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Computers and the academic performance of elementary school-aged girls in China's poor communities

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ABSTRACT

Experts agree that computers and computing play an important role in education. Since the 1980s there has been a debate about gender as it relates to computers and education. However, results regarding gender differences concerning computer use in education are not consistent. In particular there is little work done in China on this issue. Therefore, the overall goal of this paper is to demonstrate whether girls and boys can gain equally from computer-based education in China's elementary schools. To do so we analyze results from three randomized field experiments of a Computer Assisted Learning (CAL) program and One Laptop Per Child (OLPC) program. The field experiments are carried out in three kinds of schools: Shannxi rural public schools; Qinghai minority public schools; and Beijing migrant schools. Although CAL and OLPC have been considered cost effective means to improve learning outcomes, it is not known whether the programs impact girls differently than boys. Our analysis shows that, in fact, there were no differences between female and male students in either the improvement in standardized math test scores or Chinese test scores with either the CAL or OLPC programs. Our study suggests that among disadvantaged students in China's rural areas and migrant communities, there is reason to believe that computer based learning can benefit both girls and boys equally. This finding has possible implications for China's ongoing efforts to integrate computers and computing technologies into the nation's underserved schools.

1. Introduction

The rapid diffusion of computers has changed nearly every aspect of contemporary life, from work to education and health (Levine & Donitsa-Schmidt, 1998). As a consequence, today's education systems are charged with teaching children how to use computers as part of the overall education process (Baouendi & Wilson, 1989). In addition (and perhaps more importantly), it is thought that children in school can use computers as an effective learning tool and as a way to improve their overall education (Castro & Alves, 2007). In these ways, the literature suggests that computers are making an ever-increasing impact on many aspects of cognition and learning (Volman, Eck, Heemskerk, & Kuiper, 2005).

Since the 1980s, gender has been the focus of research on computer learning (Tengku Faekah, 2005). According to Kay (1993), users must have a certain level of will and recognize the utility of computers in order to successfully learn how to use them. As a consequence, the attitudes of students toward computing and their computer knowledge and skills are two factors that are closely related to the successful use of computers in education (Woodrow, Mayer-Smith, & Pedretti, 1996). For this reason, researchers have explored the differences between males and female students regarding computer attitudes, knowledge and skills (Janssen & Plomb, 1997).

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Are there differences across genders regarding student computer skills and attitudes toward computers? Insofar as computer skills are concerned, the evidence from existing research is consistent: female (in general) significantly lag behind male when judging their computer skills (Tengku Faekah, 2005).

The literature, however, is more nuanced when examining differences between genders with respect to attitudes toward computers. A large body of research, such as Barba and Mason (1994), Yaghi (1997) and Bovée, Voogt, and Meelissen (2007), shows that male students have more favorable attitudes toward computers. According to Bovée et al. (2007), in general, female students appear to be more anxious with computers and regard the computer as more difficult to deal with than male students. Most female students (in this case, secondary students) feel less confident with the use of computer than their male counterparts. Other studies indicate that there are differences in the ways that male and female students "like" computers or perceive their usefulness (Robertson, Calder, Fung, Jones, & O'Shea, 1995).

In contrast, other research teams have found no significant differences in attitudes toward computers with respect to gender. Hunt and Bohlin (1993) discovered that females and males did not display significant disparities in terms of any of the four types of attitudes toward computers (i.e., liking, comfort, confidence and perceived usefulness). This is true in both developed and developing countries. Bovée et al. (2007) found in a study of 240 students from South Africa that there were no gender differences in the attitudes of boys and girls regarding computers. Neither male nor female students were anxious toward the computers. Both enjoyed working with computers and regarded computers as useful tools for their lives.

In a small minority of studies researchers have found that females have a more positive attitude toward computers than males. For example, according to McGrath and Thurston (1992), female students were found to have more favorable attitude toward computers compared with the male students. Female students also were more interested in computers than male students. Tengku Faekah (2005) also found one case in which female students, more than male students, believed computers would be more useful in their future lives. This literature has raised the question: Does the fact that researchers have detected differences between genders regarding student computer skills and attitudes toward computers have implications for whether boys and girls can gain equally from computer-based education?

Perhaps surprisingly there is little work done in China on this particular issue. This is unexpected because the actions of the government demonstrate that putting computers in the classroom as a way to enhance learning is a priority in the coming years. In the 12th Five Year Plan, for example, the government will spend billions of dollars putting computers in every classroom (IDC, 2011). Computers are one of the key platforms of the Ministry of Education's strategic plan. At the same time there is concern about achieving gender equality in China. As both a millennium goal and a matter of basic national policy, China's leaders are committed to gender equality in education (Guo, 2011). Despite this, Pang, Zeng, and Rozelle (in press) has shown that there is still considerable gender inequality in China—especially regarding educational attainment.

The overall goal of this paper is to demonstrate whether there is any gender differential in terms of how girls are able to learn when using computers in China's elementary schools. In most general terms, we are seeking to answer two broad questions. Are there differences between young boys and young girls regarding student computer skills and attitudes toward computers? If so, do these differences have implications for whether boys and girls can gain equally from computer-based education?

To meet this goal and answer these questions, we draw on the results of three randomized controlled trials. Although the three studies were implemented in three different environments—migrant communities outside of Beijing; poor rural mountainous region in Shaanxi Province that is populated mostly by China's ethnic majority Han; and a poor region in Qinghai province that is populated mostly by non-Han ethnic minorities—in each place the intervention was nearly the same. Students in half of the study schools (the treatment schools) participated in a Computer Assisted Learning program (or CAL, for short) while students in the remaining half (the control schools) did not. Students in both treatment and control schools were given standardized math and/or Chinese language tests before and after the intervention. In this paper we look at how third, fourth and fifth grade female students performed in the treatment and control schools by looking at changes in standardized test scores between the baseline and endline surveys and compare their performance to the performance of their male students classmates in each grade.

We also examine gender differentials in a fourth experiment which randomly assigned laptop computers to 150 students and did not give anything to a set of 150 control students.

2. Sampling, intervention, data and methods

In this section we do four things. First, we briefly describe the sampling process and the final sample that is used in each of the three RCTs. This subsection is purposely because since there are detailed appendices describing the sampling for each of the three RCTs. The second subsection describes the intervention that was implemented in each of the three study locations. The third subsection describes the data collection. Although we report on findings from three different study sites, because the interventions and data collection were essentially the same, the description in these subsections is simplified. In the fourth subsection we review the common statistical approach that was used to analyze the data from all three studies.

2.1. Sampling and randomization

2.1.1. Sample in Beijing migrant communities (study 1)

The sample in China's migrant communities is located in the suburbs of Beijing. Of Beijing's 16 districts and two counties, we chose the three that had the largest number of migrant workers and their families (Lai, Luo, Zhang, Huang, & Rozelle, 2011). There are more than 200 private migrant elementary schools in these districts. Of the total number of schools in the three Beijing districts, 43 of the schools were large enough to have two classes of grade 3 students. Using the 43 schools as the sampling frame, we chose 24 schools to be in our sample. There were 54 classes of grade 3 students in the 24 schools.

Using this set of schools, we conducted a clustered (at the class level) RCT of a Computer-Assisted Learning program (or CAL—see the next subsection for a detailed explanation of the intervention) in the fall semester of 2010. Because of a limit on the number of computers available, we only implemented the program in one class in each school. The other classes in the sample schools were the control classes. Assignment to the treatment group was performed randomly.