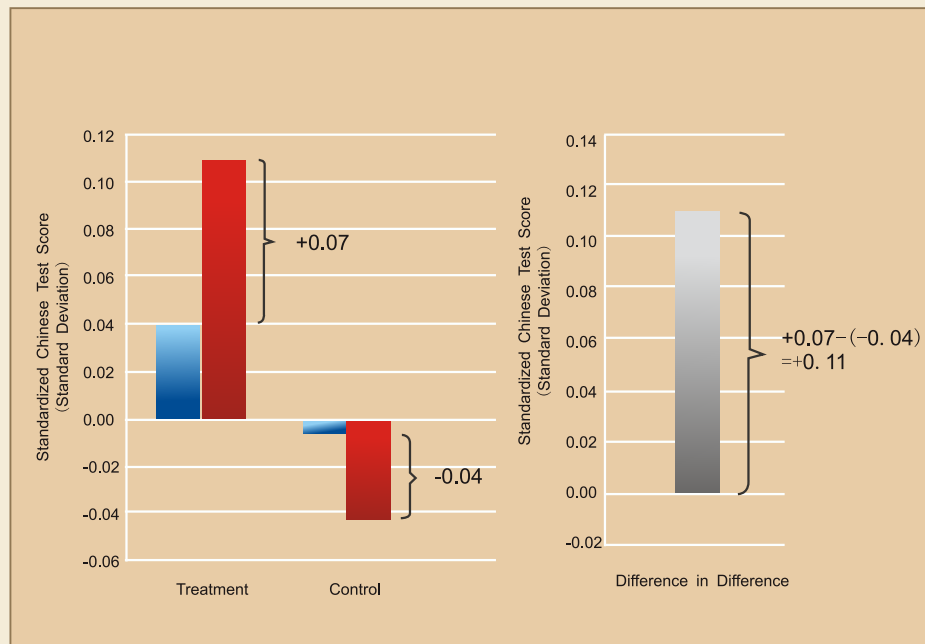


Figure 1. Effects of the CAL Intervention on Standardized Chinese Test Scores

We were also thrilled to find that the CAL program had an even larger spillover effect on math, raising standardized math scores by 0.21 standard deviations (Fig. 2). This was a surprising discovery because the CAL lessons focused only on Chinese. What happened? It turns out that because CAL improved the children’s reading level in Chinese, they became better able to read and understand their math textbooks. It makes sense that well-developed listening and reading skills can help students be more adept at learning and understanding a whole range of other subjects.

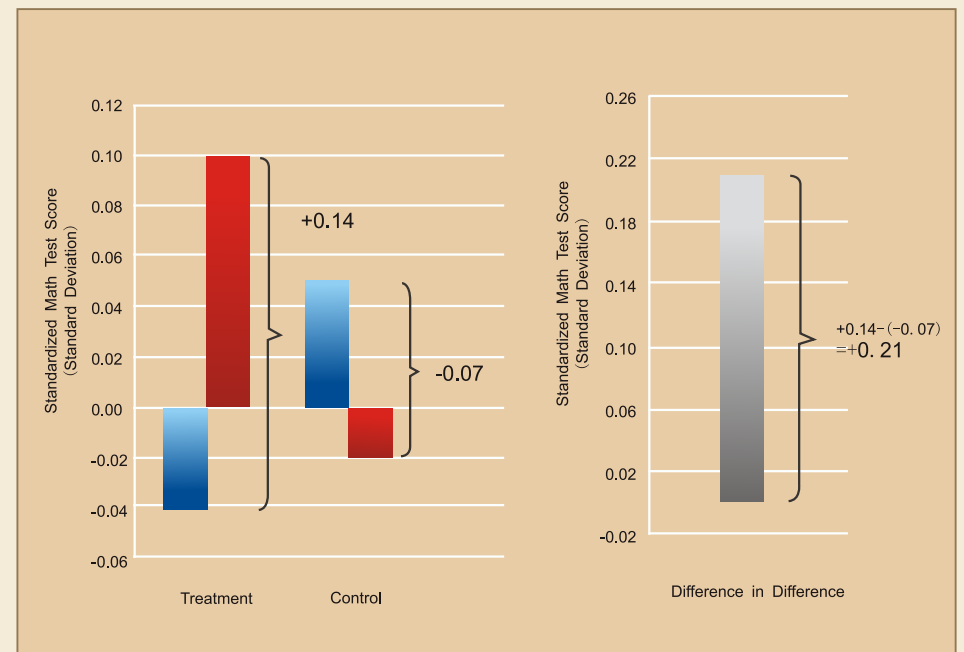


Figure 2. Effects of the CAL Intervention on Standardized Math Test Scores

In addition to the quantitative results, field interviews reveal that principals, teachers and students are virtually all enthusiastic about CAL. Principals report that the program has helped their students advance in township-wide tests. Teachers laud the ease of following our CAL protocol and students enthusiastically line up daily outside the computer room waiting for their turn to try CAL.

What Now?

Due to the promising results as well as the overwhelmingly positive feedback we received, we have now expanded the program to include fourth grade students in each intervention county. We have also added math lessons to the curriculum for both grades, increased the number of computers to 400, and lengthened the intervention from one semester to measure impacts over two semesters. Phase II of the program began in October 2011. In June 2012, the team will head back to the field to conduct an evaluation survey in both the intervention and control schools to see how student performance in each measures up.



Students line up outside the computer room waiting for their turn to try CAL.

In 2011 China's central government earmarked in its Twelfth Five Year Plan (2011-15) billions of yuan to upgrade IT facilities in rural schools. REAP is working every day to provide China's policymakers with proven solutions that leverage new technologies and platforms to improve learning in rural schools. As some of the most intractable shortcomings in rural education are found in ethnic minority areas, we are committed to seeking tailored solutions there as well. Please visit our website to find out more about this work, and stay tuned for the latest CAL results!

REAP would like to extend a special thank you to the Lee Family for their generous support in bringing the CAL projects in Qinghai to fruition. We would also like to thank PH Yang for so carefully photo documenting our work in Qinghai.

Thank You!



For more information about our many research projects that address poverty in China please visit our website:

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