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Working Paper nº 6, May 2011

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INTERNET IN BRAZILIAN PUBLIC SCHOOLS: POLICIES BEYOND POLITICS*

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1. Introduction

Computer distribution programs are now present in the school systems of virtually every country, including the poorest. If there is a rationale behind these programs, it is certainly not to be found in studies or impact assessments of how computers and the Internet might be used as tools to improve instruction. In most developing countries, systematic impact assessments are nonexistent, while studies carried out in developed countries are contradictory: in some, the outcomes are found to be positive; in others, neutral; and in some, negative.[3] Even when a positive impact is found, it cannot be separated from the educational context in which the study was performed, with properly trained teachers, the use of monitored software, and adequate maintenance and support systems for school computer labs.

Our intention is not to denigrate computer distribution programs, but simply to observe that they are politically motivated, products of the Zeitgeist, which leads low-income families to make sacrifices so their children can study in private schools, schools that claim to practice "advanced teaching methods" that include the use of computers. The fact is that the "computers for all" platform is a vote winner, as was the case during the latest elections in Uruguay, or this year in Argentina, where the Conectar (Connect) program has been widely publicized through a typically election-centered marketing campaign.

We still know little, very little, about how the cognitive abilities of current and future generations will be shaped by new information technologies, whose impact includes, but greatly

* This study was supported by the Edelstein Center for Social Research as part of its Information Society research program.
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[3] Learning Point Associates provides a number of studies online: http://www2.learningpt.org/catalog/. For a good summary of evaluations carried out through 2005, see "Critical Issue: Using Technology to Improve Student Achievement." http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm (retrieved March 6, 2011). The major studies carried out in the 1990s were summarized by John Schacter in "The Impact of Education Technology on Student Achievement: What the Most Current Research Has to Say." http://www.waynecountyschools.org/150820127152538360/lib/150820127152538360/impact_on_student_achievement.pdf (retrieved March 6, 2011). The argument that new technologies require a radical change in teaching methods in order to be effective is proposed by Clayton Christensen, Curtis W. Johnson, and Michael B. Horn, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*. New York: McGraw-Hill, 2008.

exceeds, the school system.[4] There may be cognitive gains as well as losses, as when previous revolutions reshaped the technologies we use to store and share knowledge. In the short term, new technologies pose great challenges to our education systems, compounding a state of crisis that predates the Internet and involves the relation of authority between teachers and students, as well as the growing demand made by families that each student receive individualized attention – not to mention "civilizing" transformations around values such as discipline or hard work.

The issue to consider, then, is not whether computers should or should not be adopted; that decision has already been made. Politics must now be translated into responsible policies in both the use of resources and the goals they are meant to support, maximizing benefits and minimizing waste.

Computers, for What?

In the 1990s, the first government programs for school computers were aimed primarily, though not always explicitly, at digital inclusion, understood as "teaching children without home access how to use computers." The assumption was that a digital divide was developing between children who had computers at home and those who did not. The goal was to offer children access to computers at school, where they could practice and develop the ability to use them as a tool.[5]

Although access to computers and the Internet has increased tremendously in recent years, a significant number of low-income children still do not have a computer at home. Despite the growth of Internet cafes (*LAN houses*), which are also present in low-income neighborhoods, and despite the current generation's ability to develop digital literacy by "osmosis," the argument that a percentage of low-income youth have little or no access to the Internet continues to be valid. But if "digital inclusion" is the objective, we should think carefully about the best way to achieve it. Certainly a project like Uruguay's Ceibal Plan,[6] which distributes one computer per school-age child (beginning with the country's inland regions), is the best way to achieve the goal of universal inclusion.

The focus of computer distribution in public schools has shifted, however, from digital inclusion to improved instruction. Beyond digital inclusion, school computer programs can actually

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[4] There are countless studies on the impact of the Internet on young people. See, for example, John Palfrey and Urs Gasser, *Born digital: Understanding the First Generation of Digital Natives*. New York: Basic Books, 2008. And for Latin America, see Fundación Telefónica, *La Generación Interactiva en Iberoamérica – Niños y adolescentes ante las pantallas*. Madrid: Editora Ariel, 2008. Regarding the broader impact of the Internet on society, opposing perspectives can be found in equal number. See, for example, from the "optimists'" camp, Manuel Castells, *Communication Power*. Oxford/New York: Oxford University Press. And also, Yochai Benkler, *The Wealth of Networks*. http://cyber.law.harvard.edu/wealth_of_networks/Download_PDFs_of_the_book (retrieved March 6, 2011). A more critical perspective can be found in David Singh Grewal, *Network Power*. New Haven, CT: Yale University Press, 2008. Jonathan Zittrain, *The Future of the Internet and How to Stop It*. New Haven, CT: Yale University Press, 2008. And Nicholas Carr, *The Shallows: What the Internet Is Doing to Our Brains*. New York: W. W. Norton, 2010.

[5] This was judged to be the initial impact, for example, of the Enlaces (Links) program of the Chilean Education Ministry (personal interview by the coauthor [BS] with team members). According to the interviewees, even in 2006, 60% of students had Internet access only at school.

[6] http://www.ceibal.edu.uy

serve five different functions that are interrelated to a certain extent: 1) as a means of improving the administrative structure of the school system, facilitating contact among superintendents, principals, and teachers; 2) as a tool for teachers to complete in-service training and continuing education programs; 3) as a way for schools, teachers, and parents to communicate, as well as a means of enrollment; 4) as a way for teachers and students to communicate; 5) as a teaching and learning tool both inside and outside the classroom.

Each of these five facets calls for constant assessment, although the handful of existing impact studies has tended to focus only on the last one. The assumption is that these programs will boost school system quality, making it possible to overcome the problems faced by public education in Brazil. Rather than speculating about it, this assumption should be properly monitored so that the necessary measures can be adopted to achieve the desired results. The issue to consider is how to evaluate the impact of these programs.

How to Evaluate?

Studies that analyze the impact of computers in the classroom usually compare groups that use computers with those that do not. Although a necessary aspect of any evaluation, this is clearly insufficient. The primary reason is that, in addition to the difficulty of eliminating other variables (for example, teachers who are willing to use new technologies usually have a higher level of personal motivation), the mere introduction of computers is seen as the main condition for success, without considering the presence of technical support and teachers who are adequately trained to use the new equipment. As confirmed by both the limited literature on the topic and our own research, this is not the case. The introduction of computers is simply a link, and usually the least difficult and burdensome to implement, in the chain need to ensure that the outcomes of computer use are positive. This chain includes:

a) A system of technical support to ensure that computers are properly maintained, constantly updated, and supplied with peripheral material such as paper and ink for printers (and the money needed to make such purchases).
b) Ongoing teacher training in the use of educational programs and software.
c) Websites with constantly updated material, educational programs, and online support for teachers and students.
d) Adequate communication among superintendents, principals, and teachers.
e) A new course on “How to Use the Internet Critically” added to the curriculum, or at least incorporated as a theme across the curriculum.

If one of these links malfunctions, as in any production line, the pace of the operation as a whole will be affected. As demonstrated by a recent World Bank study in Colombia, disappointing

outcomes in school computer programs may be the results, in large part, of earlier links in the chain rather than the classroom itself.

This article represents an initial attempt to analyze the current situation in Brazil's public school system, focusing on Rio de Janeiro as a case study. It points to significant shortcomings in all the essentials of a properly functioning system. The Brazilian school system faces a long period during which its teaching staff will operate at two different speeds: those who are interested and willing to experiment with new technologies and those who feel threatened by them to the point of boycotting any form of innovation. This issue will be explored in the article's conclusion.

2. Methodology

The study focused on the practices and opinions of teachers in order to map current patterns of Internet usage in the Rio de Janeiro school system.[7] A particular effort was made to identify obstacles and dead ends that would hinder the productive pedagogical use of this tool for information and communication. Over the course of 2009, three distinct research approaches were developed: a) an online survey on the website of the Municipal Secretariat of Education (Secretaria Municipal de Educação – SME), answered by a statistically controlled sample of teachers from the district; b) two focus groups, one with teachers and another with administrators (coordinators and principals); c) observation of the daily routine of computer labs in four city schools. The results presented here summarize and attempt to tie together the conclusions drawn from the intersection of these three approaches.

The online survey was answered by 475 teachers from a group that was preselected through a random sample that accounted for the size of the school and its location in the city. The distribution is shown in Tables 1 and 2. [8]

Table 1: Schools by Region

	N	%
Barra	95	20.0
Center	87	18.3
North	129	27.2
West	105	22.1
South	59	12.4
Total	**475**	**100**

Table 2: Schools by Size

	N	%
Large	112	23.6
Medium	255	53.7
Small	108	22.7
Total	**475**	**100**

[7] We would like to thank the Overview Pesquisa company for its assistance in the gathering and cross tabulation of data.
[8] We are aware that this study, which employed an online survey, runs the risk of teachers who are more familiar with the Internet and/or more motivated imposing their views on their "silent" colleagues. Notwithstanding, we believe that this concern, although relevant, did not significantly affect our results, since the criteria of regional representativeness and school profiling were satisfied.

The observation of computer labs was carried out in four schools in different regions of the city. Selection was based on lists provided by the SME in which labs were classified according to their level of use: high, average, or low (one, two, and one, respectively).[9] The researcher spent one week in each lab, observing the behavior of teachers and students.

Regarding the focus group meetings, whose participants were also selected by the SME, the group of teachers was very homogeneous, consisting of 10 teachers (three men, seven women) with experience using computers at school. Several had earned graduate-level specializations in "educational computing," and all had completed one or more training courses through the secretariat. Some had even served as course "facilitators."[10] Among the participants, only one was a classroom teacher (*professora regente*). The others were teachers who oversaw school reading rooms or computer labs, or who had been placed in "Education for Work" centers (Polos de Educação para o Trabalho – PET). Two of the participants also held the position of Technology Adviser (Orientador Tecnológico – OT) in the state school network.[11] One of them possessed advanced technical skills and was responsible for compiling software for school use. The group members agreed that their knowledge of computing and the Internet did not reflect a typical sample of teachers within the school system; still, they felt valued for being "heard," since they possessed extensive experience in the area.

For its part, the group of administrators (eight principals and coordinators, only one male) was much more heterogeneous. Some had been in leadership positions for more than a decade, whereas others had less than a year of administrative experience. Their familiarity with computers also varied considerably. Some coordinators maintained blogs and discussion lists, while there were principals who (apparently) preferred to delegate the use of administrative computers to a "subordinate" who "was better at it."[12]

For methodological reasons, these steps were carried out in the following order. First, the school laboratories were observed. The data collected during this stage were used to formulate the agenda of the focus groups. Finally, the evidence gathered during these stages was used to structure the questionnaire that was administered to teachers. This report takes a quantitative approach, using the focus groups and laboratory observation to illustrate, nuance, or attempt to better understand the research results.

[9] The schools have been assigned the letters A, B, C, and D.
[10] During the focus group, we were informed that the city had just over 100 teacher-trainers.
[11] A support role assisting the adoption of information technology in state schools.
[12] In one of the laboratories that was observed, a teacher blamed the principal himself for the underdeveloped use of computers at the school: "[The principal] doesn't use computers, he writes everything by hand and asks them to type it for him"; he also posed the question, "How can a lab work well if the institution's own principal doesn't see how valuable computers can be?"

3. Respondent Profile

The group of teachers that responded to the survey was overwhelmingly female (90%) due to the predominance of first-segment teachers in our sample (those responsible for teaching first to fifth grade, referred to here as T2). They represented 63% of the total sample, while second-segment teachers (responsible for sixth to ninth grade, referred to as T1) represented 37%. Among T2 teachers, the predominance of female teachers is absolute (99%). Although there are fewer female T1 teachers, they still represent a significant majority at 73%. T2 teachers are concentrated in small schools (83.5%) and are a minority in large schools (40%). The number of male teachers in small schools is miniscule (4%), limited to physical education instructors.

Age was another relevant feature of the respondent group: 66% of teachers were 41 or older, with the largest contingent (43%) ranging from 41 to 50 years old. This age profile is significant because it indicates that the vast majority of these teachers had virtually no contact with personal computers during their childhood or adolescence. At the same time, 79% of respondents had children, half of whom were between 10 and 25 years old, meaning that they had daily contact with potentially frequent Internet users.[13]

Of the teachers interviewed, 84% had earned a teaching degree, 25% had completed a graduate-level specialization, 4% had earned a master's degree, and 0.5%, a PhD. Regarding the area of study in which these degrees were obtained, however, 44% of the total were in education or related areas.[14] Of the entire sample, only 1.7% had earned a degree related to computing. Half of the respondents had only one municipal teaching license (*matrícula*) and no other form of employment. Of the remainder, 32% held a second municipal license; 13% worked in the state school system, which is responsible for secondary education; and 4% worked in the federal or private school system.

4. Skills and Practices of Teachers vis-à-vis Computers and the Internet

Computer access was nearly universal: 98% of respondents stated that they owned a home computer, and 79% indicated that they had a broadband Internet connection. Only 16% used a dial-up connection, and only 5% did not access the Internet from home.[15]

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[13] The survey revealed that teachers who had children were more likely to have broadband Internet access at home (81% vs. 71%).

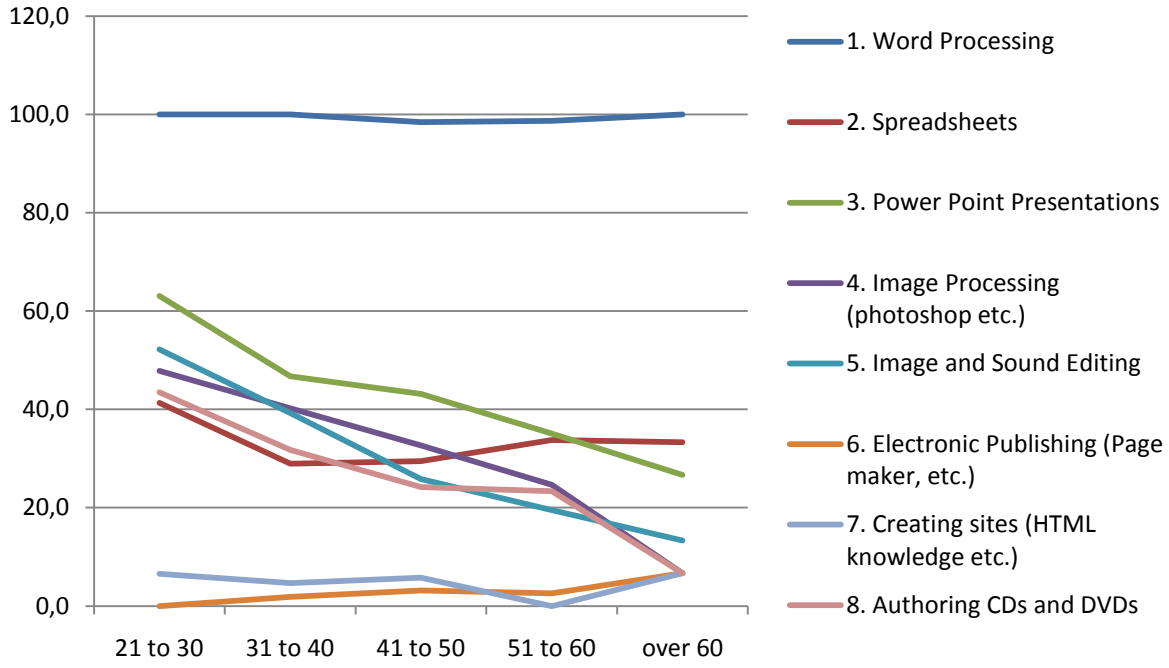
[14] This was an open-ended question. As responses related to teaching, we included administration, management, school planning and supervision, higher education pedagogy, education itself, early childhood education, special education, psychology, psychomotricity, and educational psychology.

[15] It is possible that part of the explanation for the widespread dissemination of computers may be attributed to the Municipal Secretariat of Education's 2008 laptop distribution program for all teachers in the school system. At the same time, according to some research participants, the program was not fully able to meet its goals: some teachers chose not

Although the simple presence of a home computer does not guarantee its use, 93% of respondents were computer users, with widely varying levels of skill. Nearly all those who described themselves as users were familiar with word processing software (99%). The second most familiar resource involved the creation of slide shows (with software such as PowerPoint), used by 44.3% of respondents. About a third of the teachers also used image processing programs such as Photoshop (a surprising 33.9%), spreadsheets (31.4%), and image and sound editors (an even more surprising 30.3%). Skills such as website creation and online editing occurred in significantly smaller percentages (4.6% and 2.5%, respectively). Although the number of men in our sample was small, men were more likely than women to indicate proficiency in some of the tools just mentioned: PowerPoint (62% vs. 42%) and spreadsheets (45% vs. 30%). In general, the results indicate that the vast majority of teachers are familiar with computers and related resources. The most relevant variable for this group was that of age: younger teachers (21 to 30 years old) were proportionally more likely to be technologically proficient, as shown in Figure 1:[16]

Figure 1

Computing Proficiency among Teachers (by Age)



to claim their computer, whether because they feared it would be stolen or because they thought it would be used as a form of control.

[16] Some surprising results may come from overestimating one's own knowledge. Yet although there are image processing programs that are quite simple, it would be hard to say the same for image and sound editing programs. However, regarding the question of "authoring CDs and DVDs," which was answered affirmatively by 27.3%, it is likely that the majority of these responses were based on the ability to copy CDs and/or DVDs, not exactly the ability to "author" them – i.e., creating menu pages, defining selection paths, etc. At any rate, the teachers' general familiarity with computers cannot be denied.

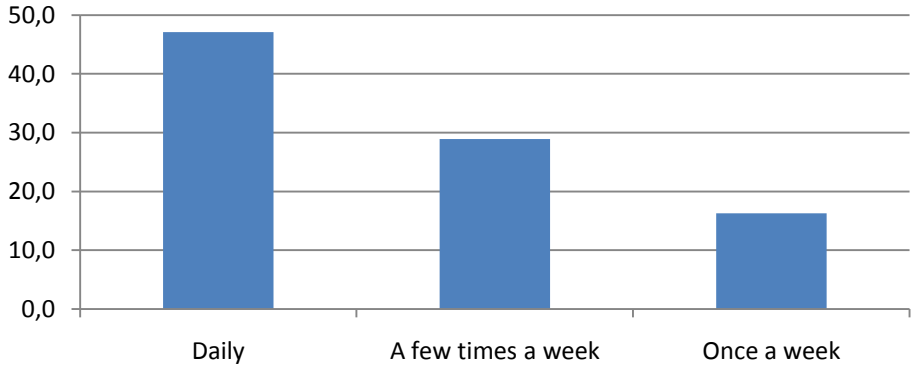
Access to and Personal Use of the Internet

More than half of the teachers (53%) accessed the Internet on a daily basis, with younger teachers (21 to 30 years old) doing so more frequently than the rest (76%). Only 9% accessed the Internet less than once a week, and only 2.8% stated that they never used the Internet. We can safely say that the older the teacher, the greater the chance of being a sporadic user or of never using the Internet. The percentage of men who accessed the Web daily was greater than that of women (62.5% vs. 52%).

Almost all who accessed the Internet did so from home (94.6%), but the school was also a frequent place of access for 37.6% of respondents. Teachers in small schools were more likely to access the Internet on a daily basis (58.3%), and they were also the group most likely to do so from school. Significantly, the more often a teacher accesses the Internet, the more likely he or she is to do so from the school in which he or she works, as shown in Figure 2:

Figure 2

Teachers Who Access the Internet from school (by Frequency of Use)



Internet Usage Patterns among Teachers

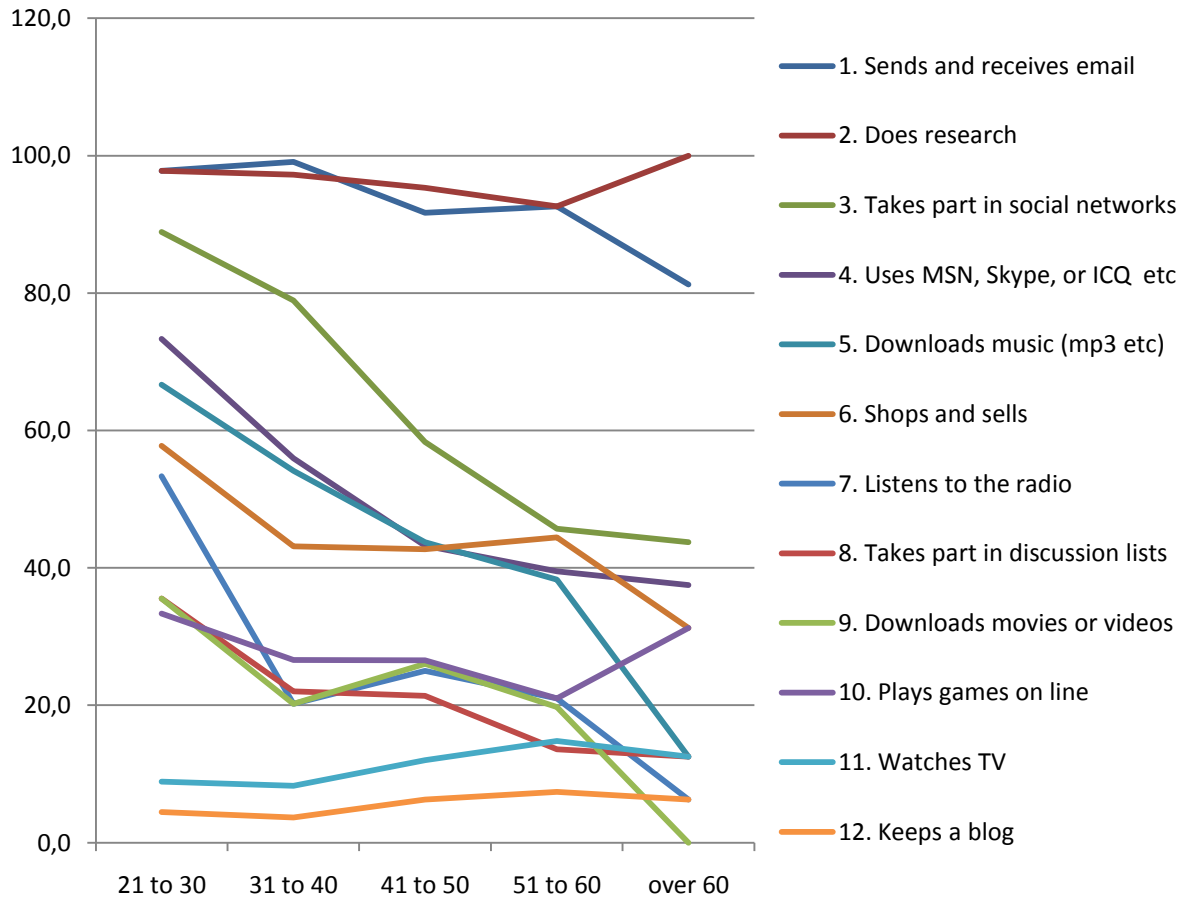
Electronic mail and research were activities that more than 90% of respondents carried out online, and 60% participated in social networks. Communication tools such as MSN and Skype were used by nearly 50%, slightly more than those who made purchases or downloaded music. One in four teachers played online games or listened to the radio, and one in five downloaded movies or videos and participated in discussion lists. Only one in 10 watched television online, and one in twenty maintained a blog. Overall, the teachers appeared to be very familiar with the basics of the Internet (communication and information, social networks, etc.) and indicated in very significant numbers that they possessed advanced skills, although this decreased according to age.[17]

[17] As of the focus group meetings, teachers and coordinators had been prohibited from keeping blogs or sites with their school's name. Efforts such as these, even ones that had been approved by the principal, had been "cut." According to

There is virtually no gender difference regarding basic Internet proficiency. Only two distinctions stand out: women participated in social networks more intensively than men (67% vs. 53%), while men downloaded more videos and movies (36% vs. 21%). A comparison by age is more revealing. Although activities such as email and research remained basically stable, almost all other activities decreased as the teacher's age increased (the exceptions were "games" and "watching TV"), as can be seen in Figure 3:

Figure 3

Internet Usage Patterns among Teachers (by Age)



A significant majority of teachers stated that they made use of the Internet for lesson planning (72%). Here as well the age of the teacher is greatly influential. The younger the teacher, the more likely he or she is to make use of the Internet for lesson planning, as shown in Figure 4:

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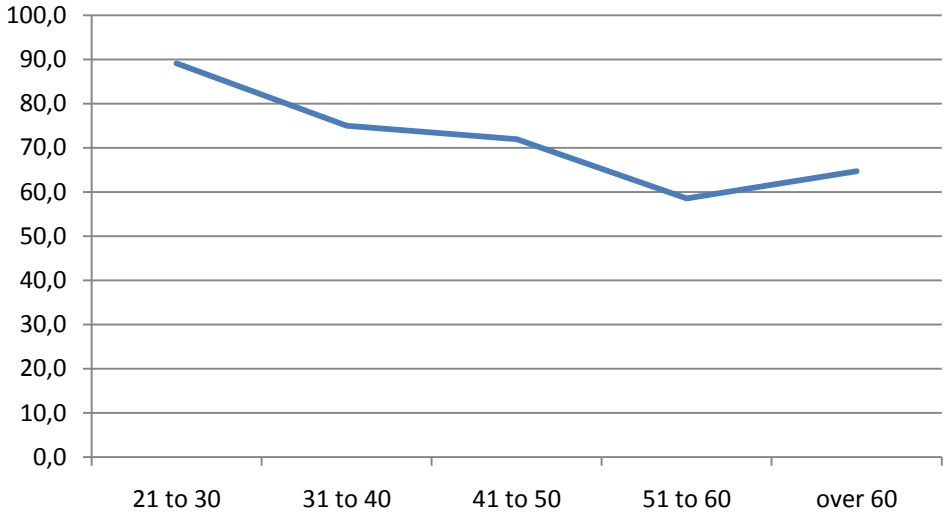
some, the decision had been made by the Regional Education Office. This left many teachers frustrated because during their training sessions, they had been encouraged to create blogs with their students. Not even the reading room teachers were authorized to keep blogs as part of their teaching repertoire.

Figure 4

Teachers Who Make Use of the Internet for Lesson Planning (by Age)



Impact of Educational Computing Courses

The teaching profession shows the same tendency as the majority of the population, in which the youngest age group uses computer technology more skillfully and frequently. Since 2000, however, the city of Rio has invested in programs to train its teachers in "educational computing." In the first two years, teachers received a bonus to participate in training courses, and training facilitators were also paid. In the teachers' focus group, the comment was made that "the majority" took the course just "for the money." After the attendance bonus was eliminated, the number of participants declined and, according to some, the quality of the course improved.[18] Yet another reason was suggested to explain why the interest in computer training had declined: many teachers took the courses because they expected to be made responsible for the computer labs that had begun to be installed in schools. When this failed to happen, interest fell off, and those who had enrolled in the courses hoping to be promoted were left frustrated.

Of the teachers who were surveyed, one-third had already participated in training courses, with a higher ratio of T2 to T1 teachers (37% to 28%). Among those who had enrolled, the most common reason reported was "interest in gaining expertise" (96.7%), as shown in Figure 5:

[18] It was said that the system had been modified at the request of the teacher-trainers themselves, since those who were there "just for the money" hindered class performance.

Figure 5

Reason for Attending Educational Computing Courses

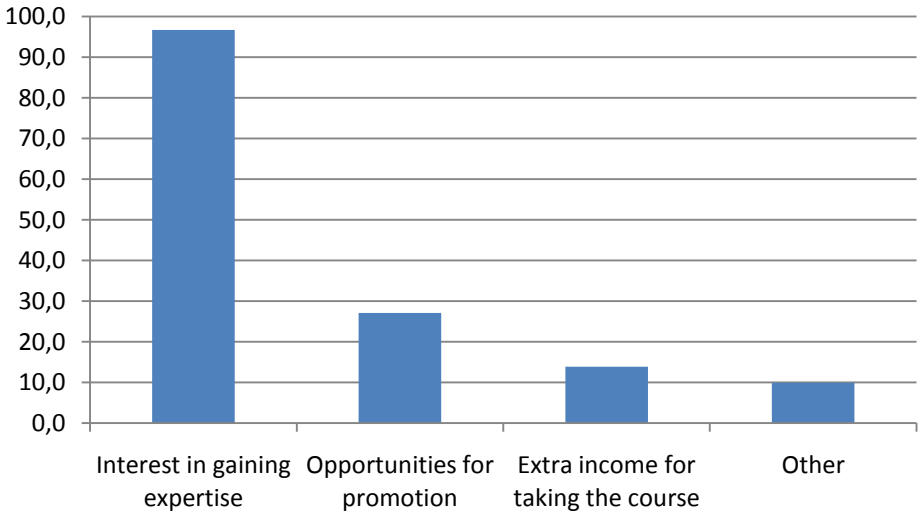
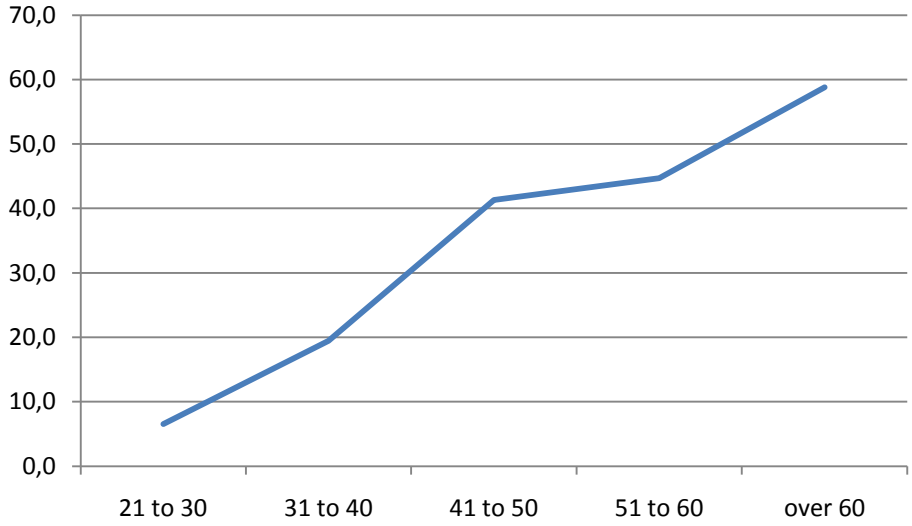


Figure 6 shows that the percentage of teachers who enrolled in training courses increases considerably by age. This trend can be explained in part by the smaller class sizes resulting from the end of the attendance bonus in 2002, but the slope of the incline suggests that older teachers, with less computing proficiency, may have enrolled in the course to increase their personal skill level (and not only to qualify for a new position), while the youngest felt less need to do so.

Figure 6

Teacher Participation in SME Computing Courses (by Age)



As will be seen, participation in training courses has a significant impact on the use of computer labs, particularly among T2 teachers, those responsible for the first segment. In the focus group, a mathematics teacher stated that the training sessions had helped her find ways to better

develop her students' abstract reasoning skills, which had been her greatest difficulty. She recalled the example of a game, adapted by a local teacher, that simulated a bombing run. Instead of dropping "bombs," however, it drops "problems." As the students' performance improves, she increases the speed of the game.

A similar story was told by a teacher working on a "project" with students who had started sixth grade without basic literacy skills (and who had "gone through the whole range of literacy approaches," she made sure to add). She also uses software with bombs – "they love bombs," she said. The game drops a series of letters, and if the student fails to hit the corresponding key, the "bombs" wreak havoc on the city below. The teacher observed that she had achieved good results with the "project" and that many students been able to move on to the next grade.

Despite these positive reports, one teacher/facilitator pointed out that one of the primary obstacles to integrating computers into the school system was the disparity in available resources between the training courses and the schools. The courses take place in comfortable classrooms, each with 10 functional computers, whereas this is not always the case at school. A common complaint expressed by the teachers was that "I wasn't able to apply what I learned in the course." Once, this same teacher recalled, she had led a course with teachers from a variety of locations. The laboratory of the school where the course was being given used Windows, but some of the teachers worked at schools where Linux was used: "Their schools didn't have many of the programs I was trying to teach them, which made for a frustrating experience." To avoid this kind of situation, she argued that teachers should be trained at their own schools. This perspective was embraced by the entire group of teachers, who then manifested a preference for unpaid training held during work hours at the teachers' own schools.[19]

In the group of administrators, the word "frustration" also was also used several times when this topic came up. One coordinator, who had also served as a training facilitator, when describing the teachers who had been trained but had not had the opportunity to apply what they had learned, put it this way: "They feel their knowledge is going to waste, because the school system invested in these training sessions, and they feel frustrated by not being able to apply things, whether because the computers don't work, or the Internet doesn't work, or because they can't teach what they learned in the courses because of the school." The greatest "frustration," according to one of the principals, is felt by those who "applied themselves" because they "hoped to be promoted, since five years ago 200 computer labs were opened, and they hoped to work in them."

[19] They are currently held on Saturdays and during "alternative" time slots.

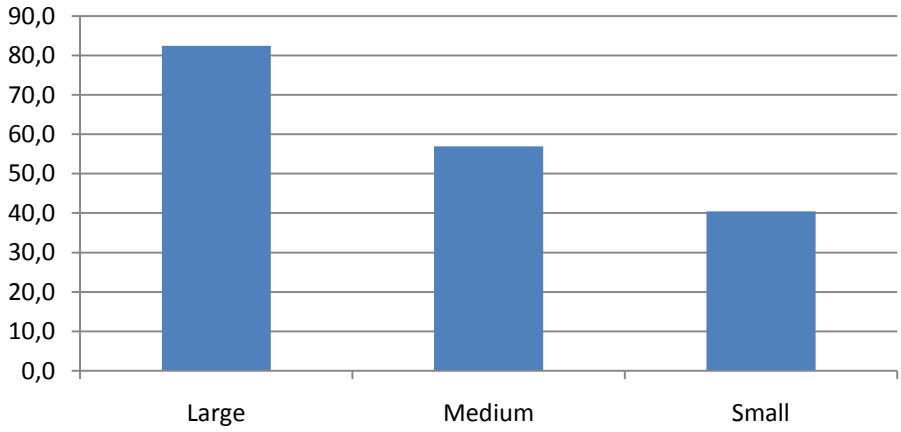
5. Computers and the Internet at School

Computer Lab Operating Conditions

Among the respondent group, 59% indicated that they worked in schools with computer labs. The size of the school makes a difference in this regard. While 82% of teachers in large schools indicated that their institution had a computer lab, only 40% of teachers in small schools did so (Figure 7).

Figure 7

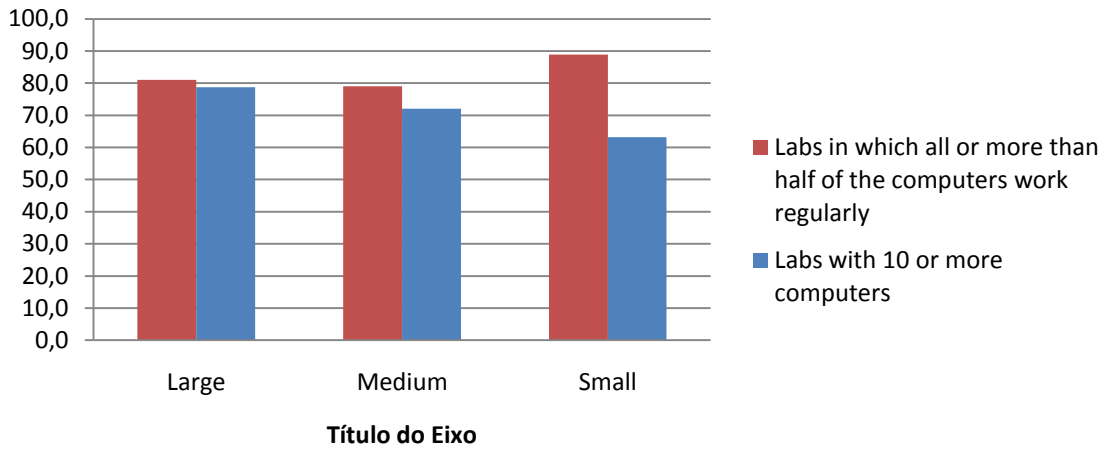
Presence of Computer Labs by School Size



The number of available computers varies greatly (from three to 30), but the most frequently cited number was 10 (present in 58% of schools with labs); however, 27% of teachers indicated that they worked in schools whose labs had fewer than 10 computers. Although the size of a computer lab tends to vary according to school size, operating conditions are better in small schools than in large ones (Figure 8).

Figure 8

Quantity and Operation of Equipment (by School Size)



Laboratory observation revealed that maintenance conditions varied greatly from one school to another. In School A the laboratory contained 10 computers; all were in perfect working condition, and the most popular software was available. According to the teacher responsible for the lab, maintenance issues were addressed by the Help Desk of the Regional Education Office (Coordenadoria Regional de Educação – CRE) in a period ranging from two to three weeks.[20] In School C, the lab contained 19 computers and, at the time of observation, another four were awaiting disposal and not being used. Software resources were also broad and diverse. Despite its favorable infrastructure, however, the laboratory was much idler than that of School A. The alleged reason was the absence of a "teacher responsible for the lab." At this school, when equipment malfunctioned, the CRE Help Desk usually resolved it in two to three days. The biggest complaints about the Help Desk were heard at School D, whose lab contained 20 computers: requests were backlogged or never resolved and there was a "bureaucratic" approach in which nothing was done unless it was "asked for." Like School A, School B had a laboratory with only 10 computers, which vary greatly, since some are quite old. Even so, its lab received much more use than the larger ones of Schools C and D. However, its equipment required constant repair because it was very outdated. On the other hand, according to the teacher responsible for the lab, maintenance was done quickly because it was "easy to get spare parts."

In the focus groups, the comment was made that machines were often cannibalized for spare parts, mainly due to the age of some of the equipment. Although the computers in the four laboratories that were visited were all in working order, the survey revealed that in 19% of schools, less than half of the computers worked consistently. One teacher responsible for the reading room at an "Education for Work" center stated that the center's laboratory used to be "hopping," but that, over time, the machines stopped working as their warranties expired; currently, the center has only four working computers and no Internet access. She stated that this was "very discouraging," especially for science teachers, who used the laboratory frequently to work on projects with their students.

The differences among schools begin with the source of the equipment: federal (from the *ProInfo* program), municipal, and the "4 + 2" project (which provided four computers for educational activities and two for administrative use). According to teachers and administrators, the amount of equipment, as well as the "municipal" part of the schools' maintenance funding, does not vary according to the number of students. Schools with 1,200 students have the same resources for computing purposes as schools with fewer than 200 students. One principal summed up the situation in the following way:

[20] The CREs are responsible for curricular decisions and administrative and financial oversight of the schools located in each region. The city of Rio de Janeiro is divided into 10 regional offices. Among CRE responsibilities is providing computer support to schools.

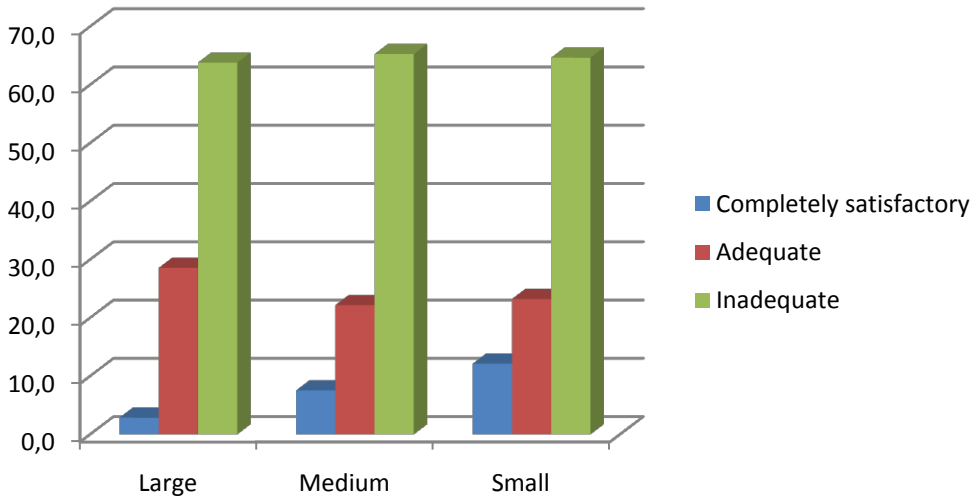
> Federal funding depends on the number of students, but municipal funding doesn't: with those eight thousand, her school might sparkle, but mine won't, because I have to clean the water tank, fix the bathroom, install equipment for deaf students – and all this has to come out of the same budget as the eight hundred reais for computers.

The perception that larger schools lack sufficient resources for information technology goes beyond the issue of funding, however. Laboratories with 10 computers were the norm in 50% to 60% of schools, regardless of size, and many teachers underscored the difficulty of working with classes of "40 or more students" in a laboratory with only 10 computers. In one teacher's opinion, however, the number of students is not the problem. The problem is that teachers are trained to use certain tools, but not to use information technology and the Internet as a way to make their classes more "dynamic." In addition, they are faced with yet another problem: if laboratory rooms were somewhat larger, it would be possible to "set up workstations of four students working cooperatively," but some laboratories are mere "hallways" with barely enough room for one person sitting in front of a computer.

Due to this combination of factors, only 7% of teachers considered their school's resources "completely satisfactory." For 24% these resources were merely adequate, and for 65% they were inadequate. School size tends to have a somewhat greater influence in this regard. Although the proportion of teachers who chose "inadequate" is roughly the same, there were more teachers in small schools who considered their computer labs to be completely satisfactory for their teaching needs (Figure 9).[21]

Figure 9

Teacher Opinion regarding School IT Resources



[21]Similarly, full satisfaction was greater among T2 teachers than T1 (9% vs. 4%).

In point of fact, the foremost shortcoming, indicated by 73% of respondents, was the amount of equipment, although other factors, related to human resources, also stood out: the lack of a laboratory supervisor (61%) or of teacher training (60%), for example. Additional factors that were mentioned included poor connectivity (51%), lack of money for peripherals (32%), and lack of maintenance (25%). Large schools registered the highest level of complaint regarding lack of maintenance (36%), obsolete equipment (22%), and lack of money for peripherals (43%).

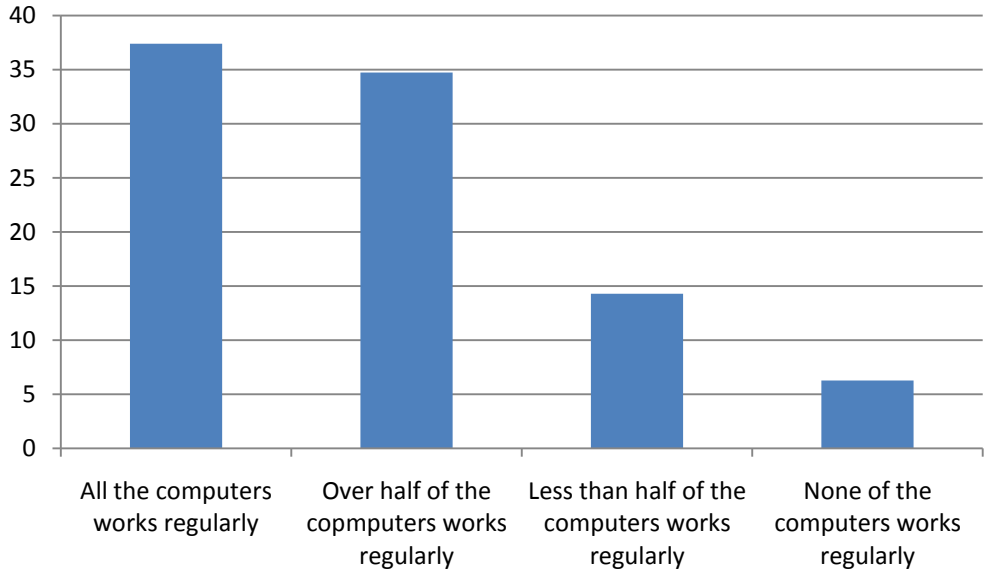
All available computers worked regularly in only half of the laboratories (51%); in another 30%, more than half of the equipment worked regularly; and in 19%, none or less than half of the computers worked adequately. Regarding Internet access, 18% of teachers stated that their laboratories did not have access to the Internet; 30% responded that access was limited; and 50% indicated full access. However, when we attempted to specify what kind of limitation the teachers were referring to, it became clear that they had interpreted the question differently: for 43%, it was a matter of a "slow or unstable connection," whereas for 45% it concerned restricted access to certain sites.

Teachers' Use of Laboratories

Among teachers whose schools have labs, 53% never used them, whereas 12.5% did so weekly. As would be expected, much depends on computer lab operating conditions. When a majority of equipment was in good working order, 35% of teachers tended to use the lab at least once a month. When conditions were less reliable, frequent use did not exceed 15%, as shown in Figure 10.

Figure 10

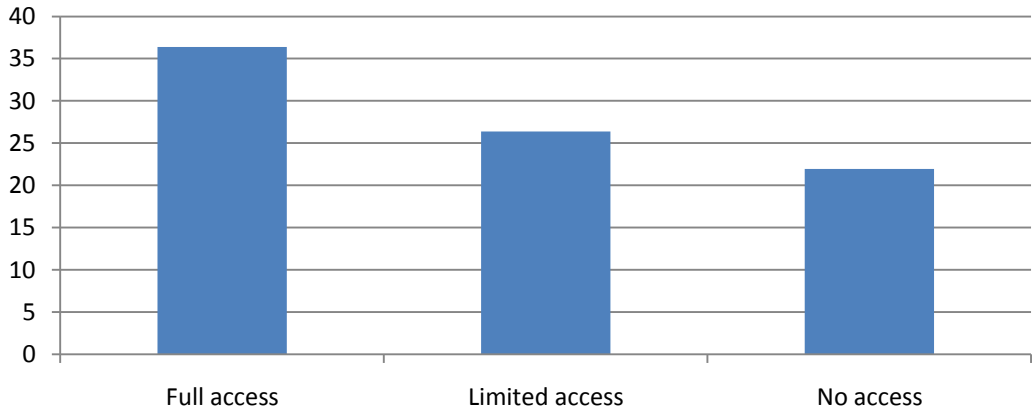
Teachers Who Use the Lab Once a Month or More, by Operating Conditions



Furthermore, Figure 11 shows that the better its Internet connection, the more teachers made use of the laboratory.

Figure 11

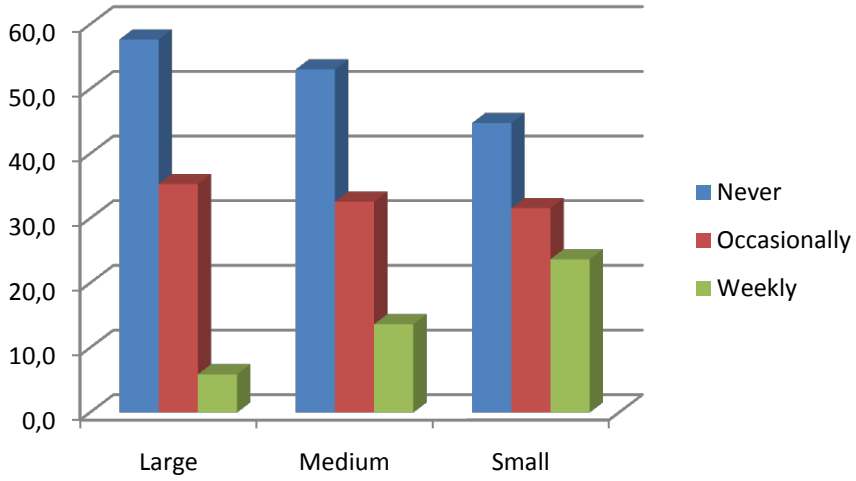
Frequency of Lab Use (Once a Month or More), by Internet Access



School size also has an impact on frequency of use: the larger the school, the less often teachers use its lab; the smaller the school, the more likely they are to use it on a weekly basis (Figure 12).

Figure 12

Teachers' Use of Laboratories (by School Size)



Similarly, more T2 teachers (responsible for the first segment of elementary school) than T1 teachers used the computer lab on a regular basis: 39% vs. 18%. At the same time, when correlating teacher characteristics and frequency of lab use, proficiency in using the Internet and participation in training courses have a real impact: they are more significant, for example, than the simple ability

to use software tools (word processing, creating tables) and the size of the school in which the teacher works (as shown in Table 3):

Table 3

Correlation between Teacher Characteristics and Frequency of Lab Use (Once a Month or More)

	Beta	Sig.
Constant		0.214
• Participation in computer training courses offered by the Municipal Secretariat of Education	0.1256	0.006
• School size	-0.008	0.857
• Activities that are usually performed online	0.1657	0.005
• Tasks that are performed regularly, or that are able to be performed	-0.039	0.505

F = 4.874

Although labs are more likely to see intensive use in small schools, the interest level of a particular teacher is determined by his or his Internet proficiency or by having participated in a training course offered by the secretariat. In this regard, training programs may have helped empower certain teachers, in particular T2 teachers, providing them with knowledge of the local tools that would allow them to use the laboratory, even when not connected to the Internet.[22]

Regarding the activities that teachers assigned their students, the most common was composition (67.6%).[23] Guided study and exercises were also common (53.4%). Graphic design and research/reading activities also stood out, assigned by 20% of teachers. It is no surprise that 15% of teachers assigned activities involving the creation of newspapers and magazines, but it is surprising that 12% encouraged the creation of cartoons.[24] In the four schools that were observed, the primary lab activity was "Internet research."

Among the four schools that were observed, School A was the one that used its laboratory most intensively. The teacher in charge was present at the school three times a week, during both shifts, but the entire weekly schedule was covered by monitors, who were mostly upper-level

[22] For this reason, the most frequent lab users (once or more per month), second to computing instructors, were those with an educational degree (28.6%).

[23] At School D, where there was no Internet connection and the lab was rarely used, this was the only activity that teachers occasionally performed with students.

[24] This could be a skill to be developed as part of continuing education programs in educational computing. One teacher who participated in the focus group completed a specialization in "computing applied to education" and works with animation at an Education for Work center.

students. Both the teacher and the student monitors had the skill and knowledge to handle the programs and resources available in the lab (including processing and editing photos and multimedia files).

Because the laboratory had only 10 computers, average use during class time consisted of two to three students per computer. In most cases, the student seen as being the most "skilled" controlled the mouse, but everyone participated. During the observation period, the laboratory was used primarily for Portuguese, English, history, and geography, although it was also observed being used for math and art. The following lab assignments were observed: searching for expressions in English (English); searching Google Earth to find specific locations (geography); using Excel to solve math problems, create tables, and insert functions (math); searching for images to illustrate a newspaper (art). During class time, teachers supervised students' computer use in order to keep them on task. Activities that were off-limits included MSN and Skype.

At this school, students were allowed to use the lab during "free time" (when it had not been reserved for a class) under the supervision of monitors. They were able to use the Internet freely, and the monitors never attempted to censor their peers, although filters had been installed to restrict access to certain sites (pornography and pedophilia, according to the teacher in charge of the lab). During free time, there were always computers available, and they were used by teachers and staff in addition to students, whether for personal use or for teaching purposes (research, for example). During recess, however, the laboratory remained closed.

Although School C had twice as many computers and much more in terms of resources than School A, its laboratory was rarely used. Nothing resembling a regular schedule had been posted, either inside or outside the laboratory. Because the school lacked a teacher to oversee the reading room, attending to the computer lab was claimed to be unfeasible. According to reports, this school had been a "model" in adopting the use of computers, with monitors who were capable of developing multimedia products.[25] The lab was not allowed to be used during "free time," since there were no monitors (once again, because of the lack of a teacher responsible for "supervising" them). The lab's only regular activity was an Internet research project involving the centenary of the school's patron.

[25] One young teacher who had specialized in educational computing and had worked as a laboratory coordinator provided the researcher with a description of this "golden age." Supervising students to serve as monitors and organizing practical workshops, she had succeeded in forming teams of student-monitors who not only "took care of the lab, but answered questions and passed what they had learned on to other students." Coming to the school from the private sector, she had invited employees from her former company to lead workshops in robotics and animation – "incredible experiences" in her words. "The students were so excited about the animation that they decided to do something similar in class." This "something similar" was what guided the production of three animated documentaries sent to the Anima Mundi Festival in 2007 and 2008. "The students were able to edit voice, sound, photos, videos." As she put it, the school was training excellent student-monitors who, in turn, would go on to win prizes in competitions promoted on the Web. Once, "a student who had worked on the animation project, before a microphone and audience during an awards ceremony, just like a grownup, put his hand on his heart and said that before, when he was younger, he used to be in awe of what he saw on TV; but now he himself was doing it. . . ." These students would also teach younger students what they had learned: "It was very exciting to see an older student teaching a much younger child how to use the multimedia editing software. And everyone got along!"

The sum of its activity was limited to the use of search engines. At this school, in addition to the filters mentioned previously, access to MSN, Orkut, and "sites showing dead people" was also restricted.

At School D, the laboratory was equally large (20 computers in perfect working condition) and equally unused. In this case, the alleged reason was the lack of an Internet connection, since the school had a teacher to oversee the reading room and computer lab. Without the Internet, the school's teachers felt little incentive to use the lab, and they rarely used the available software for any kind of activity. The school's educational coordinator commented that the teachers were unaware of alternative games and programs for offline use and that this contributed to the lab's present state. As in School C, School D did not maintain a visible schedule for lab use, even though teachers were expected to schedule their use of the lab ahead of time. The laboratory also lacked student-monitors.

In School B, lab use was somewhat more frequent, but still subject to long periods of downtime. During the week of observation, for instance, there were no teachers who used the lab for their subjects, but the teacher in charge of the reading room was working on two projects with students ("Year of France in Brazil" and "Swine Flu"). Because there were only 10 computers available, the lab supervisor, who was only present during three shifts per week, had to split the classes whenever a teacher wished to use the lab with his or her students. Half the students remained with their teacher in the classroom, while the other half worked on the lab assignment under the supervision of the lab instructor. According to her, the laboratory was used most for the subjects of science, history, geography, and Portuguese. The predominant activity consisted of Internet research. This school also lacked monitors. However, when the lab instructor was not present, the lab remained accessible to any teacher who requested the key. Unlike the other three schools, students were permitted to stay in the lab unattended once it had been opened. In practice, there were no restrictions on the use of communication tools or access to games and social networks.[26]

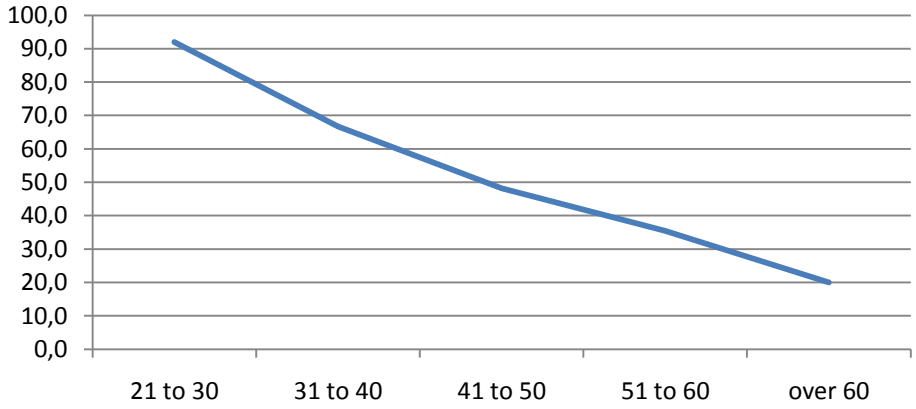
Across the schools, one of the most widespread restrictions seemed to be that students were not permitted to print their work. In the administrators' group, many were in favor of students copying the results of their Internet research by hand because that way they would absorb something (rather than simply cutting and pasting). In School A, prior teacher authorization was required before anything could be printed. The teacher responsible for the reading room put it this way: "It's impossible to check the *authenticity* of their work, but the requirement of writing it out by hand really helps to make sure they grasp what they've been taught." The same restriction occurred at School C. At School A, it was unclear how students stored their work (if they did so) because flash drives, disks, or CDs were not available. At School C, some students were in the habit of sending a copy of their work to their own email as a way to save it. At School B, where lab use was more open, students had subfolders on the computers for saving their work.

[26] This kind of use tended to occur during off-shifts and, as in other schools, it never took place during recess.

According to the survey responses, the teacher who assigned the work was the one who provided students with the most support as they finished it (53%).[27] Support coming from other teachers was notable (38%), but only in 8% of cases were students supported by peer monitors. In this regard, teacher age is once again the determining factor. Figure 13 shows that the younger the teacher, the greater the likelihood that he or she will be the one to support his or her students as they work with computers. Training received by older teachers does not have an impact in this regard.

Figure 13

Percentage of Teachers Who Assist Students in Computer Use (by Age)



This "other teacher" helping the student tended to be, as was observed at School B, the one in charge of the reading room, who, according to colleagues, was "overburdened." The position is generally filled by a teacher with a 16-hour workload, unable to spend the whole day at school.[28] In addition, this teacher ends up filling in as a substitute teacher whenever the need arises. According to one principal, the reading-room teacher "has to catalog all the books; keep the reading room and computer lab open, making sure everyone is reading; develop the reading incentive program; develop the computer program; and substituting for absent teachers." At some schools, the lab is next to the reading room, and the supervising teacher is able to oversee both of them closely, but at others the two may be located on separate floors. According to the teachers who participated in the focus groups, this is used as a justification for keeping the laboratories "basically closed," or greatly underused, as observed at School C. Both focus groups viewed the merger of reading room and computer lab as unfeasible, since to make matters worse, the teacher in charge often lacks the necessary qualifications. This seemed to be the case at School D, where the teacher in charge devoted almost all her time to the reading room and kept the laboratory virtually closed. Although this teacher was familiar with several educational applications, it was clear that, as a computer user, she had little real knowledge of basic programs and processes.

[27] After those teachers who have computing degrees, mathematics teachers are the ones most likely to assume this role (67%).

[28] To keep the reading room open every day during both shifts, it would take three teachers.

Some teachers used the expression "there's the key" to describe the conditions under which lab access was permitted, although this was not true in practice, since the principal had made it difficult to "release" said key. The administrators' group also agreed that there were those who "would not release" the key, but none of the participants stated that they were among them (although not everyone denied it categorically). One principal summed up the situation by providing a clarifying explanation of the key policy. Any teacher who wishes to use the lab may have the key if they have scheduled a time beforehand: "Everyone knows that the lab key is hanging there; the teacher just schedules a time and gets the key." During free time at her school, if no teacher is scheduled to use the lab, only monitors may use it.

To emphasize the risk of leaving the laboratory open without a teacher to supervise it, one principal stated that "even the mouse balls have been stolen before." Another principal added that even while she was present in the lab, "they opened the cabinet" and stole the software installation CDs. The vast majority of principals argued that monitors could not be left alone with other students because they did not have "that type of training." One principal reported that at his school, the monitors had been threatened by their peers and forced to turn a "blind eye." Because of this, he banned lab use during recess.

Both teachers and principals stated that in large schools lab use tended to be more closely controlled. In small schools with fewer than 300 students, labs are supervised by student monitors and can even be used during recess. Other schools do not allow lab use during recess – because demand would be too great – but do allow it during "downtime" (that is, when a teacher is absent). Principals at small schools, whose policies are more lenient, stated that their laboratories had never been stolen from.

Several principals insisted that students needed to recognize that the lab was "not an Internet cafe." How could they allow the use of Orkut, for example, if it explicitly states "that you have to be at least 18?" asked one principal.[29] For her, students think that "the Internet is only MSN and Orkut." Everyone agreed that it was wonderful when students perceived the research value of the Internet. Yet there are no specific classes that teach "how to do Internet research."

School Internet Use

Although "Internet research" was the primary activity carried out in the laboratories observed during the research period, the comment was made in the administrators' group that only a small percentage of teachers actually use the Internet for research. For the majority of teachers, just as for students, the Internet is equivalent to MSN and Orkut. One principal mentioned that out of a

[29] At two of the schools whose laboratories were observed, students were allowed to access Orkut, despite having "filters" that restricted access to certain sites.

teaching staff of 37, four to six would actually be able to guide students in their research. At the same time, 72% of teachers who answered the survey stated that they used the Internet when planning their lessons.

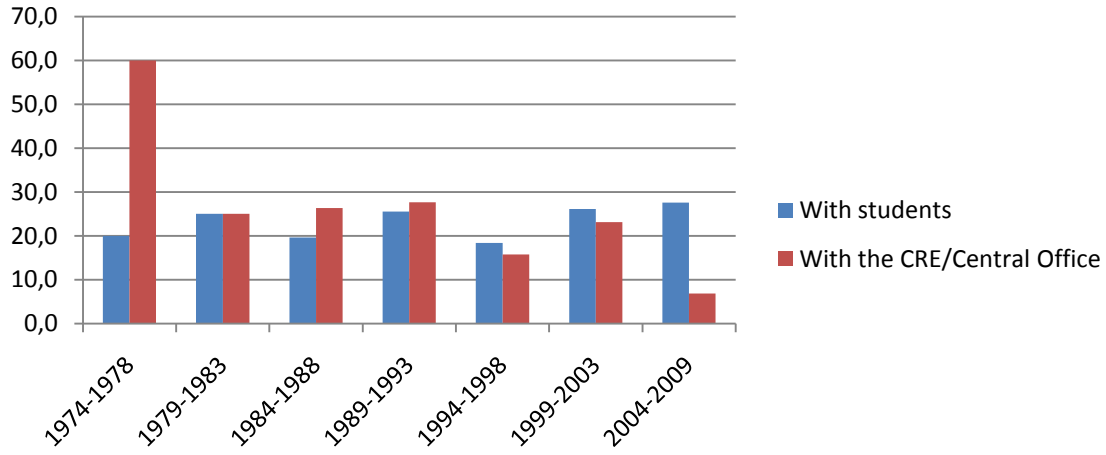
Despite its heavy use as part of their personal lives, teachers are less likely to use the Internet in professional communication: 74.5% of teachers used the Internet to keep in touch with fellow teachers, but contact was much more limited with their school's principal and/or coordinator (37.5%) or with the central office/CRE (23%). The predominance of the Internet as a tool for horizontal communication also limits its use between teachers and students, cited by only 23% of respondents.

There is a slight tendency for younger teachers to make more use of the Internet as a means of communicating with colleagues and students, although hierarchical thinking (in which "seniority rules") seems to outweigh this characteristic. For example, Figure 14 compares, by year of entry, teachers' level of contact with students, Regional Education Offices (CREs), and the central office of the secretariat.

Figure 14

Teachers' Internet Use for Professional Communication

(by Year of Entry into the SME)



When we look at the group of teachers as a whole, including those whose schools do not have a computer lab, we see that 30% frequently assigned their students exercises that required the use of computers; 40% also did so, though less frequently; and only 30% never did so.[30] The vast majority of teachers also stated that they assigned their students exercises that required Internet access (66.3%). In doing so, 71% of teachers suggested sites for students to use when completing these assignments. The most frequently recommended site, as expected, was not a site with content,

[30] This contrasts, for example, with the use of video, which has been adopted by virtually all teachers (92% stated that they used videos or DVDs for educational purposes).

but a search engine, Google (51%); in second place were sites for general searching and research (19%), followed by "educational sites" (13,2%). When asked whether they knew of websites that were helpful for "educational activities, providing exercises, educational tools, or student activities," responses tended to vary somewhat more, with first place going to "educational sites" (26%), followed by sites for general research (19%) and Google (12%). Sites such as Nova Escola (New School) or Clube do Professor (Teachers' Club) and "children's channels" (such as Smart Kids, Discovery Kids, etc.) were mentioned in the range of only 8% to 10%.

In the focus group, one teacher mentioned that she used a site hosted by the Federal University of Rio Grande do Sul (UFRGS), which offers puzzles for tutoring students with learning disabilities in reading and writing (during remedial sessions outside of regular class time). She remarked that some teachers disapproved of the idea, but she argued that when they used these games, students were "reading and writing." One teacher stated that what students "see outside of school is much more interesting," commenting that he asks himself why students can learn to sing funk songs like "Eguinha Pocotó" but not "learn to write [the word] 'ball.'"

6. Teachers' Opinions regarding the Internet and Education

When responding to the survey, teachers were invited to rank the importance of certain topics related to the Internet. All told, 97% of teachers viewed the risks posed by the Internet for children and adolescents as being a "very important" issue; virtually the same percentage (94%) gave the same rating to the Internet's use for educational purposes. The issue of copyright on the Internet was seen as very important for a significant, albeit smaller, number of teachers (80%). Teachers had received frequent information regarding the possible pedagogical uses of the Internet, whether from the school principal's or coordinator's office or from the Municipal Secretariat: 70% of teachers recalled receiving information about on the topic. Regarding Internet "risks," however, only 26% recalled receiving guidance about them. On the issue of "copyright," a meager 4% claimed to have received any information.

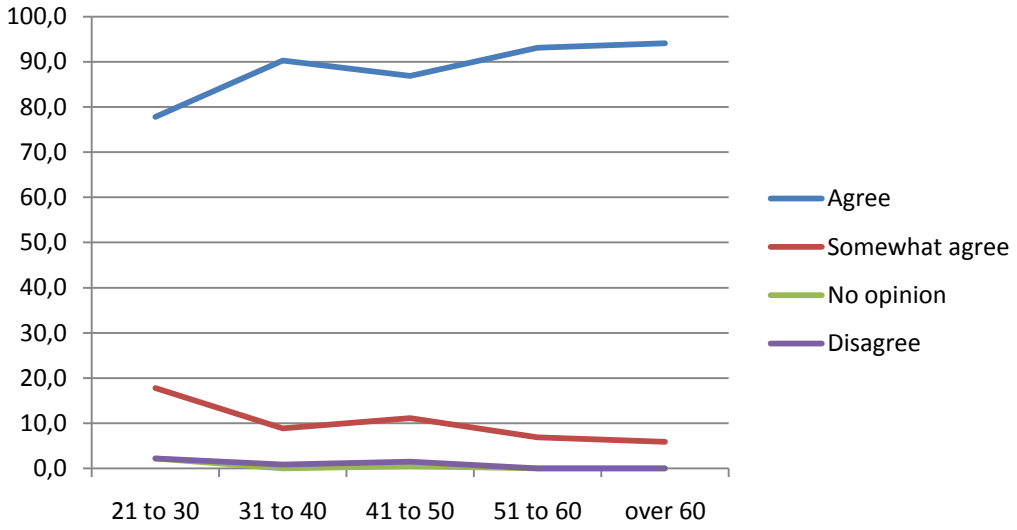
A high degree of consensus among teachers can also be observed regarding other issues:

a) 88% agreed that learning how to become proficient computer and Internet users should be part of the school curriculum. But beneath this apparent unanimity lies a certain divergence. Younger teachers tended to embrace the idea somewhat less than their older peers, in what is likely a sign of the "naturalization" of these resources in their daily lives, as shown in Figure 15.

Figure 15

"Learning how to use computers and the Internet should be part of the school curriculum."

(Agreement by Age Group)



b) and 84% agreed that students' Internet use at school should be controlled in light of the risks to which they are exposed online.

Presence or Absence of a Specialized Teacher at Each School

With respect to an issue that was debated intensely in the focus groups, 85% agreed with the idea that if there were an educational computing specialist at each school, teachers would adopt this resource more quickly. At the same time, when presented with the opposite view – that having this kind of specialist at school would lead the majority of teachers to no longer concern themselves with learning how to use technology – only 70% disagreed.

The debate around this issue is driven by teachers who have had experience with the state school system, which has a position for a teacher who provides support and guidance to others in the use of information technology, referred to as the Technological Advisor (Orientador Tecnológico – OT). One of the OT teachers, who works in the city in another position, stated that this is a "watershed" between the two systems: "The municipal system believes that it's enough to set up a computer, while the state system believes that you need to have an intermediary." Another OT teacher, however, praised the municipal approach, which opts to train teachers so that each of them can become qualified to use information technology.

For the last 10 years, one teacher commented, the city has insisted that there is no need for someone to serve as a "catalyzer," but she disagreed: it is not a matter of "catalyzing," but of having someone who can lead the process of bringing IT to the school, directly assisting the other teachers. Another teacher in the group used the word "manager" to define this position. This position would

involve managing the process of bringing IT to the school as a whole, in the context of an educational program. The task could be assigned to the school's educational coordinator if he or she has "adopted" these media, but this is not what usually happens.

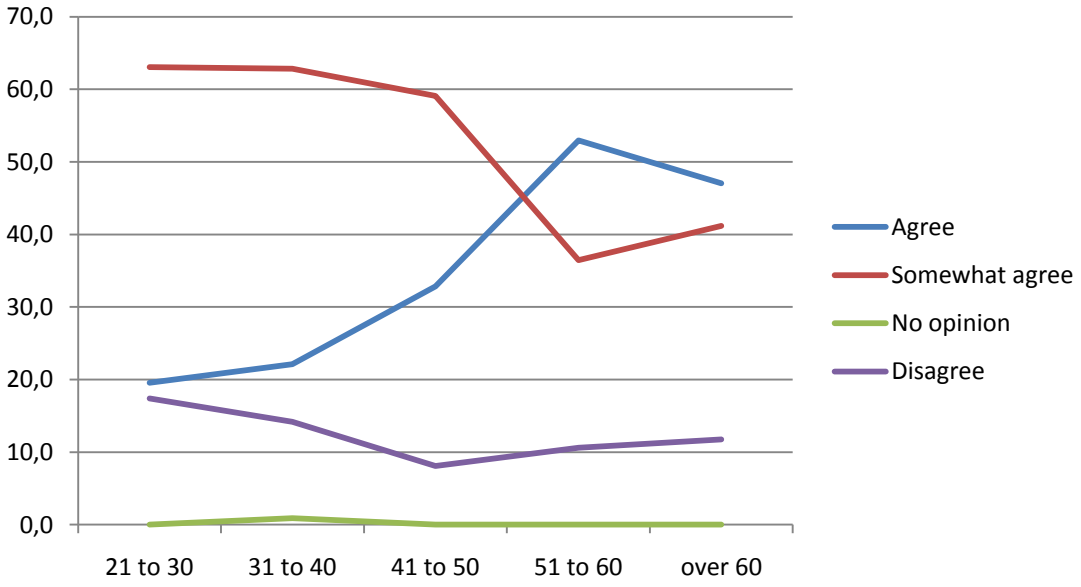
At the same time, one teacher argued that if the OT position had made such a great difference, the state network would be better off than that of the city, which according to him was not the case. The majority of the group, however, affirmed that as long as a school lacked a "computer instructor," real ownership of information technology was not going to occur. This was also the prevailing opinion among the administrators' group.

Does a school's adoption of new media depend on the ***motivation level of its teachers?***

The statement that "a school's adoption of new media depends, above all, on the motivation level of its teachers" was not as unanimously supported. Teachers tended to agree "somewhat" with this assertion (56%), while 33% strongly agreed and 11% disagreed. Interestingly, agreement among teachers increased with age, as shown in Figure 16 – which may be the result of older teachers' long "experience" in the school system.

Figure 16

"A school's adoption of new media depends, above all, on the motivation level of its teachers."



In the groups, a "paradigm crisis" was spoken of, since many teachers still believe in "traditional methods." This tendency was seen as "historical" in nature. In this view, the system has always struggled to adopt new media/technologies (the same thing occurred with overhead projectors and video). The "burden" of this shortcoming tends to fall on teachers – as they themselves protest – because of their supposed conformity or conservatism. One longtime teacher –

who began teaching in 1973 – stated that this view dated back to "the Brizola years" (Brizola was governor of Rio de Janeiro from 1982 to 1986 and 1990 to 1994), when teachers were accused of being "barriers to social transformation."

In fact, some argue, there are simply no good programs or policies in place for "new media" adoption, nor have investments been made in universal training. One teacher, however, maintained that "it's impossible to ignore" the lack of willingness shown by many colleagues. In the end, it was more or less agreed that IT adoption depends on a teacher's personal desire to learn to use technology. Whether or not a teacher prefers to maintain the "status quo" ends up being a "personal matter."[31]

But there are also teachers who point to the student's role: it is one thing to work with "projects" or Education for Work centers, where students are "interested," but it is another thing to teach regular classes, which are very heterogeneous, with students who attend because of the "Bolsa Família" program, or who do not even know why they are there. One teacher who works at an Education for Work center objected, stating that her experience had not been any easier, since her students were not "captives" and must still be "won over" from class to class – forcing teachers to be more innovative.

Despite these differences, the consensus was that schools were "overburdened." Further difficulties stem from how schools are "managed," "administered," and operated (in terms of time and space): the same practices have been in place for decades, standing in the way of change.[32] One teacher pointed to the curriculum as an example. Students are encouraged to use new media and the Internet, but the curriculum, which defines what students should or should not learn is not affected by this: "Here we are in the twenty-first century, able to use the most amazing technologies," which permit "the production of knowledge," but students are still not "able to interact in terms of the curriculum, to raise questions that might spark some kind of interest or curiosity for them." Students are still seen as "unable to think for themselves."

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[31] One teacher in the group complained that she was viewed as a "dinosaur" because she writes information on the board for students to copy. She was incensed that asking students to "copy" from the board was no longer seen as acceptable. She stated, "The day will come when students won't even be allowed to pick up a pen," commenting that she encounters students who make it to the sixth grade without knowing how to copy something from the board in their notebook. Accordingly, she argued that computers were by no means the "savior."

[32] One teacher summed up what it meant to be overburdened, on top of the secretariat's constant policy changes. The school as an institution has taken on countless responsibilities, including "hospital, psychologist, prison guard (because there are principals who want students to stay there in the classroom and forget about it... And then there's the mother who doesn't check the student's notebook, or else you call the mother to discuss the situation and she says, 'I don't know what to do with him.' A nine-year-old child and she doesn't know what to do, so then I'm supposed to know? And then there's the twelve-year-old who is pregnant, and when I ask her, 'But, angel, with so much going on out there, condoms, you know...' 'Yeah, but at least I'll have something that belongs to me.' Because she doesn't have a bedroom, she doesn't have a baby doll, she doesn't have anything, so she decides to have a baby. 'The baby is mine, all mine.' It's insane! And there I am trying to teach quadratic equations. Sometimes I ask myself what I'm doing there." And when she tries to make changes or take action, the government comes along and says no: "It's insane because I work with practical knowledge that takes a long time, my subject takes time because I want the guy to learn, but I can't, because now I have to just regurgitate content."

In both groups, the consensus was that the school system was very large and diverse and that different schools faced different issues, making it difficult to implement certain policies. Teachers expressed difficulty in understanding the intentions of the Secretariat of Education – especially regarding changes in teaching methods. One of them referred to the secretariat as a "sphinx" that he kept trying to "decipher." Teachers bemoaned the fact that the "project" approach had been eliminated and that now "targets are everything." They also complained of "eternal" principals who behaved as if they owned the job. The "perpetuation" of principals runs counter to the changes that need to be made, creating a "gap" between teachers and principals. Principals, for their part, complained that each CRE maintained a different policy for computers and the Internet: one might permit Wi-Fi, for example, while another might not.[33]

Student Access to the Internet

Regarding other issues related to school Internet use, there was less agreement among teachers. Even so, 48% agreed that "students should not be permitted to make personal use of school computers," while 37% agreed only "in part" with the idea, and 13% disagreed. In the focus group, one teacher described the process of bringing the Internet to schools as "conservative modernization," since access to site such as Orkut, for example, was prohibited, a prohibition that, as we have seen, is actually ignored in some schools.

Although everyone agreed that there were risks to children and adolescents on the Internet, they acknowledged the absence of a more in-depth procedural discussion. One teacher in the group argued that the goal should not be to enforce limits but to guide and discuss students' Web use. Although Orkut is banned in the majority of schools, principals are often called to mediate problems that occur among students in the lab. Principals recounted cases of bullying, identity theft, and slander (including against teachers and coordinators).

Computers: Do Teachers Feel Inhibited in Front of Students?

When asked whether they agreed with the statement that "the majority of teachers feel inhibited in front of their students because students almost always know more than they do about the subject," a not insignificant 18% agreed, 40% somewhat agreed, and 38% disagreed. In the two focus groups, the issue also produced different opinions: some agreed, while others stated that it was a "myth." According to the latter, many students only know how to use certain communication tools and social networks, but have little or no information about other uses and applications. One coordinator cited the example of students creating profiles on Orkut without knowing that part of the process involved

[33] The question is tied to the way in which each CRE manages its budget. One might allocate funds to buy routers, while another might not.

creating an email account, or the purpose of having an email account. Administrators, with somewhat more conviction, stated that "teachers do feel insecure" in front of their students.

The Internet and Professional Communication

Another bone of contention among teachers was whether the Internet should be used to communicate with administrators and the central office: 28% agreed, 40% somewhat agreed, and 25% disagreed. Despite the Internet's intensive use for personal communication, there is still strong resistance to its "hierarchical" use, even though this resistance is apparently decreasing. In the administrators' group, the comment was made that it was easier to communicate by email with students than it was with teachers.

One principal, however, has a virtual newsletter that she regularly sends to teachers. Not all of them have email, she said, but she felt that it was important to be proactive. Another principal tried to stay in touch with her subordinates by email, but because some refused, she had to "return to the old way of communicating." Some principals complained that there were teachers who, even when they had information hand-delivered, claimed that they "didn't know anything about it": for them to admit otherwise would require some kind of signed statement.

The Secretariat of Education, for its part, uses the Internet to communicate with principals and coordinators, but it was acknowledged that there were still administrators who did not "open their email." The secretariat also maintains an intranet that contains virtually all the relevant information needed for management purposes, but in several of the Regional Education Offices (CREs), online communication does not work. According to one principal: "We also have a drop-box system, where you go to the CRE to pick it up.

> Everything that is sent by email is also sent on paper and additionally by fax. So, if something comes up and we need to respond, we have to do so in three ways. I don't even remember life before the Internet and cell phones, so I send everything by email. If you ask me a question by email, I reply by email and assume that you're going to read it. But then you get a call, and they say you never replied. So, I say that I sent it by email five seconds ago, and the person asks me to fax it and then leave a copy in the drop box. The 7th CRE has killed every tree in the world all by itself.

According to one principal, only the Computing Division managed to communicate solely by email.

Conclusions

For the most optimistic observers, the use of new technologies has enabled new forms of teaching that value the skills and individual learning pace of each student, as well as innovative forms of collaborative work that can bring colleagues together across space and time. Until that promise comes to full fruition, the road ahead will certainly – at least for those responsible for administering the school system – be a long one. This study can help identify the pitfalls to avoid along the way and can help put aside false obstacles, many of which have been evoked repeatedly to "explain" the difficulty schools have experienced in incorporating new media, especially computers.

First of all, it bears pointing out that we are no longer in a time when it can be said that elementary school teachers and computers are foreign to each other. Contrary to conventional thinking (given the age profile of the group and its overwhelmingly female majority), Rio's school teachers appear to be relatively familiar with the use of computers and the Internet. At the same time, and this is precisely the point of greatest interest, familiarity does not immediately translate into regular use and/or systematic adoption of educational computing in the schools, much less efficient use of the medium for professional communication, whether with students, superintendents, or administrative superiors.

School computer labs have been present for the last 10 years, but have not yet reached the entire city school system. From the perspectives voiced by the teachers and administrators who participated in our research, we can see that the most significant variables for determining daily use, aside from the issue of available content and appropriate teaching methods, are Internet access, equipment maintenance, and the presence of a teacher who is "responsible" for the lab. If this teacher is not able to manage the school's adoption of these resources (as an "educational computing specialist"), he or she should at least tend to the lab room, keeping it open to those who wish to use it and assisting his or her colleagues in the activities carried out there.[34] The absence of one of these three factors tends to condemn the lab to disuse. The dissatisfaction of the vast majority of teachers regarding available resources (the motives of which also include the amount of equipment and the size of the lab rooms) reflects the difficulty faced by educational authorities in trying to balance these factors.

These shortcomings affect the whole school system, but it is because of them that the comparative advantages of small schools come to the forefront. Contrary to what would be a simple correlation between supply and demand, which would lead large schools (with more teachers and students) to use their laboratories more intensively, our research show that the opposite occurs.

[34] The ability to fill this role, and the level of computing skill and motivation of the person who fills it, depends on having a trained group of monitors. Because the work schedule of lab instructors is part time, labs can be kept open every day during both shifts only with the help of trained monitors (with few exceptions).

Frequency of use and the proper functioning of lab equipment depend first and foremost on variables such as the ability to facilitate oversight and appropriate behavior, characteristic of small schools.

In spite of structural problems, however, some transformations are underway. Still, it is unclear just how much this is the result of implementing a particular policy or whether it is an inertial, or even "natural," process. In fact, our research indicates that the younger a teacher, the greater his or her mastery of basic computing tools, the more skilled he or she is in using the Internet, and the more likely to directly assist his or her students in computer-related activities. This tendency suggests that, left to follow its "natural" course, the adoption of these resources will occur in accordance with the pace – be it fast or slow – of the generational turnover of school teaching staff. If we take the position that the great expansion of public education, in terms of the primary level, has already happened (as reflected by the age profile of teachers), the tendency is that the process of renewal will occur slowly, compromising the full adoption of these resources in the short term.

The "real" incorporation of information technology in the teaching process – that is, the actual state of things in the Rio school system – is clearly linked to yet another element, beyond the influx of younger teachers: namely, the Internet itself. Our research points to the clear centrality of the Internet in the current context: laboratories with a quality Internet connection see greater use, and Internet research is the most frequent lab activity (and practically the only one assigned by teachers who do not use the lab). Teachers who have more Internet-related skills are the ones who use the lab most frequently. Lastly, but no less importantly, teachers who access the Internet on a daily basis are also the ones most likely to use school computers for this purpose (and, ergo, most likely to strive for satisfactory levels of access, in terms of both connectivity and equipment conditions).

Finally, it seems clear that incorporating computer use into school curricula, in a broader sense, is different from using computers with the specific goal of remedial learning in mind, with tools created specifically for that purpose. While the former may contribute, at worst, to spreading a "culture" in which computers and the Internet become inseparable from everyday experience, the latter demands specific training and information. There is no evidence that these two dynamics, which are complementary in theory, can work together in actuality. In this regard, our research shows that the teacher training carried out by the Secretariat of Education over the course of 10 years, although limited in scope, has played a decisive role in determining whether or not a teacher will use the school laboratory with his or her students. Nevertheless, this tendency, which helps encourage the use of labs whose Internet access is absent or precarious, seems to prevail only with respect to the early years of primary education. The higher the grade level, the more likely it is that "educational computing" will be limited to "Internet research." It was not possible to identify the reasons behind this trend in terms of the present study, although possibilities include a lack of knowledge, a lack of specific tools,

shortcomings in the way training programs have been designed, or simply a lack of faith among teachers that these resources are compatible with traditional teaching methods.

This study, like others that have been conducted in Brazil and elsewhere, suggests that there are tremendous gaps in the invisible chain that is crucial to ensuring that equipment is put to good use.[35] The technical support structure is still precarious, not to mention the lack of standardization in the systems being used. Teacher training, especially when carried out through online courses using outdated "distance learning" methods, leaves much to be desired because it does not take an individualized approach, something for which the Internet would provide ideal support and that these courses should exemplify. The commitment of school principals to introducing new technologies is uneven, but generally remote, if not hostile. Available teaching material is still limited and fragmentary.

There is certainly much to be learned from the experience of other countries, particularly those with similar characteristics. International research indicates that the effective use of new technologies requires increasing the time students spend at school, and some suggest, for example, that separate computer labs are not learning-conducive environments, leading to the creation of mobile laboratories that make it possible to transport equipment to regular classrooms where resources are scarce.

A central challenge involves those teachers, a considerable number, who see new technologies as a threat to their role as educators. Aside from conservatism and group interests, these teachers express an important concern: the redefinition of their role in a classroom where the computer (not to mention text messages sent by cellphones) "steals" students' attention. In this new technological environment, redefining the role of the teacher is a challenge that requires rethinking the role of the educator so that it maintains its relevance. A considerable number of refresher courses for teachers focus on technological issues, which although important miss the heart of the matter: the technical skills of many who were born in the digital world are ahead of those possessed by the majority of teachers.

The teacher's role continues to inhabit the realm of content and not technology. Maintaining a personal relationship with students will remain central during early schooling, but the teacher's main role will ultimately involve the ability to guide students in the critical use of material available on the Internet, helping them communicate ideas – verbally or visually – interpret information, and solve problems. These challenges include finding one's way in a world of information overload, not blindly accepting the first hits that appear on Google or Wikipedia, problematizing and critically

[35] This conclusion is echoed by one of the few systematic studies on the topic, focused on Colombia and carried out by the World Bank: Felipe Barrera-Osorio and Leigh Linden, "The Use and Misuse of Computers in Education: Evidence from a Randomized Experiment in Colombia." http://siteresources.worldbank.org/EDUCATION/Resources/278200-1099079877269/547664-1099079934475/547667-1145313958806/WPS4836_Computers_Edu_Colombia.pdf (retrieved March 5, 2011).

analyzing information, knowing how to ask questions and be wary of online content (including spam), and managing threats to privacy and personal security.

It is not only a matter of educating students about the dangers lurking on the Web, including cyberbullying and privacy issues (with an understanding of the ways in which information about one's personal life, and that of one's acquaintances, may be used in the future). These are central concerns, but they are often presented as the only issues about which students should receive guidance, reducing the role of teachers and parents to one of repression, rather than offering a broader perspective in terms of ethics[36] and citizenship[37] for the responsible use of the Web.

These issues have redefined the role of the teacher, no longer seen as controlling what each student does in the classroom or relaying knowledge that he or she alone possesses (today, any student can go online to fact-check a teacher's information and eventually question it). In his or her new role, the teacher is a Socratic figure who teaches students how to reflect and question. In this regard, new meaning should be given to information sources like Wikipedia: students should be guided to analyze the revision history of each article, where they will find disagreements about content, or to analyze examples of emails that masquerade as authentic by appealing to the reader's prejudices.

Efforts at pedagogical reinvention could be bolstered by a new class subject that would provide a "Critical Introduction to the Internet," with content continually updated for each grade level. This issue seems particularly relevant because the Internet, in every aspect of analysis, has proven to be the most important factor for incorporating computers into the curriculum of Rio's schools. The risk inherent to the current scenario lies in simply riding the "wave" – a wave driven by feedback from public opinion and the market.

The systematic introduction of computers in public education, as the federal government has outlined via the Pro-Uca program,[38] or as state and city governments have outlined, should be accompanied by capacity building for ongoing monitoring and evaluation, as well as the production and evaluation of educational tools. This process will certainly open the doors to business lobbies that operate in the area and that tend to reduce the challenge of introducing new technologies to a simple issue of creating the right software. Without a doubt, private companies have a role to play here, but there are certainly a large number of public domain products available in Brazil and abroad that could be put to use and that require an ongoing process of cataloging and evaluation. In an area where resources are insufficient, the digital transition creates allocation dilemmas that need to be foreseen. The creation of a new educational system involves huge investments, and it bears repeating that so long as there are basic shortcomings in teacher training and motivation, the

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[36] See, for example, Charles Ess, *Digital Media Ethics*. Cambridge: Polity, 2009.
[37] See, for example, Mike Ribble and Gerald Bailey's handbook, which addresses the United States: *Digital Citizenship in Schools*. Washington, DC: ISTE, 2007.
[38] http://www.uca.gov.br/institucional/

distribution of computers is a comparatively minor issue. Good intentions are not enough. If hamstrung by predetermined plans and educational goals, the positive impact of computer distribution (which will certainly exist) may be smaller than its disruptive effect. Although political motives may compel a course of action that lacks initial clarity regarding outcomes and costs, it is never too late to take responsibility and increase the level of transparency about what is being done.