REAP Rural Education Action Project http://reap.stanford.edu | www.reapchina.com | www.reapchina.org

Core Members

FSI STANFORD THE FREEMAN SPOGLI INSTITUTE FOR INTERNATIONAL STUDIES AT STANFORD UNIVERSITY

中国科学院农业政策研究中心 Center for Chinese Agricultural Policy, Chinese Academy of Sciences

NSDRC 西北社会经济发展研究中心

Stanford University School of Education

STANFORD SCHOOL OF MEDICINE

CiEFR 中国教育财政科学研究所

清華大學 Tsinghua University

Affiliates

中国疾病预防控制中心 寄生虫病预防控制所

HEALTH POLICY STANFORD CENTER FOR HEALTH POLICY/ CENTER FOR PRIMARY CARE AND OUTCOMES RESEARCH

EMORY UNIVERSITY

IAMO

LICOS Centre for Institutions and Economic Performance Catholic University of Leuven

UNIVERSITY OF OXFORD

SCID Stanford Center for International Development

SPICE STANFORD

UNIVERSITY OF MINNESOTA Driven to Discover

SHORENSTEIN APARC STANFORD

STANFORD biodesign

UCL

UNIVERSITY OF MARYLAND

中国人民大学 农业与农村发展学院 Renmin University of China

西安交通大学 Xian Jiaotong University

西北大学 Northwest University

安徽大学 Anhui University

浙江工商大学 Zhejiang Gongshang University

四川大学 Sichuan University

青海民族大學 Qinghai University For Nationalities

兰州大学 Lanzhou University

宁夏大学 Ningxia University

安康学院

教育部基础教育质量监测中心 NATIONAL ASSESSMENT OF EDUCATION QUALITY

Adobe

NOKIA Connecting People 诺基亚

DELL

CATERPILLAR

LCY

Pfizer

民生药业 MINSHENG PHARMA.

acer 宏基

Quanta Computer

MVDhouse

点点乐学堂 TimeBook.cc

TimeBook

永业集团 YONGYE GROUP

NU SKIN

NOURISH THE CHILDREN 爱饥儿滋养计划

IET Foundation

CORE China Open Resources for Education

FORD FOUNDATION

Target Foundation

Give2Asia

the Tyler Foundation FOR CHILDHOOD CANCER

3ie International Initiative for Impact Evaluation

unicef

CTF 唐仲英基金会 Cyrus Tang Foundation

China Youth and Children Foundation for Social Education

TAG Foundation

中国儿童少年基金会 China Children and Teenagers' Fund

中国青少年发展基金会 China Youth Development Foundation

Narada Foundation 南都公益基金会

PING & AMY CHAO

阳光文化基金会

Plan

青年發展基金 The Youth Foundation

STUDENTS FOR RIGHT TO PLAY

ADOC

歌路营 Growing Home

蒲公英中学 Dandelion School

农民之子 nmzz

Computers as Tutors?

Leveraging PCs to Advance Learning in China's Rural Schools

REAP Brief #116

REAP Rural Education Action Project

DELL

youth connect

LICOS Centre for Institutions and Economic Performance Catholic University of Leuven

REAP
Rural Education
Action Project

Take a look at our other REAP briefs:

REAP Brief #102: Behind Before They Start: The Challenge of Early Childhood Education in Rural China

REAP Brief #103: Chasing the Ultimate Dream: Early Commitment for Financial Aid, Liquidity Constraints and the Choice of Universities of Poor Rural Students in China

REAP Brief #104: Are CompassionateHearts Scholars Compassionate? Smart? Confident?

REAP Brief #105: An Invisible Epidemic: Anemia in Rural China

REAP Brief #106: Malnutrition in China's Rural Boarding Schools: The Case of Primary Schools in Shaanxi Province

REAP Brief #107: Barriers for the Rural Poor on the Road to College: New Evidence from REAP

REAP Brief #108: Development Challenges, Tuition Barriers and High School Education in China

REAP Brief #109: Eye tests, Eyeglasses and Improving Education Performance in Rural China

REAP Brief #110: Millions on the Margin: Educating China's Migrant Children

REAP Brief #111: Up By Their Bootstraps: Peer Tutoring for Migrant Children

REAP Brief #112: The Scourge Within: Intestinal Worms in Rural China

REAP Brief #113: Overcoming Undernutrition and Anemia Among Impoverished Rural Primary Students: The Results of VitaMeal

REAP Brief #114: Money for Matriculation: Conditional Cash Transfers to Reduce Junior High Dropouts in Rural China

REAP Brief #115: Just a Click Away: Using Computers to Boost Grades in China's Migrant Schools

Left Behind: China's Rural Students

Without a good education and technology skills, Meilin may be unemployable in the future.

Xiao Li will have no trouble joining China's future workforce.

Meilin, a rural boarding school student in Shaanxi Province, has failed a number of her recent exams at school. Her teachers have not offered her additional help after class. Like many of her classmates, her parents send back barely enough money from their migrant worker salaries to pay for her boarding school fees. "A private tutor?" Meilin gasps, "My parents could never afford that!" Xiao Li, on the other hand, grew up in Beijing and is almost guaranteed entrance into a top college. She has easy access to the Internet both at school and at home and can easily find information to help her complete homework assignments. Under the watchful eye of her well-educated parents, she has excelled in every subject, particularly after her parents gave her a new laptop and helped her

learn how to use it. "Good computer skills will help her succeed in life," says her father. "Technology is the key to China's future." No doubt he is correct on that count. Can technology also help bridge the rural-urban education gap?

An academic gap: rural students are struggling to keep up

China's rural children have been shown to be one of the poorest performing groups of students in the country (Fig 1).

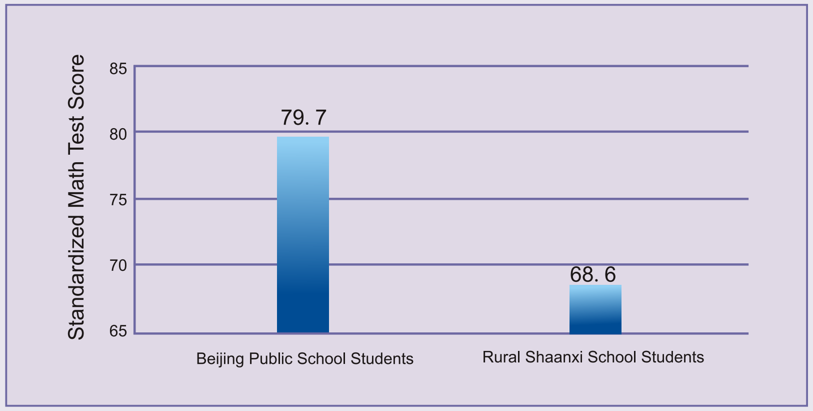


Figure 1. Test Score Gap Between Beijing Public School and Rural School Students

There are many possible reasons for this poor performance. Rural schools are underfunded and have sub-par facilities. Poor conditions mean that experienced or talented teachers have very little incentive to stay in rural areas. Moreover, teachers in urban areas do not want to relocate to rural areas to teach. Thus, the flow of good teachers and school administrators is virtually unidirectional: rural to urban. With inadequate staffing, rural schools offer fewer and lower quality classes. Those teachers that do work in rural schools frequently end up having to teach subjects for which they have little training or conviction.

In addition, anecdotal evidence suggests that one particularly serious problem that rural children face is lack of care outside of the classroom. What happens, for example, to a student who does not understand a lesson? How can he or she catch up? In contrast to their urban counterparts, students enrolled in poor rural schools do not have access to resources such as private tutoring and before or after class review sessions. What is more, rural parents are often under educated or have migrated away and therefore cannot help their children at home. For these reasons, although rural students may have free time after school, they have no sources of remedial care that could help them match or surpass their urban peers.

Another gap: the digital divide

Unused computers and computer parts piled in the corner of a poor school classroom.

One often reads that China has the largest online population in the world. This misleading statistic obscures one of the most obvious symptoms of the education gap between China's rural and urban students: the digital divide. In rural China, students lack regular access to quality computing technology. Few rural schools have computers, and when they do, the machines are often archaic or broken. Moreover, only about one third of the computers are equipped with any type of learning software—none of which are aligned with the national curriculum. To compound the problem, rural students often live in poor, remote villages, so owning a computer is a luxury that less than one in ten can afford. Even then, only a small fraction of students use computers for study purposes and less than 3% have any access to the internet at home (Fig. 2).

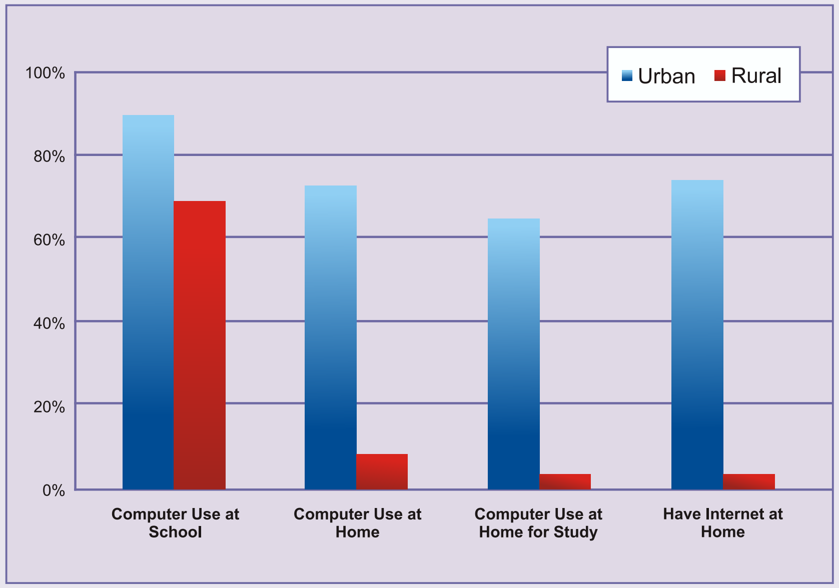


Figure 2. Computer and Internet Use Among Urban and Rural School Students

What are the implications if these two gaps are not addressed?

China is currently transforming into a modern, knowledge-based economy. Building a skilled labor force is a vital component of this transition. The enhanced human capital that underpins such a labor force requires the equitable delivery of quality education throughout the country.

However, millions of rural children are still unable to access quality education today. For this reason, serious questions remain about whether China's labor force can rise to the challenge of establishing an innovation-oriented economy. The majority of China's rural youth hope to find high paying urban jobs, but the days of abundant unskilled labor in China's cities are rapidly drawing to a close. As China moves up the value chain to sustain economic growth, workers will increasingly require two things if they are to stand a chance at competing with urban—indeed, global—peers: proper schooling and a facility with computers and information technology.

Jobs of the past…

…and future.

Computer Assisted Learning (CAL): Part of the Solution?

A promising means to deliver remedial care and exposure to computing technology exists in Computer Assisted Learning (CAL). Rigorous evaluation studies in other developing countries have shown that access to computers with innovative educational software can significantly improve a student performance in poor or otherwise ill-equipped learning environments.

If such promise exists, why is it so hard to find quality computer based instruction in China's rural schools? REAP has identified four main components to this problem. First, hardware is expensive. Rural school administrators struggling to provide decent lunches to their students have few spare resources to invest into computer facilities. Second, the software suites that are necessary for computer based learning are expensive and hard to come by. Third, even if software were affordable, little of it exists that could help rural students keep pace with the national curriculum. Available software often requires an Internet connection or is focused on parochial lessons like basic computer programming. 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 students growing up in a digital age.

Bringing Computer Assisted Learning to Struggling Rural Schools

Given the serious implications that these gaps will have on the future employment of rural children and China's economy, REAP wanted to know if leveraging computer assisted learning could address both the education gap and the growing digital divide in China between rural and urban areas.

In 2010, REAP partnered with Dell YouthConnect to launch a project to provide computer assisted learning in China's poor boarding schools. We had three objectives:

Intellectual objective: Provide clear, quantitative evidence about the linkage between CAL programs and the educational performance of underserved 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 poor student performance is chronic.

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

- Hardware: 220 new laptops donated by the Dell 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 Math
- Protocol: A step-by-step protocol designed to allow any teacher to run the CAL program "out of the box"

CAL in Rural Boarding Schools

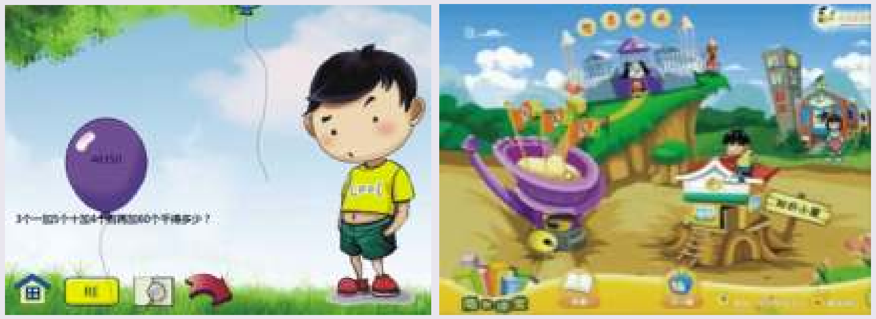
To conduct our intervention we randomly selected 72 rural boarding schools in Shaanxi Province. We then randomly divided this sample into 36 intervention schools and 36 control schools. The intervention schools received, on average, eight desktop computers courtesy of Dell YouthConnect. In these schools we arranged for third and fifth 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 math learning software. During their sessions on the computer, students listened to animated lessons and played educational computer games that involved solving math problems at varying levels of difficulty. The lessons were carefully pegged to the national curriculum in math. 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 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.

Boarding school CAL by the numbers:

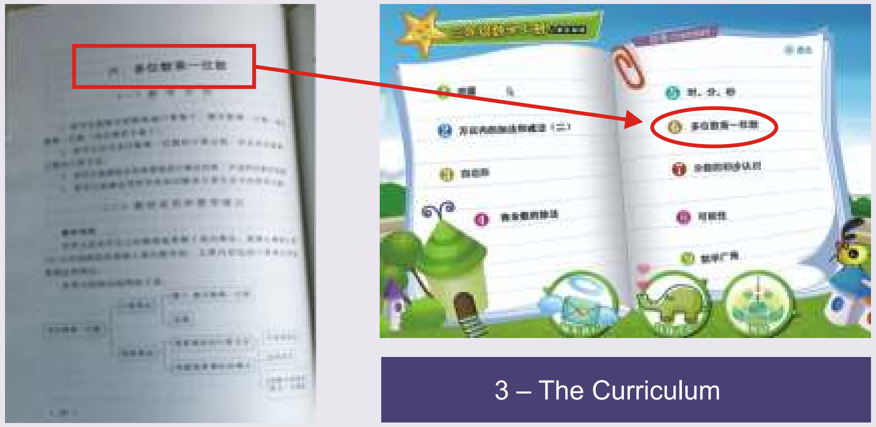
- 72 rural schools
- 2160 third graders
- 2160 fifth graders
- 220 computers
- 2 hands-on sessions per student per week
- 2 game-based math and Chinese learning software suites

We launched the CAL intervention on September 13, 2010.

1 - The Hardware (and installation)



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



3 – The Curriculum

4 - Protocol (training and instruction manual)

戴尔学习站
Dell Learning Station

…And launch!

Promising Results

In December 2010, the REAP team headed into the field to conduct an evaluation survey and bring the data in for analysis. After crunching the numbers, we made some astounding findings: the CAL intervention had large, positive and significant impacts in two key areas:

- Academic performance
- Self-confidence and self-efficacy

Academic performance

Our results show that CAL has significant beneficial effects on student academic outcomes. Two 40-minute CAL math sessions per week for thirteen weeks increased the student standardized math scores by 0.13 standard deviations among third and fifth graders (Fig. 3). Isolating the results for third graders reveals an even greater impact: 0.18 standard deviations. This finding underscores the importance of tackling educational barriers in the early years of child development. Both outcomes are significant, comparable to and often exceeding the effects of much more costly and complicated interventions such as reducing class sizes and providing extracurricular tutors. Another useful way to think about the effect is that a 0.1 standard deviation improvement is roughly equivalent to one semester's worth of learning. Thinking about it that way, thirteen weeks of CAL for third and fifth graders improved test scores as if the intervention students had attended over a semester's worth of school more than the control students. Remarkable!

Thirteen weeks of CAL is roughly the equivalent of providing one semester more of schooling, or raising student grades from a C+ to a B.

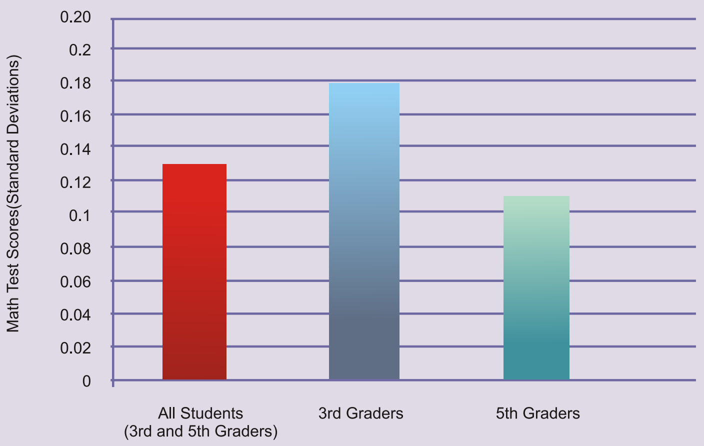


Figure 3. Effects of Interventions Among Student Groups

Heterogeneous effects

Interestingly, when we looked at the intervention's heterogeneous effects (i.e. how CAL affected different types of students differently) we found that the biggest improvements in math scores occurred among the most economically disadvantaged students—those that ware eligible for poverty subsidies from the government. These are exactly the students for whom CAL was designed to help most: the ones with the least access to resources.

Self-confidence and self-efficacy

Positive Student Feedback on Impacts of CAL

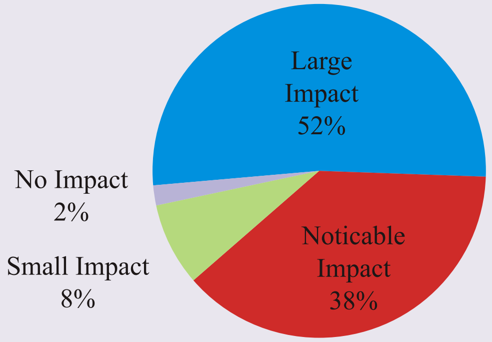


Figure 4. Measure of CAL's Perceived Impact on Student Studies

REAP was also careful to measure non-academic outcomes related to the CAL intervention. Before and after the intervention we measured how interested the students were in school, their self-confidence, and the perceived impact CAL had on their studies. We found improvements across the board in these variables for the intervention students when compared to the control. With respect to the perceived impact of CAL on their studies, 90% of the intervention students believed CAL had at least moderate positive impact with 52% noting CAL had a significant positive impact (Fig. 4). Over half expressed increased interest in their studies after the CAL program, revealing additional positive spillover effects that can further boost student engagement and performance in school.

CAL Boosts Student Interest in Their Studies

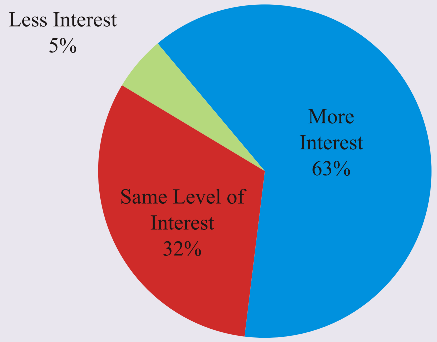


Figure 5. Measure of Student Interest Pre- and Post-CAL.

Helping to cross the digital divide

When REAP conducts our baseline and evaluation surveys, there are limits on how much we can ask students due to time constraints. For this reason, we conducted a separate, parallel study in another group of schools that focused exclusively on whether computers with CAL can help students cross the digital divide. The results? After a six month period, students who used CAL computers were far more proficient in basic and intermediate computing skills than students in the control group! All signs suggest that students interacting with computers loaded with CAL software achieve a statistically significant boost in their computing knowhow.

What now?

Having demonstrated such positive results in CAL sessions held after school, we established a new objective for the 2011-12 school year: expand the CAL program and its benefits into the regular school day. In this second phase of the program, we have tripled program capacity from 220 computers to 660. We have brought the program into the school day by replacing two student study hall periods each week with CAL sessions. We have also lengthened the duration of the program and expanded it to reach more grades (third through sixth). This way we can track how CAL affects different age cohorts over time.

Having demonstrated CAL's effectiveness in raising academic performance when administered after school, REAP hopes to integrate the program into the regular school day.

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. In addition to addressing the education gap and digital divide for the future stability and growth of the Chinese economy, we work to make sure that the Meilins of China have equal opportunities with the Xiao Lis.

Please visit our website to find out more about this work, and stay tuned for the latest CAL results!

REAP's CAL program for China's rural schools would not be possible without the generous support of the Dell Corporation. We would also like to extend a special thank you to PH Yang (phyang.org) for photographing our CAL work in Shaanxi.

Thank You!

REAP
Rural Education
Action Project

For more information about our many other projects to address rural education problems please visit:

http://reap.stanford.edu
www.reapchina.com