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● EXPERIMENTAL ASSESSMENT OF THE ● PROGRAM "ONE LAPTOP PER CHILD" ● IN PERU ●

Even though this program has only recently been implemented, this document presents a few preliminary findings that could be relevant for its future development. On the one hand, we find evidence of better attitudes and expectations among teachers and parents; students that are more critical of school work and of their own performance; and a greater development of technological skills among girls and boys. On the other hand, there seems to be a decrease in the intensity of computer use in the classroom, as time passes and difficulties arise in the implementation of the project. Due to the short interval of time since implementation, no impact was observed in learning. This should be verified in future surveys.

CONTENTS

Background
Page 2

Characteristics of Evaluation
Page 3

Preliminary Findings
Page 6

General Conclusions
Page 11

References
Page 12

About the Authors
Page 12

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Information and Communication Technologies (ICTs) have had a major penetration in educational systems. Their introduction has intended to support an improvement in the quality of education, to make it more relevant for 21st century demands, and to develop renewed practices among teachers, students and educational communities.

Among other strategies, the distribution of one computer to every student (1-to-1 model) has experienced a major development in the last three years. Its implementation has tended to reduce social gaps of access to ICTs and strengthen their potential for impact.

Despite the above, the impact assessments of these initiatives have been scarce, and those of an experimental character have been even fewer.

The present assessment, developed by IDB in agreement with the Peruvian Ministry of Education (MINEDU), has as its purpose to explore the impacts of introducing the 1-to-1 model of computer supply on the educational practices and learning of students in multi-grade rural elementary schools, located in areas of lower socioeconomic level in Peru.

The methodology chosen to assess the impact of the program was a random allocation of computers within a group of schools identified as eligible, from which data were gathered for the study in November of 2009. The study has also benefited from qualitative approaches, which complements the findings of the quantitative evaluation described above.

Background

In Peru, as in many Latin American countries, there are high levels of coverage of primary education (>95%) and low results in terms of learning (OREALC, PISA, National tests). This becomes even more acute in rural areas, where the challenges of bilingual and multi-grade education are reflected in the unevenness of the outcomes of the National Tests¹. In fact, Peru shows one of the most pronounced rates of educational inequity in the results of learning, as a result of socioeconomic inequalities.

In 2007 the Peruvian Government decided to carry out the "One Laptop per Child (OLPC)" program with the following objectives:

- A To improve the quality of public primary education, especially that of children in the remotest places and in extreme poverty, prioritizing multi-grade schools with only one teacher, in the framework of the guidelines of the National Educational Policy.
- B To develop in primary school students the abilities considered in the curricular design through the pedagogical application of XO portable computers.
- C To train teachers in the pedagogical use (appropriation, curricular integration, methodological strategies and production of educational materials) of XO portable computers in order to improve the quality of teaching and learning².

For implementation, the decision was made to use XO machines with the Sugar operating system, developed by the OLPC Foundation. The OLPC model is based on the constructivist pedagogy and massive distribution of computers. Operations for this initiative began in rural schools nationwide, especially one-teacher schools, and a progressive expansion was proposed that made it possible to cover a total of 559 schools in the year 2008. Additionally, 2,919 schools had been selected with the same focalization criteria and were on a waiting list for the following two years.

The program entails providing a portable computer to each student and teacher, who have ownership on the device in order to be able to use it inside and outside the school grounds, according to their own interests and possibilities. Teachers receive basic training and user manuals. The computers include educational programs and a collection of digital books, and have the potential for Internet connection (where a wireless connection is available), as well as network connections among themselves (mesh network).

1. "Inequidad de los Aprendizajes escolares en América Latina" BID WP 180, J. Duarte, S. Bos y M. Moreno.

2. http://www.perueduca.edu.pe/olpc/OLPC_Home.html

1-on-1 experiences in Latin America

IDB has identified six initiatives using laptops in Latin America that have been evaluated to some extent:

Brazil: Um Computador por Aluno. Funded by IDB in order to document experiences and changes brought about in educational processes.

Haiti: 10,000 XO were delivered with IDB funding since 2009, and a report from UNESCO is expected for 2011, to the extent that the effects of the January 2010 earthquake allow the continuation of the project once educational life has returned to normality.

Peru: A pilot project was carried out in Arahua in June 2007 with 46 students and five XO with Internet connection. The report from the Ministry of Education identified a decrease in school absenteeism. The experimental evaluation described in this document would also contribute to the studies in Peru.

Uruguay: A pilot project began in 2007 with 150 XO's, in which a positive attitude was found on the part of students, teachers and parents. The subsequent works carried out by Uruguayan authorities also detected difficulties among teachers in the pedagogical incorporation of the machines, as well as a growing increase in satisfaction and the expectations of students and families. Currently, several evaluation initiatives are being carried out with different objectives, coordinated by the newly established Center of Studies of the Ceibal Plan, supported by IDB.

Paraguay: The "Paraguay Educa" Foundation is developing a pilot study with more than 3000 computers delivered to students in the province of Caacupé. IDB is supporting the processes of qualitative and quantitative evaluations, associated with improvements in learning and change in practices.

Colombia: The "Pies Descalzos" Foundation, supported by IDB, is working in four schools that have standardized evaluations of learning before and after the intervention.

The experience in the projects developed in Pirai (Brazil) and San Luis (Argentina) can also be added to this list.

Not much quantitative evidence exists on the impact of using portable computers on the students' academic performance. Therefore, the present study concerning the Peruvian experience is intended to contribute with evidence concerning the effectiveness of the model and the conditions for its implementation.

Characteristics of Evaluation

The evaluation seeks to measure the impact of the program on students' learning and skills. It also examines the program implementation process, particularly the way in which the laptops are used for teaching and learning, and the possible changes in pedagogical practices, in their expectations and attitudes towards education.

The evaluation has two components. The first, which is qualitative, has made it possible to document the implementation, views and responses to the distribution of computers in some schools, and has shaped the design of instruments for data gathering. The other is quantitative and is based on data gathering, both in schools that received computers and in those that did not, in order to measure impact.

Thanks to the experimental design, it is possible to identify the impact of the program by comparing the treatment groups (which are beneficiaries of the program) to the control groups. In order to identify these impacts, a longitudinal design was considered at the school level in the qualitative study, and at the student level in the quantitative one.

Program Impact Areas: The evaluation³ assumes the importance of measuring the impacts that any educational intervention has on learning. It also expands the areas of observation in order to understand the processes and mechanisms through which the introduction of computers impacts the teaching-learning process. Therefore, indicators are included at the student level in the following dimensions:

Cognitive skills: measures of learning in mathematics, communication and other curricular areas and ICT skills.

Non-cognitive skills: abilities for problem-solving, collaboration, teamwork, self-guided learning, etc.

Behaviors: drop-out, attendance, motivation, effort and use of time inside and outside the school.

Expectations and perceptions.

Indicators were also included to measure the impact on teachers, particularly on their pedagogical practices and their responses to the implementation of the program, as well as information on the families of the beneficiary children.

Qualitative Evaluation

The qualitative study⁴ has had two sides: first, a cross-cutting approach applied between August and September of 2009, which included both the schools that had already received the computers and those that were about to receive them; second, a longitudinal approach (carried out in November, 2009) in which visits were made to the schools that had received the computers in October, in order to explore the impact on the attitudes, practices and perceptions of the principals, teachers, students and parents, as well as to document the implementation process and explore the first experiences, reactions and results of the distribution of computers.

The first results show that expectations are high and that, in general, these stakeholders have a positive attitude towards the program. Parents and teachers report being grateful, excited and hopeful that the laptops may improve the learning and opportunities of boys and girls.

In addition, the qualitative study contributed important elements that were later included in the questionnaires of the quantitative study. For example, documenting the training received by the teachers and the classroom practices, exploring the use of the computer outside and inside the school, made it possible to become aware of technical difficulties and document families' responses.

Quantitative Evaluation

For this evaluation, approximately one thousand schools were chosen in January, 2009, through a stratified random sampling (by size and results in previous tests) in each department (province). Due to difficulties in the distribution of the computers, it was decided to limit the evaluation to 320 multi-grade schools in eight departments: Amazonas, Apurímac, Cusco, Juanín, La Libertad, Metropolitan Lima, Pasco and San Martín.

These schools had been part of the census assessment of 2008. Hence, the results for the elementary students who took exams that year, when they were in second grade, were available. The 2009 survey was aimed at the same students, making it possible to carry out a longitudinal statistic analysis.

The following evaluation instruments were applied to the students, parents, teachers and principals:

- ▶ Communication and Math tests: Applied to the students who had participated in the census assessment when

3. Consistentemente con el Marco Conceptual desarrollado por el BID (2010). <http://tics.iniciativaeducacion.net/2010/05/tecnologias-de-la-informacion-y-la.html>

4. Diseñado por el equipo de BID e implementado por la Universidad Peruana Cayetano Heredia, por un equipo a cargo de Verónica Villarán.

they were in second grade in 2008. In 2009, they took the 2007 tests.

- ▶ Student interviews: These covered their perception of the school, the use of laptops at school and at home, knowledge on laptops, child education.
- ▶ Family questionnaire: General data on the child and the family, knowledge and perception of the program.
- ▶ Teacher questionnaire: General data and education, information about their job, satisfaction with the job, development of the program, knowledge and perception of the program.
- ▶ School Principal questionnaire: Information on the characteristics and management of the school, knowledge and perception of the program.
- ▶ Classroom observation: Class distribution, way in which the teacher carries out the class, teacher's performance in the classroom, use of resources in class, use of the laptop in class, activities carried out and general appreciation.

Description of the survey made in November, 2009:

The purpose of this survey is to document the very short-term results, given that, on average, the computers had been distributed less than 3 months prior to the survey. The purpose is to describe the implementation process, so that, in future surveys, it will be possible to establish relationships between the results obtained and the process of design and implementation. In October and November of 2010, visits will be made to the same schools and the same students will be interviewed in order to obtain an approximation of the impact in the medium term (12-18 months after the distribution of the computers).

Out of the 320 schools selected, 210 were allocated to the treatment group and 110 to the control group. The implementation of the random allocation went very well, as 99% of the schools in the treatment group received computers, and only 5.6% of those in the control group did.

Data of the students and teachers of the schools that participated in the evaluation showed that the random allocation worked adequately and the proposed groups were similar.

In general, students in both groups that participated in the evaluation were 8 years old on average, and almost all the children (in both groups) were in third grade when the evaluation was carried out⁵. In the treatment and control groups, more than 80% of the children speak Spanish as their native tongue. Additionally, only 8% of the children (in both groups) are in complete multi-grade primary schools, while the rest are registered in multi-grade schools of only 2, 3 and 4 grades.

While 9.6% of the children in the treatment group attend multi-grade schools of 5 grades, 22.4% of the children in the control group meet this condition. Finally, boys were a slight majority in the treatment group, while girls were the majority in the control group.

In the case of teachers in both groups, more than 55% are women and around 44% were between 36 and 45 years old. In addition, more than 55% were born in a different province than the school where they currently teach, and for more than 85% of the teachers in each group, Spanish is their native tongue.

Around 90% of the teachers, in both the treatment and the control groups, had completed a higher education level. Approximately 4% of the teachers in both groups indicated that they had earned graduate studies consisting of at least

5. El propósito era entrevistar a los niños que rindieron la prueba en 2008 cuando estaban en segundo grado, aquellos que repitieron segundo grado son los que en 2009 no están en tercer grado.

one year. Additionally, almost all the teachers were trained to practice at the primary educational level. More than 70% of the teachers studied in a higher pedagogical institute, and some 30% graduated from universities.

In terms of their employment characteristics, more than 60% of the teachers in the control group hold a permanent position, while only 47% of the teachers do so in the treatment group. Besides, most of the teachers are employed only as teachers, as opposed to being employed as teachers and principals at the same time (76.1% in the case of teachers in the treatment group, and 68.3% in the control group). Of the teachers who reported being employed not only as teachers but also as principals, more than 30%, in both groups, had been in that position for one year. It is, therefore, possible to conclude that, in general and as was expected, due to the experimental design of the evaluation and the adequate implementation of school selection, both groups have similar characteristics.

Preliminary Findings

1. Implementation of the Program

In four of the six schools visited for the qualitative survey, it was found that some laptops are not being used and that in many cases the students do not take them home because either the school or their families fear that damages can occur.

The teachers who had been trained considered that the process, while useful, was inadequate and felt that they required more training. Children, on their part, exploring portable computers had discovered many other activities that were not taught by their teachers.

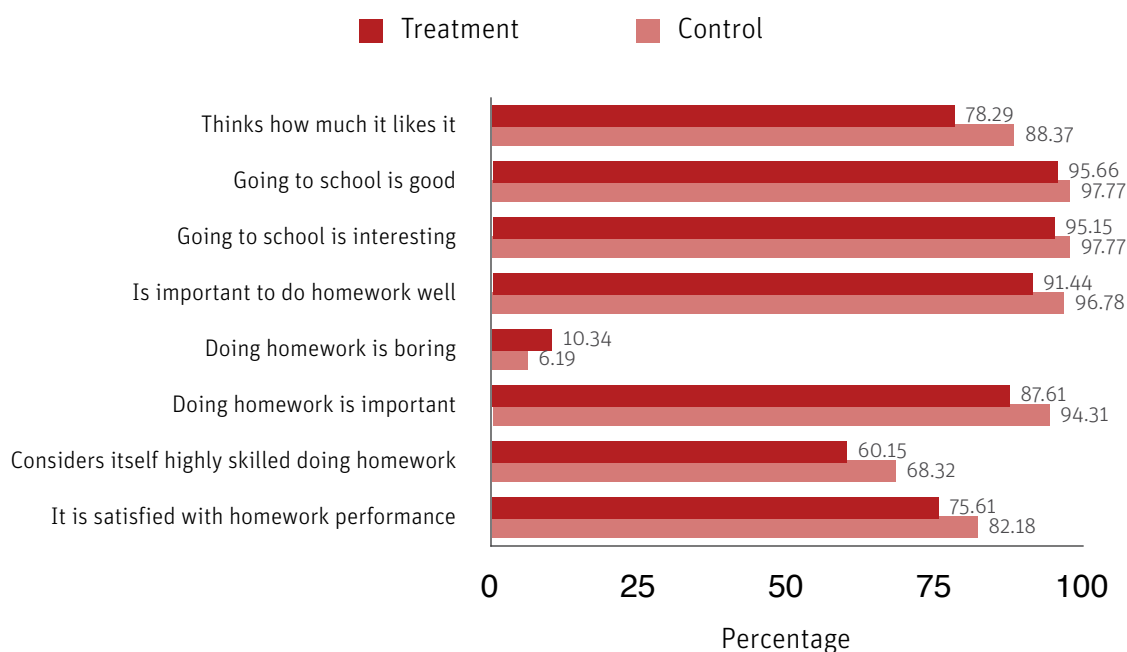
With this background, the quantitative component of the study found that 98.2% of the treatment schools received computers; in 89.0% of the schools, at least one teacher received training on their use (88.8% of the teachers were trained, which contrasts with the findings of the qualitative evaluation) and 87.1% of the teachers received the Teacher's Manual prepared by DIGETE. In other words, in general, the program has had a significant degree of implementation, according to what those responsible had foreseen.

Given the importance of connectivity to the Internet and among computers in the 1-to-1 model, this represents, beyond doubt, an area of opportunity for the program, considering that 95.2% of schools have electric power, and only 1.4% have Internet access. The use of so-called "mesh" for direct connection between machines was very limited.

2. Expectativas y Actitudes

Data on the students' interest in school show some differences between those in beneficiary schools and those in non-beneficiary schools. All of them like going to school and want to continue attending, although, when compared to the control group, children in the treatment group seem to have a more critical view with respect to school and schoolwork—they think less about how much they like school, and fewer of them think that attending school is good or interesting, and strongly believe that doing homework is boring and not important. At the same time, they are more self-critical and significantly less satisfied with their own performance. It will be interesting to go deeper into these analyses and, particularly, to analyze their endurance in time with respect to the 2010 survey.

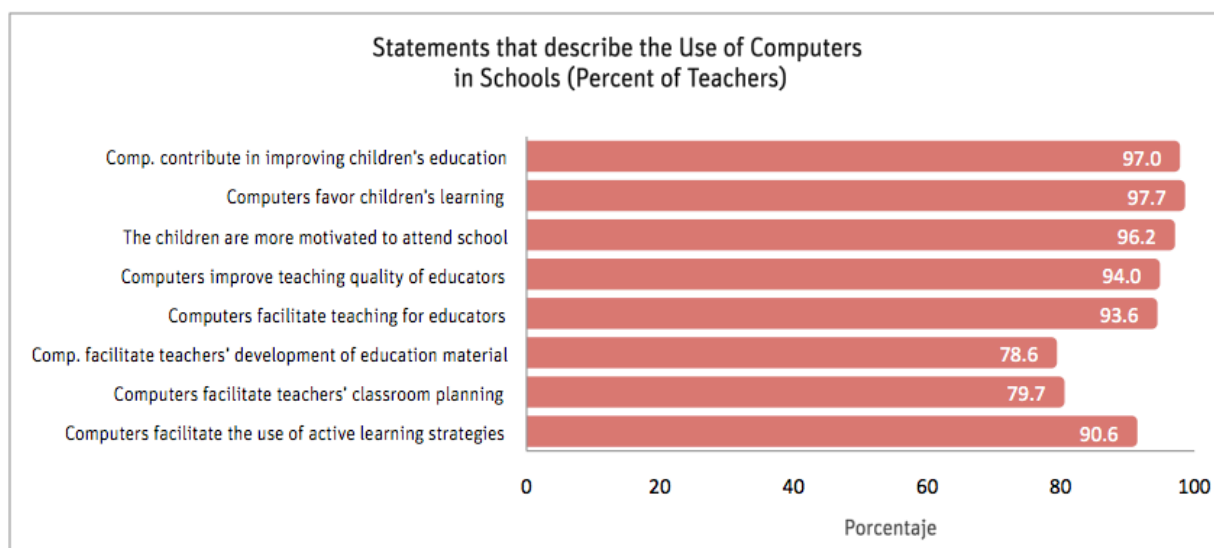
Opinions about studies and school work (Percentage of students)



With respect to the teachers and their satisfaction with their work at school, those in the treatment group are significantly happier than those in the control group in terms of the relationship with other teachers (28.1% in the treatment group vs. 17.6% in the control group) and that with the students (48.4% of the treatment group vs. 33.1% in the control group). Similarly, those belonging to the treatment group tend to be more content with the Parent Associations (APAFA), compared to those in the control group (20.35% vs. 13.4% for the treatment and control groups, respectively).

Analyzing the school's educational materials and equipment, it is found that a greater percentage of teachers in the treatment group are content with these aspects of the school (53.3% and 47.0%, respectively), compared to the teachers in the control group that are content with the same aspects of the school (33.8% and 27.5%, respectively). Finally, most of the teachers indicated that, when they carry out pedagogical activities with their students in class, they do group work; this percentage was higher for teachers in the treatment group.

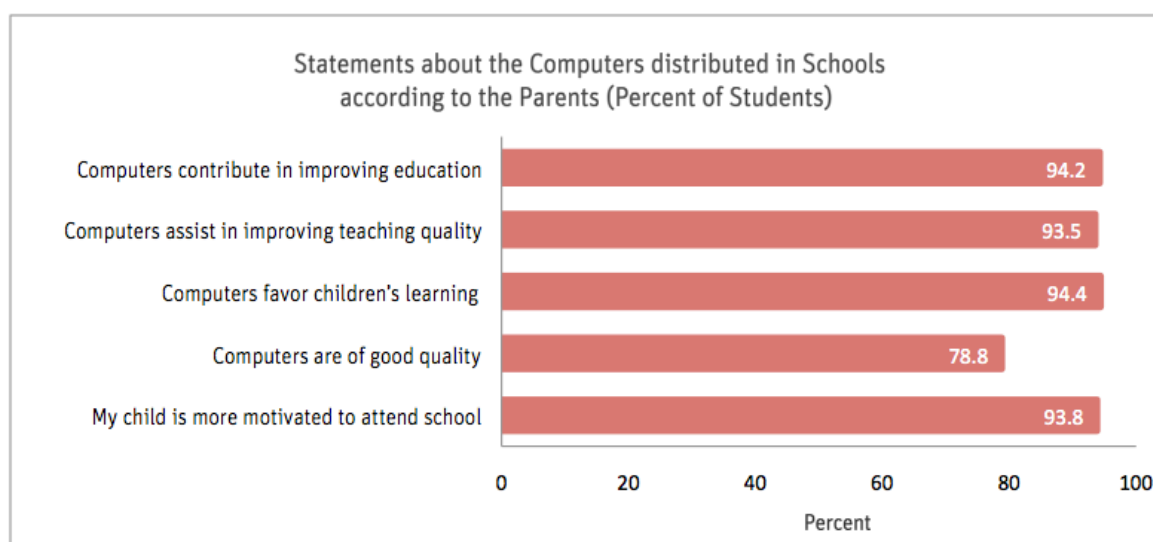
Regarding the "One Laptop Per Child" program, it is noted that more than 95% of the teachers in schools that received the laptops think that these contribute in improving the children's education and learning, and that this motivates them to attend school. Furthermore, between 90 and 94% of the teachers reported that laptops improve and facilitate the quality of teaching. Additionally, they facilitate the use of active learning strategies. Finally, around 78% of the teachers think that laptops make it easier for them to prepare class materials and to plan for the class.



p.75 Teachers Questionnaire: In your opinion which of the following statements describe the use of computers in schools?
N 266

The perception of the parents concerning the children's education is that educational materials are sufficient (52.9% in the case of the parents of children in the treatment group, and 44.6% in the case of the parents of children in the control group). Moreover, the majority of parents (above 57%) in both groups indicated that Peruvian education is good. Parents, as opposed to children, are less critical in treatment schools than in control schools.

When focusing only on the schools that received a laptop, it was observed that most parents indicated that, in their opinion, laptops contribute towards improving education (94.1%), help in improving the quality of teaching (93.4%) and enhance their children's learning (94.2%). It is also evident that parents think that their children are more motivated to attend school because they have the laptops (93.7%).



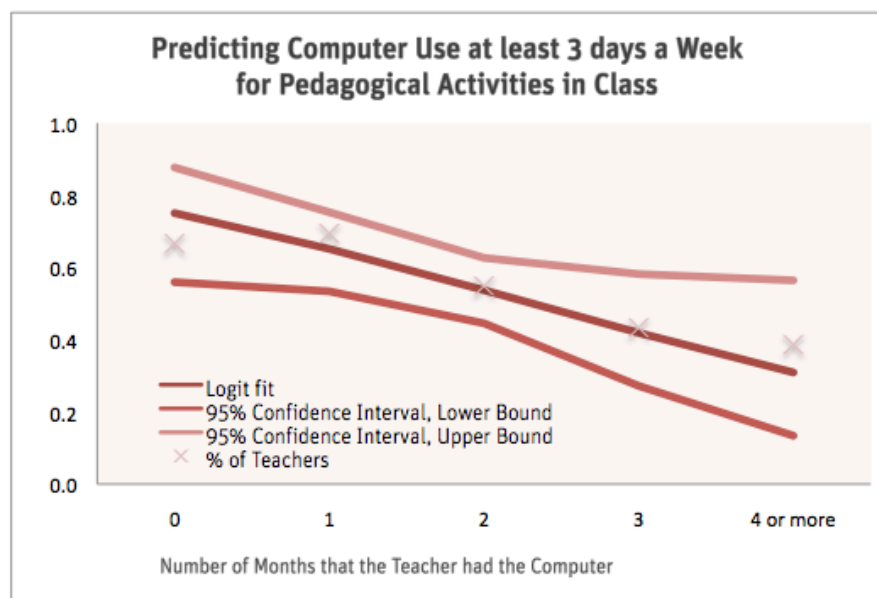
p.54 Family Questionnaire: Do you agree with the following statements regarding the computers distributed to the students at school?
¿Está usted de acuerdo con dichas afirmaciones?
N 713

3. Use and educational practices

In the classes that were observed during the qualitative evaluation, it was noted that laptops were being regularly used between two or three times a week and daily, but in most cases their use has not substantially changed the practices. Additionally, it can be observed that there is a tendency for students to transcribe texts from notebooks or chalkboards to their laptops in order to edit them later.

The use of computers is being integrated into traditional teaching practices. Hence, the challenge of laptops becoming a catalyst for change in the teaching-learning process still remains. These elements were not a key part in the program, and strengthening them appears to be a relevant issue. Only 10.5% of the teachers reported having received technical support, and 7.0% reported having received pedagogical support for the implementation of the program at their schools.

Once the quantitative component has been applied with respect to the effective use of laptops in the classroom of those schools that received them, an interesting preliminary finding is that pedagogical uses decreased among those teachers who had been working with the computers for a longer period of time in their classroom. Of the teachers who had received laptops after September (that is, they had less than two months of experience), 68.9% used them 3 or more days per week for pedagogical activities in the classroom. However, this percentage falls to 40% in the case of those who had received them before that date.



This significant difference can be explained by several factors. The first of them is the enthusiasm generated by the novelty. Once the laptops have been assimilated, the lack of planning and prepared activities, of specific contents, of technical and pedagogical support at school gradually reduces the use. However, it is interesting that the use that is maintained with the same frequency over time is that of "class preparation," which precisely takes place in contexts of less exposure and risk for the teacher. The above was ratified by classroom observations. In the observations of language classes, the use of computers by the students went from 60.5% to 44.2%, depending on whether the computers had been received after or before September, respectively. Similarly, in the observations of math classes, the same percentages went from 47.7% to 41.1%.

On the other hand, despite the project's guidelines, only 56.9% of the students declared that they took the computer home. Of those who did not, 41.6% reported that the school does not allow them, and 34.4% indicated that their parents do not allow them. This would be mainly related to the fact that some teachers and parents have the perception that, if the laptops are damaged, they would be liable (which is not the case, according to officers in the Ministry of Education).

The 80.3% of students who do take the computers home use them between 1 and 2 hours every day. This time is distributed in more or less the same way: half the students devote 1 hour of their time with the computer at home to do school work, and half the students also devote 1 hour for laptop recreational uses.

4. Outcomes in Learning and Skills

From the point of view of performance, considering the short exposure time of the program, the review of results on the national tests revealed no significant differences in the results attained by the students in the treatment group as compared to the control group.

However, in the test applied to the students to measure the management of their capabilities in ICT use, a positive correlation was found between a better ICT test result and use of the computers for 3 days or more by the teacher. There was also a positive correlation between the ICT test results and the results of the reading comprehension test.

Particularly, students whose teachers used the laptop for 3 or more days obtained a score in the ICT test that was 0.317 points higher than those whose teachers used it for fewer days. Similarly, the students with a higher score in the reading comprehension test obtained 0.204 points more in the ICT test than those who obtained a lower score in the reading comprehension test. It is important to note that the total score possible in the ICT test is 13, while the average score is 8.2.

The 2010 survey and others that might be carried out in the future will make it possible to specifically evaluate the impacts of this program on the educational results for the students, as well as on the development of skills and abilities.



General Conclusions

The experience of the first stage of the impact evaluation of the "One Laptop per Child" program in Peru has made it possible to have comparable samples and to establish the initial conditions of the project's implementation, of the expectations of those involved and of the initial educational results of the students. It is possible to propose a few preliminary conclusions:

- The design of the evaluation included qualitative and quantitative elements, focusing on indicators that measure learning, but also including other interesting dimensions that will allow the understanding of how the introduction of computers affects stakeholders and educational processes in Perú.
- While the implementation of the program had complications and delays, generally speaking it was adjusted to the parameters defined by the Ministry authorities and it was possible to keep a rigorous evaluation framework, based on the random allocation of laptops among eligible schools.
- Relevant aspects to be considered in the implementation include: 1) the demand for greater preparation by the teachers; 2) the low percentage of students that can take the laptops home; 3) the low connectivity to the Internet and to the local network; and 4) the lack of technical and pedagogical support in the schools and locations.
- Teachers and parents show enthusiasm and higher expectations in the schools that are part of the program, with respect to those that are not. These elements provide a relevant effect in terms of the implementation of public policies.
- Students in the treatment schools are more critical with respect to education, their schools and their own educational performance. This also emerges as an interesting opportunity that requires follow-up, as it could mean that this more critical view is related to greater expectations and perspectives triggered by the program.
- Concerning use, it is worth making note of what looks like a decreasing utilization of computers in the classroom, which could be a reflection of the need for more technical and pedagogical support for the teachers, as well as of the lack of planning sessions, activities and digital resources appropriate for educational use.
- The quantitative component shows, in the very short term, few differences among the children who have received computers and those who did not. This could be explained by the scarce time of exposure to the intervention.

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