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Economic Development
May 2019

Literature Review: The Effect of Internet Access on Education

The internet provides access to mass amounts of cheap, instant information, and plays an increasing role in the world. However, in developing nations, children and teachers in school may not have easy access to internet. This raises the question: what effect does increased internet access in primary schools in developing nations have on the children? This literature review considers existing experimental data on the effect of internet on primary schools in developing countries. Much of the literature is based in Peru due to the data resulting from Peru's investment in the One Laptop per Child program. In addition to direct data on the relation between internet and education, this review considers the economic and language barriers to internet access and the social effects of internet. Based off of this literature and and a brief comparison of the relevant development research to similar studies in the U.S., the evidence suggests against the investment in internet by schooling in developing countries.

The One Laptop per Child (OLPC) program provided a plan for schools in developing nations to have access to cheap laptops. The program launched in Peru in 2008 and the country invested heavily in the program; Peru accounted for over one third of the total purchases of the OLPC laptops (Beuermann). The program in Peru targeted small schools in poor regions, and favored those with possible internet access, so the introduction of these computers often resulted in the introduction of school children to the internet. Consequently, much of the data and research on the effect of internet in schooling is based in Peru. Before the launch of the program, Peru had a gross enrollment of 90%, and a net enrollment (which ignores students enrolled in a

class outside of their age group) of 75% (Cristia et al). And, Peru invests approximately 3% of total GDP into education, which is low compared to countries with a similar economic status.

However, studies of the introduction of internet in Peru initiated by the OLPC program arrived a to mixed conclusions. In one study, discussed in "Impact of Internet Access on Student Learning in Peruvian Schools", the researchers analyzed data from 5,903 public primary schools throughout Peru. Using census data from the Ministry of Education and annual standardized test data from the years 2007 to 2014, the study analyzed the correlation between internet access and second grade math test scores. The paper concludes a small positive correlation (0.042 of a standard deviation in student scores) two years after internet installation. More impressively, the study found an increase of 0.29 standard deviations five years after installation. However, this description of a success story stands out among the literature. The paper "Do Children Benefit from Internet Access? Experimental Evidence from Peru" gives a more representative conclusion. In this study, the researchers took 540 children in Lima Peru in 2011 and randomly assigned students with either a personal laptop without internet access, or a personal laptop without internet while maintaining a control group that did not receive any laptop. The study concluded a small but positive impact of providing computers on test scores, but no significantly significant difference between the groups with internet and without internet. A third study in Peru, which focuses on low-performing public elementary schools in Lima, analyzes the difference between children that randomly received laptops and the control group. However, the study found no impact on academic scores although teachers reported a lack of effort from the group receiving laptops. So, in the case of Peru and the OLPC program, studies find mixed results, leaving the impact of internet access in schools uncertain.

Perhaps the language barrier between the developing country population and the english dominated internet could have an impact when incorporating internet into schools. “The Language Divide”, Pearce et al. studies the extent to which lack of english can be a barrier to the internet. This paper focuses on the developing countries of Armenia, Azerbaijan, and Georgia, which “have both high poverty levels and high educational attainment”. The study uses survey data from the Caucasus Research Resource Center from 2006 forward, focusing on the correlation between english proficiency and internet behaviors. The study concludes that english proficiency is the best predictor of internet use. Other potential predictors -- age, education, income -- have a much weaker correlation to internet use. Thus, the paper suggests that lack of english is a barrier to internet use. However, the paper suggests that languages with more widespread internet communities, such as Spanish, should feel less of a language barrier; however, we still see poor results from the OCPL program.

In addition to language barriers, the introduction of the internet to a school or region has political and economic challenges. The paper “ICT Use in the Developing World” uses International Telecommunications Union’s (ITU) World Telecommunication Indicators Database of 161 countries to find the determinants of internet usage. The researchers found per capita income and the maturity of the government to determine the success of internet penetration to a region. The paper “Embracing ‘Open Access’ in East Africa” by Goldstein gives theory as to the importance of a mature government, noting that the establishment of the internet requires many departments of governments to collaborate which, requiring organization and agreement between departments. In addition to the social and political barriers to deploying internet, there is a financial cost to implementing internet in schools. Goldstein discusses the the

high initial cost of laying out submarine communication cables to connect large regions to the internet as well as establishing internet cables on land. But, there is the additional cost to schools directly through providing technology that enables internet access. In the case of the OLPC program in Peru, each laptop cost $188 on average, and Peru purchased over 860,000 such laptops (Beuermann), a huge financial investment and money that could support the education system in other ways. In fact, the authors of "Computers as Pedagogical Tools in Brazil" would agree that the opportunity cost of deploying computers into a school is too high. This study analyzes the effect of internet use on 8th grade student using countrywide data from the Brazilian ministry of Education. The authors find that students in schools with a computer lab perform relatively poorly on Portuguese and math tests with respective average decreases of 13% and 34% of a standard deviation. However, *teachers* with access to internet corresponds to an average increase in Portuguese and math scores by 18.37% and 8.9% of a standard deviation respectively. Thus, the authors suggest that while there are benefits to internet access, the cost of supplying students with the technology to access the internet is too high.

Current research studies on the effect of internet measure the effect of test scores on children; however, internet access in schools could have positive effects outside the scope of test scores. For instance, in the study "Can mobile Internet help alleviate . . .", the authors analyze the positive impact of the internet on social exclusion -- a measure as to how much individuals are isolated from society. In the context of development, the extent to which an individual is socially excluded has added significance, for it is the poor's reliance with communities that often substitutes for insurance and risk mitigation in general. The study takes a sample of socially excluded individuals in South Africa and surveys their access and understanding of mobile

internet. The study concludes a moderate correlation between internet access and economic income, but a high correlation between internet and social interaction. Overall, internet access and education can minimize social exclusion, a benefit of internet not captured in test scores. Similarly, “Empowerment through ICT education” takes a sample of Muslim workers in computer training in India. Through a survey, the study finds that while computer usage between men and women are close, men use internet six times as much as the women on average. The study measures empowerment of the subjects using Spreitzer’s 12-item scale, which provides methods for concrete measurements of empowerment. After a statistical analysis of the answers, the study concluded that internet has potential for empowerment; particularly, the study finds evidence that the internet has potential for psychological benefits to muslim women. Again, there exists benefits from the internet besides the measure of test scores.

However, even in developed nations with mitigated barriers to internet, studies found the introduction of internet to have a negligible effect on academic achievement. In fact, much of the internet development literature points to two studies of internet in U.S. education for confirmation that the incorporation of internet in schools has a non-positive effect. Firstly, the “Scaling The Digital Divide” study analyzes survey data of over one million fifth to 8th graders in North Carolina Public schools between 2000 and 2005. The study concludes that introduction to internet in a school corresponds to a 1-3% percent of standard deviation in math and reading scores -- a negligible impact. The paper “The Impact of Internet Subsidies . . .” has a similar conclusion. This study analyzes the effect of the E-Rate program, which provided subsidies encouraging schools to purchase technologies. The E-Rate program targeted schools without internet, resulting in many schools investing in internet. Such schools that invested has only 2%

of a standard deviation increase in math scores-- again a negligible impact. So, while incorporating internet into schools of developing nations has extra complications of language barriers, infrastructure price challenges, and government complications, similar efforts in the U.S. still have similar results to the development literature.

The evidence suggests that the best policy recommendation is to not invest in school internet. To recall the research data, the "Do Children Benefit . . ." study found no improvement in short term, "Impact of Internet Access . . ." found improvement in short term and long term. "Does Technology in Schools . . ." found no impact of internet on dropout or enrollment, and "One Laptop per Child" could not distinguish between internet effects and computer effects, but found no improvement. In Brazil, "Computers as Pedagogical Tools . . ." found a negative impact of internet. Overall, there exists no obvious pattern in the experimental data literature. And, studies generally agree that the introduction of internet has a negligible effect on test scores. So, the best policy would be for local governments to not invest in internet for the purpose of primary school education; costly investment in internet should especially be avoided, and money should go to other methods with more evidence supporting their success. Additionally, note that the introduction of internet is heavily a supply-wallah view. So, although the research suggests no improvement in general, the introduction of internet will certainly not remedy a problematic demand curve for education.

Before a more active policy recommendation would be appropriate, there must be further focused research. Further research should ask: what are the impacts of internet introduction to different age groups? Would high school and college students in developing countries benefit more the internet than primary school students? Additionally, the research is heavily centered on

South America, with some earlier research done in China. So, it may be worthwhile to see further research done elsewhere -- north and eastern Africa in particular. Furthermore, all additional research focuses on test scores, but perhaps early exposure to the internet can provide benefits down the road: are children exposed to internet more likely to find a job? The research literature must develop to address some of these questions before there can be justification of any policy recommendation.

Overall, there is little existing literature that carefully distinguishes between the effect of internet and the effect of technologies in general in the context of education in development. The literature that does exist comes to no consensus on whether the internet has a positive, negative, or neutral effect on test scores in primary schools. This uncertainty could be due to the complications regarding the cost barriers, the government barriers, or the language barriers to internet use. However, it is important to note that the initial introduction of internet into United States schools found similar negligible impacts of internet. So, before governments should take any certain action, more research questions must be addressed.

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