MOBILE LEARNING IN BRAZIL

MANAGEMENT AND IMPLEMENTATION
OF CURRENT POLICIES AND
FUTURE PERSPECTIVES

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SÃO PAULO
2015

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ABBREVIATIONS AND ACRONYMS

3G	Third Generation mobile technology
4G	Fourth Generation mobile technology
ANATEL	Brazilian Telecommunications Agency
FNDE	National Fund for Education Development
FUNDEB	Fund for the Maintenance and Development of Basic Education and for the Appreciation of Education Professionals
IBGE	Brazilian Institute of Geography and Statistics
IDEB	Basic Education Development Index
INEP	National Institute of Studies and Research
MEC	Brazilian Ministry of Education
MiniCom	Ministry of Communications
MPOG	Ministry of Planning, Budget, and Management
NTE	Educational Technology Center(s)
OECD	Organization for Economic Co-operation and Development
PAR	Articulated Action Plan
PISA	Program for International Student Assessment
PNAD	National Household Sample Survey
ProInfo	National Educational Technology Program
SAE	Secretariat of Strategic Affairs
SETDA	State Educational Technology Directors Association
ICT	Information and Communication Technology
UNDIME	National Union of Municipal Secretaries of Education
ADSL	Asymmetric Digital Subscriber Line
CETIC	Center for Studies on Information and Communication Technologies
CONSED	National Council of Education Secretaries
EJA	Adult and Youth Education
ENEM	National High School Examination
FAPESB	Research Support Foundation of the State of Bahia
GESAC	E-Government - Citizen Services
HDI	Human Development Index
LDB	Brazilian Educational Foundations and Guidelines Law
M&A	Monitoring and Evaluation of Public Policies
PBLE	Broadband in Schools Program
PDDE	Direct Money in Schools Program
PNE	Brazilian National Education Plan

	Integrated Proinfo National Program for Continuing Education in Technology
PROUCA	One Laptop per Child Project
REA	Open Educational Resource
SEB	Department of Basic Education
SGP	Pedagogical Administration System
IT	Information Technology
TPACK	Technological Pedagogical Content Knowledge
UCA	One Laptop per Child
UNESCO	United Nations Organization for Education, Science and Culture

Identification of interviewees

After quotations, the interviewee's profile will be identified in the following manner:

Federal Government	Ministry of Education (MEC)
Administration	Secretaries or Sub-Secretaries of Education
ET	Coordinators of Educational Technology
IT	Information Technology Directors
EC	Educational Coordinators
Organizations	Non-governmental organizations and private companies
Teachers	Teachers
Middle	Middle School
High	High School

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

PART I – A STUDY OF EDUCATION

Chapter 1 – The foundations of the study

1. The concept of mobile learning

In studies and debates about technologies in education in Brazil, a focus on equipment still prevails. In regards to use, these devices have been typically seen as “accelerators of conventional education practices rather than the expression or possibility of new readings of the world, which precedes new readings of words” (SOBREIRA, 2012, p. 31), thus affirming a perception of technologies as a passive medium.

Using a different approach the UNESCO’s concept of mobile learning locates mobile technologies, associated or not with other ICTs, as a means on enabling learning at any time or place (UNESCO, 2013), an aspect highlighted by several authors that associate mobile learning to struggles against inequality, as it allows access to learning materials and information to improve the quality of life of individuals regardless of where they live, their status, or cultural considerations (ALLY, 2009).

In this sense, digital technologies, especially mobile ones, by virtue of their very ubiquity, should be regarded as drivers of a

new teaching-learning process, and not simply as a medium for supporting and reproducing established standards.

Therefore, it is not a matter of having ICTs as a means of learning, but as an integral part of it. Digital technologies do not become invisible, leaving current practices unaltered, nor take the spotlight, in a manner that undermines the importance of pedagogical practices. Digital technologies become a catalyst in the teaching-learning processes.

In the field of public policies, the shift away from the approaches of ‘school computerization’ and ‘ICTs in Education’ towards mobile learning entails a shift away from efficacy indicators -- like the implementation of the ICTs in an educational network, or the quantification of time spent by teachers with ICTs in the classroom, for example — towards a focus on indicators of effectiveness, such as the measurement of the students’ learning and their engagement based on guided and regular use of digital technologies in lessons.

Thus, in order to support public policies, we define mobile learning as the promotion of learning at any time or place through using mobile technologies appropriated by the subject of the action. To make it possible, within the context of formal education, necessitates: the availability of infrastructure, digital content, and adequately trained human resource, in combination with policies that emphasize the guided use of ICTs in schools.

Mobile learning, thus, becomes a normative concept which: a) avoids a narrow focus on devices in public policy, because it is bound to learning results; b) limits dysfunctionalities by synthetically considering the three pillars of policies: infrastructure, digital content, and trained human resources at the service of previously planned learning objectives; c) is an instrument to address inequality in the long-term since it generates ownership of digital technologies by the subjects of the initiatives; d) allows for synergies with several

current tendencies in education, that focus on pedagogical practices and curricular innovation.

2. Methodology

The purpose of this research is to analyze, from the perspective of a public policy, the current landscape of mobile learning in Brazilian public education in municipal and state school networks. Beyond building this panorama, we also sought to understand and characterize the varied teachers' relations to ICTs in schools, and their attitudes and practices towards the existing contexts of technological integration. Such information provides the basis for thinking about the future and making recommendations in terms of the existing reality with a focus on achieving even more effective public policies.

As a structure of a public policy for mobile learning, were considered, in addition to the policy dimension, three fundamental pillars: infrastructure, digital content and human resources for the use of ICTs in school.

2.1. Method and scope of the research

For this qualitative study, more than 160 hours of primary data were registered, collected by means of in-depth semi-structured interviews and focus groups with the participation of actors involved with ICTs in Brazilian public education, in different positions and functions, belonging to all five Brazilian regions. Interviewees selected included decision makers in the federal and local governments, including education secretaries, pedagogical managers, IT and education technology managers, teachers, and representatives of companies and social organizations.

Visits to and observations in 24 municipal and state schools that are part of the educational networks studied were also carried out, focusing on the organization of the school units regarding technologies and engagement of school staff with technological devices and

facilities available at the schools. In addition, to all the departments studied, an online survey was sent which included questions on general data of the school systems, focusing primarily on data related to infrastructure. The field research was carried out between July and September 2014 and the interviews and focus groups were conducted in the cities of Brasília, Curitiba, Goiânia, Manaus, Rio de Janeiro, Salvador, and São Paulo.

2.1.1. Sample

The core sample of the research are the decision makers from local governments, who seek to represent the state and municipal departments of education that have the projects involving the pedagogical use of mobile technologies, implemented or in planning, at elementary schools and high schools. The sample of decision makers from the federal government, companies and social organizations was defined based on referrals from local decision makers at the local level, bearing in mind the actions already in underway, partnerships, and contacts established through day-to-day activities. The graphs and charts detailing the sample and the research scope can be found on pages 69 to 73 of this publication.

The total number of interviews, considering all the groups targeted, was 93. In addition, 11 focus groups were carried out. The process of recruitment for the focus groups and their method of analysis are explained in Chapter 8 - The school perspective: the teachers.

Chapter 2 – The context of Brazilian basic education

In this chapter, we discuss the context of the national basic education, its institutional aspects and challenges, and initiatives aimed at Information and Communication Technologies (ICTs) in the field. For this, we focus on the National Educational Technology Program, ProInfo, presenting some available quantitative indicators that convey a sense of the current scenario, and offer a qualitative diagnosis based on theoretical frameworks that guide the analysis of this study.

1. Financing and evaluation system: the quest for quality in education

According to the Law of Directives and Foundations of the Brazilian Elementary Education (Law # 9394/1996), education is a right of every citizen and is the responsibility of the State along with the cooperation of the three levels of government: municipal, state, and federal.

Regarding the financing of education, states and municipalities are obligated to invest 25% of their revenue in education – an amount that is constitutionally defined. Through the FUNDEB (Fund for the Maintenance and Development of Basic Education and for the Appreciation of Education Professionals), the government binds part of the annual revenue of states and municipalities, and redistributes it based on the minimum value to be spent per student on elementary education (ARRETCHE, 2014).

The evaluation system of the Basic Education maintained by the Ministry of Education (MEC) is considered uniquely strong, including when compared to other countries, since it enables comparison the quality of learning of any Brazilian school, by means of a standardized Portuguese and mathematics test, weighted by the school pass rate, in all federated levels, with the results available to any citizen with access to the Internet.

Although the primary responsibilities of basic education are incumbent upon states and municipalities, the federal government has notably aimed to influence the agendas of local governments, inducing the adoption of certain public policy trajectories, through its regulatory capacity, or through its spending powers (LOTTA & VAZ, 2012; ARRETCHE, 2014).

The actions and strategies adopted have been responsible for improvements to date in the Brazilian educational system (financing mechanisms, universalization of elementary education, reduction of age-grade distortion), and are fundamental to give support to address the challenges currently faced. However, progress in

educational quality, especially in high school (see figures on page 80 and 81 of this publication), and the difficulty of the system in elevating the performance of the students at the bottom of the pyramid to better levels (BRUNS, EVANS, & LUQUE, 2012), show the need for new approaches.

The discourse of educational quality is accompanied by the demand for improved infrastructure and availability of resources in schools. In this scenario, digital technologies are often mentioned and, in the projects of new “integral” schools (i.e., full time), they are always present, including the availability of mobile devices for teachers and/or students, the installation of smart boards in classrooms, Wi-Fi in the common areas of the schools, and etc.

2. Information and communication technology (ICT) initiatives

2.1. ICT access: the Brazilian population and the school universe

The comparative study of ICT access, based on data available through IBGE (Brazilian Institute of Geography and Statistics) and CETIC.br (Centre of Excellence in Information and Communication Technologies), allows us to infer not only its gradual growth in the general population, with the acquisition of devices (cell phones, notebooks and tablets), but it also indicates that teachers are the ones with greater access to desktop computers, tablets and the Internet at home, compared to the general population and students. The students, who also have more access than the general population, represent the group that most uses the internet on cellular phones. As for the frequency of use, teachers from the public network stand out for higher daily internet use, compared to other groups.

It should be noted the high range of computerization policies in schools carried out so far, since 99% of public schools have computers, 95% have internet access and 85% state that they have computer labs (CETIC.br, 2014). The available internet speeds, however, as well as the electrical grids of more than 40% of the schools, are

still not adequate for mobile learning. This situation results in teachers and students accessing the internet outside of school, especially at home (ditto) (see charts on pages 85 and 86 of this report).

It is important to underscore that, although access to ICTs is increasing, the means through which they are being integrated into the teaching-learning process is quite open, unguided, and continues to be focused on the process (i.e., enabling ICTs to be used in teaching practices), rather than on the results (i.e., learning).

2.2. The role of the National Educational Technology Program (ProInfo) and the Educational Technology Nuclei (NTE)

ProInfo (National Educational Technology Program, a federal-level action) is principally known by local administrators for equipping schools with computers (ProInfo labs) and for facilitating the purchase of equipment for municipal and state education networks, as well as, through Integrated ProInfo (ProInfo Integrado), providing courses aimed at educators and technicians from the Basic Education networks, and providing content through the Teacher's Portal (Portal do Professor) and School TV (TV Escola). Over the past four years, ProInfo started to invest in the acquisition of mobile devices and the introduction of technologies in classrooms.

However, despite the relevance and importance of their actions and investments, our research shows that ProInfo has not been prioritizing the provision of guidelines for local administrators, while systemic and structured planning to achieve its goals has not been evident. Furthermore, discontinuities at ProInfo are common and noted by local governments, since its priorities change as directions change. This brings negative consequences, since some actions end up not having sufficient time to mature and deliver results. Added to this, is the absence of a consistent monitoring and evaluation plan as part of the development of the ProInfo initiatives.

ProInfo, facing all of the transformation caused by its own program of consistently increasing ICT access in schools, has sought to

expand their actions to involve not only fixed technologies, but also mobile ones, and not just schools, but teachers as well. The focus, however, due in part to the absence of a plan to guide its actions – there is only one decree from 2007, a very different moment than the present – continues to be on processes rather than results, and on the equipping of schools, with responsibility for the integration of equipment for pedagogical practices being in the hands of municipal and state departments.

Perhaps because the actions which have been carried out by ProInfo have had more of a technical scope than a pedagogical one, since they are more visible in financing the acquisition of equipment and technical support to help performance, and there are no programmatic directives which give support to the adoption of devices, MEC has its role reduced before the FNDE (National Fund for Education Development) in the education departments, with this pedagogical function becoming a responsibility of the departments, with support from the Educational Technology Nuclei (NTEs).

The NTEs are decentralized structures that serve as coordinating bodies of ProInfo at the local level. Their main role is to provide teacher training; however, there is an expectation that they also give pedagogical and technical support to schools, including the development of projects for the pedagogical use of ICTs, the follow-up and support of this use, and the research and dissemination of educational experiences.

However, this study shows that the majority of NTEs presents many difficulties in carrying out their functions, principally due to the lack of human resources. Their limited institutional capacities, result in the NTEs carrying out localized activities that are sparse and have limited effectiveness. This is a consequence of their lack of structure and compromised role in local policies, which can be developed without these nuclei, given the distance between the pedagogical of educational technology sectors and the NTEs within decision-making spaces regarding ICTs, in the cabinets of municipal and state departments.

2.3. Current situation of the actions from the “ICT in Education” approach

Despite the efforts made during over fifteen years, the scenario of ICT policies in the Brazilian public education are still in its initial stages of development, according to this current study.

The infrastructure, which includes the physical structure, such as the electrical grid and furnishings, connectivity and its technical support, is characterized by a restricted access for students and teachers at schools.

Digital content has been developed in a decentralized manner, with the public and private sectors operating in parallel and also together. The difficulty remains, however, in integrating ICTs in the curricula, not only in terms of competencies, but also in terms of achieving transversality of technologies within school curricula.

Although the teachers who form the human resource base of the educational departments are developing their ICT skills, they cannot count on local pedagogical support for the integration of ICTs in everyday life at school, resulting in a heterogeneous attitudes towards ICTs in their practices and, consequently, low incidence of teachers use of technologies in the teaching-learning process.

Finally, ICT policies in education are typically partial and generic, characterized by casual and experimental development, and do not integrally consider the pillars that should structure mobile learning initiatives.

This scenario does not impede the emergence of good practices in the use of digital technologies in schools in all regions of the country, through the encouragement of educational departments and also due to the personal profiles of some teachers that are more personally inclined to the pedagogical use of digital technologies, as we shall see later on; but here we draw attention to the general framework of the ICT policies in education at the moment, which, when understood, will allow more consistent actions towards the achievement of a more effective integration of technologies in schools.

PART II – MOBILE LEARNING IN BRAZIL

Chapter 3 – The political dimension and the agenda

The focus of this section is to understand how the mobile learning agenda has emerged in the country, its administrative aspects and the federative relationship involved in these actions.

There are different institutional arrangements involved in the technology initiatives of the central government together with federal agencies; some occur in direct relationship with the schools, and others go through the coordination of education departments. The acquisition of tablets in 2012 and 2013 was an action formulated by the federal government and implemented through joint efforts with the education departments.

1. The purchase of tablets for high school teachers and the importance of a plan

In recent years, mobile devices have been highlighted in the actions of ProInfo, and the choice of equipment has been occurring at the highest levels of government – which was the case in the project for distributing low-cost laptops to students (‘One Laptop per Child Project’ - UCA), with the decisions coming from the President at the time, in 2005.

In the case of tablet acquisitions, according to the interviews carried out, it was primarily the enthusiasm and the propensity of the former Minister of Education for new technologies that, starting in 2008, resulted in the mobilization of the FNDE to evaluate the market and to define possible equipment suitable for elementary, middle and high school students.

That same year, a ministerial change leads to a modification of the target audience for the use of tablets, which again shows the level

of centralization of decision-making. The target public shifted to high school teachers, instead of students. It is understood that the equipment, already ordered, is compatible with the new target audience, but amongst the technicians responsible for defining the equipment at a federal level, there were different and complementary interpretations and expectations of the use that the tablet would have when reaching teachers – the result of the lack of a clear and public definition for the expected usage of the new device in terms of educational policy.

The divergent opinions, during the development of the program, lay bare the effects that the absence of a plan can cause in the sedimentation and guidance of an objective. During implementation, the expectations of the teachers benefited, to whom the task of defining the use of equipment was delegated in the absence of a prior plan of their own departments, are added to these perceptions, giving form to a scenario with uncoordinated ideas and expectations.

2. Unaddressed pillars: content and teacher training

The federal government's procurement of tablets in 2012 proves to be emblematic: involving the acquisition of hardware. By focusing mainly on the computerization of schools, aiding the acquisition of equipment, and choosing to outline a policy that more timidly addresses the pillars of training and digital content, the federal government fulfills possible efficacy indicators, since the tablets have reached the teachers, although it does not promote advances for state and local governments to consistently achieve the effectiveness of their mobile learning initiatives and policies. Nevertheless, the federal government is a relevant actor and has great influence on the implementation framework of new devices currently in public schools.

These aspects indicate the need for some critical reflections in regards to the different impacts resulting from the means of equipment acquisition.

A very important factor is that the arrival of mobile equipment to an education network is unlikely to change its characteristics if a policy that covers all the necessary pillars of mobile learning is not formulated.

One must keep in mind that the hardware is not neutral, while the processing, storage and memory capabilities also have important implications for the use of equipment. In this sense, depending on the history and trajectory of local policies, a type of hardware may or may not be appropriate.

The action of acquiring the tablets was not complemented with guidelines for their pedagogical use, mainly leaving up to teachers in schools to define the purpose of the new equipment. Given the lack of direction and digital content that would allow for verifying the utility of devices for specific uses for which they were acquired, criticisms of all sorts have emerged, making it difficult to counter them because there is no publicly established basis for comparison of the expected purpose of the equipment.

Finally, the factors considered in defining the specifications of equipment to be purchased should be expanded. It is precisely because it is always a difficult decision to define the specifications of an electronic device with the information one has at hand, that having clear goals set for the equipment purchased, accompanied by a research involving teachers and education departments, along with studies of future scenarios on the development of ICTs, can help to ensure the best choices in the field of digital technologies.

3. Decision-making at the local level: the vision of education secretaries

3.1. The profile of administrators

Interviews show that decisions regarding investments in ICTs, or how this investment will be made, do not depend exclusively on

the personal profile and proximity to new technologies of the education secretaries themselves.

On the other hand, a personal trait that stands out, where different procedures and more programmatic actions in relation to ICTs are evident, is the administrative capacity of those in charge of the departments, and that can be characterized by: systemic vision, leadership in the design of projects including ICTs, concern with control and results-oriented vision.

These attributes, however, are not sufficient on their own, given the lack of stability in administrative positions in education. The turnover in departments demands attention from any area, including in the implementation of mobile learning programs: without a robust and strongly appropriated project by the various departments, there is always an imminent risk of discontinuity.

3.2. Factors considered to invest (or not) in ICTs

From the point of view of the factors considered to invest in ICTs, all local administrators are quite open to technology, understanding that it can improve the quality of education through the enrichment of student learning. When the propensity to invest exists, the amount invested is an important decision factor, given the size of the education networks and the fact that investments are subject to contingency on other areas. Another aspect considered by some administrators regarding investment decisions is the sense of modernity and currentness that technologies add to education and that to them is already present in private networks; and further, as already pointed out, the actions conducted by the federal government. Factors outside of the department itself are also taken into account in some networks, as windows of opportunity open through negotiations in other government areas, or even budgetary matters where equipment purchase is seen as a good action for compliance with the mandatory expenditure of 25% of the budget in education.

However, when the decision to invest exists without a clear vision of educational goals to be achieved or a planned initiative, the most common scenario is to have an action limited to hardware, which has the potential to convey to society that something is being done in this field. Within the scope of hardware distribution, and in the absence of a plan for the use of ICTs, technology enters the network from the viewpoint of valorizing teachers and rewarding students.

The result of the distribution of mobile technologies without focusing on the other pillars that constitute a mobile learning policy, digital content and teacher training, and focused, above all, on the premises of rewards or human resources policy, is that such actions cannot lead to expectations of results on student learning, since they have no direct effect on them, even though they may have positive effects on the self-esteem of beneficiaries.

Among the points raised by administrators as discouraging and limiting factors for innovations and reforms using ICTs, the following stand out: legislation, whether towards curricular regulation, or to enable more flexibility in the purchase and administration of equipment; work environments and their characteristics, which are not always amenable to changes within departments; and the absence of a national guideline program in this field.

3.3. The factors and influences that impact decisions about ICTs

In municipal and state education networks featuring or developing an ICT usage plan, it is common to observe the participation of secretaries in this framework, as well as direct participation of people from the cabinet.

The infrastructure departments, sometimes also known as information technology, herein referred to as IT, play a major and close role to the cabinet, and are even described as those in charge for suggesting pedagogical content software – which should not be

under their direct responsibility, given their technical specialization. The pedagogical departments, in most departments, have a less salient role in decision-making, mainly because of a lack of intimacy with this area, which is normally lead by the IT departments.

Most departments have specific areas focused on technology in education, often subordinated to the pedagogical department and known as educational technology. However, without the capacity to generally boost integration of the ICTs within the department, they end up realizing their own localized actions.

It is noteworthy that the departments where ICTs are more strongly valorized, as a basis for their education network, tend to have better structured educational technology sectors, with distinguished administration, which are more connected with the training centers of the education network. They also have a more direct contact with the administrators, influencing their decisions.

According to this study, for more consistent and lasting initiatives, the education technology nuclei (NTEs) and the education technology coordinating departments should have a less purposive function and more of a mediating and influencing function relative to other departments and areas of the pedagogical department. With a more purposive approach, such departments and sectors could implement ICTs in their actions and procedures. The way most NTEs currently function, trying to do “whatever is possible”, with very limited staff, the effects end up having limited repercussions.

3.4. The lack of plans to support mobile learning in the education networks and the risks of discontinuity

In the school networks studied, the plans in place to support mobile learning are recently created, which shows that, in practice, they tend to follow the arrival of equipment, giving meaning to them. The discourse of administrators without established plans end up

being limited to internationalities, and in cases where ordinances and decrees have been published, which include the objectives of new resources allocated to schools, they are general and are not a reference to network educators.

On the other hand, some school networks are developing their own plans. Especially in state networks, within efforts to create full time schools, technologies emerge as great allies in the design of projects.

Thus the deficiencies of mobile learning initiatives in public schools end up being visible, given the absence of guiding plans for the use of equipment, mainly for the teachers. These plans tend to be established after the devices arrive, but might also never be developed within the education departments, as happened in the past with the computer labs, resulting in their continued underutilization even today. In addition, the lack of monitoring of initiatives under way contributes to limiting visions of results.

On the other hand, cell phones, increasingly used by teachers and students in educational activities and everyday communication, do not appear as central tools for education administrators, who do not consider the devices already purchased by educators and students in the departments' initiatives. Regarding mobile Internet, education secretaries interviewed considered it as an alternative that complements the Wi-Fi unavailability in schools. It would be a second option, more accessible at the present moment.

Another trend observed is in the sphere of educational administration, and concerns the use of software for classroom management. In the use of mobile or non-mobile labs, this is very useful tool that makes teachers feel ahead of the procedures and in control of the students. It, therefore, ends up being highly valued as an ally in the use of ICTs in the classroom.

The use of administrative systems in education brings the experience of ICTs applied to the pedagogical area, being an important step towards improving tracking of the students' learning process and in building effective mobile learning policies.

Such trends become crucial in the light of a common feature of public administration: the administrative discontinuities that work against the institutional memory of programs - a key aspect when considering investments in equipment and training in order to make better use of initiatives implemented for the incorporation of ICTs. The scenario of potential discontinuity tends, therefore, to be exacerbated by the absence of medium- and long-term plans appropriated by educators, so that they can be carried out in the event of administrative changes.

To contribute to greater continuity in this area, given that the federal government is a funder and catalyst of equipment acquisition, it is important to consider if this level of government should also strengthen efforts to help monitoring the projects of local governments, or guide and assist the creation of plans to support comprehensive policies.

The fact is that the manner in which the initiatives have been pursued has been incomplete, omitting the important pillars of digital content, teacher training and other layers of infrastructure prior to hardware, and limiting the integration of equipment and transformation of the teaching-learning processes.

3.5. The relationship between local governments and the MEC

While the MEC is praised for the financing and the design of some policies, at the administrative level, the expectation for more guidance for local actions is also expressed, helping to position states

and municipalities in a common direction, established by the ministry based on a development project for the country.

In regards to the efficiency of policies, secretaries address the lack of communication in the actions of the ministry as a factor that tends to diminish it.

Another issue raised by local governments is the fact that federal actions are general, based on averages – leaving some of the federal units aside, including those that are the most developed in this field, and those that have a lot of special conditions.

Given the incompleteness of the results achieved in the area of digital technologies in education so far, it's necessary to rethink the relationship between the federal entities in favor of the construction of mobile learning policies that are comprehensive and long-term. Due to the MEC's privileged position, provisioning research and guiding initiatives to increase the effectiveness of municipal and state initiatives, are some of the possible roles that the ministry could play.

3.6. Perceptions of federal government tablet acquisitions

The MEC's Plano de Ações Articuladas (Articulated Action Plan) requires an plan in order to approve the funding for projects of federated entities, however, this prerogative is not only generic but tracking by the federal government is absent. This fact, associated with the lack of effective results reported to local administrators, contributes to the perception of limited federal government oversight of the tablet acquisition initiatives.

It is important to note that a minority group of administrators, by virtue of having established technology use plans within their education networks that include digital content provision and infrastructure projects, do not give great importance to the lack of direction and presence of the MEC. They view the acquisition of devices as yet another incentive for teachers to employ ICTs in their activities.

There are also those who advocate for better coordination between federal initiatives and existing local projects.

It is important to underscore that the critical perspectives of local governments have a consistency, even where tablet and notebook acquisition is done locally, without the intermediation of the federal government. Approaches that valorize the teachers and reward students' efforts, as previously mentioned, tend to prevail to the detriment of the existence of programmatic plans for equipment receipt. Therefore, this is not a problem *caused* by the federal government. New models should be established so that the different levels of government can, together, implement more structured mobile learning policies.

3.7. Administrator's perceptions of institutional partnerships with other actors

One of the trends we found in the field research conducted is the creation of partnerships with the private sector for the design and equipping of schools with ICT resources, thematic laboratories and technical courses. One of the municipalities studied had a direct partnership with the regional internet provider to increase their schools' bandwidth in exchange for sponsorship of a big event in the city.

Partnerships with companies in other technology areas are also mentioned, with the concession of software and licenses for school use. However, the necessity of contracting for products (hardware) and services (software, internet provision, maintenance) awakens insecurities of various types among administrators, particularly at the municipal level. One example is the local technical limitations to evaluate the offerings of companies.

In regards to non-governmental organizations, there are different approaches to their engagement with schools, with institutions implementing projects already designed by their teams, or designing a project in partnership with schools from previously formulated

foundations. The type of approach can influence degree of acceptance by educators – key actors for implementation.

The administrators see these partnerships as a welcome support, but, in some departments, these projects are limited to a few schools and do not play a wider structuring role.

Partnerships with businesses and third sector organizations are experiences in which there is a notable striving for transformation of the school context and the generation of contact between diverse audiences, organizations and schools. These contrasts and eventual conflicts that ensue can yield positive transformations in the long term, with potential replicability to other contexts. Among government administrators, expectations, insecurities, and, in general, positive perceptions of such partnerships prevail.

Chapter 4 – Structural aspects of implementation and management

This chapter turns to organizational aspects of education departments, the divisions or departments involved in the process of implementing and administering mobile learning policy, as well as the roles they play and the ways in which they relate to each other. Such factors have been rarely addressed in discussions and initiatives on the integration of digital technologies in education and warrant closer scrutiny from decision makers and experts in the field.

1. Fundamental requirements

A successful public policy for mobile learning requires 1) that the three supporting pillars are covered: infrastructure, digital content and teacher training; 2) the creation of a guided use plan for technologies, focusing on the curriculum and teacher practices in the

classroom; 3) that there is continuity and maturation time for the parts to take hold, both in relation to technologies and the specific project(s) created; and 4) that monitoring of the policy is conducted, in order to assess its results and correct possible trajectories. As a rule, many projects are considered flawed without having fully implemented their three pillars. Medium and long-term projects are necessary, given the high investments needed to execute them and the embryonic stage of the development of connectivity in the country.

This study shows that infrastructure projects, when existent, tend to be developed through the initiative of administrators of IT departments, with or without a pedagogical plan for the use of ICTs in the departments. Generally speaking, state departments exhibit more robust structures relevant to the issue, but their representatives point out difficulties in the convergence of administration and planning.

Experiences observed in the field that evidenced continuity, demonstrate that, the greater the capillarity of the project and its appropriation outside of the secretary's office, the greater the chances of longevity. On the other hand, in the absence of a plan created and appropriated by the education network, the constant adaptation in the face of new situations prevails, generating inconsistent policies.

2. The necessity of intersectoriality: the relationship between the IT and pedagogical areas

Technology initiatives in education with a focus on hardware are normally established through dialogue between the education secretary and the IT management. The participation of educational managers is less decisive in these cases, and, frequently, they

participate more like formal evaluators, after the decision has already been initially developed, rather than as entrepreneurs of the initiative. This is a pattern that is also replicated in the federal government, where the FNDE, responsible for technical definitions, has established itself as a major reference for the state and municipal education departments in initiatives related to the distribution of equipment from the MEC. Moving beyond a focus on hardware through implementing educational policies requires constant dialogue between the IT and the pedagogical areas, with mediation by the secretaries of education, in order to ensure a more active role of the pedagogical area in the design of action plans and the integration of technology in the school curriculum.

2.1 The IT area in ICT-focused educational projects

The most common scenario found in this study is that in which there is an initiative of the IT area in educational ICT integration projects. This occurs because of the prevalence of hardware-focused initiatives in departments, a topic in which the IT area has more dominion, or because, given the under-utilization of equipment distributed in schools, the IT areas develop initiatives that answer to ambitions to catalyze technology usage in schools. At the same time, the influence of IT managers has also had an impact on the adoption of mobile technologies in education. For all these reasons, it is essential to reflect upon the role of IT in mobile learning activities and how to leverage their knowledge and integrate it with the experiences of the pedagogical sector. New organizational models that favor this dialogue and offer paths for innovation will be propitious.

When considering the relationship between the IT and pedagogical areas, one must consider the profile of pedagogical administrators, which are not homogeneous. There are those personally committed to playing an active role in the inclusion of ICTs in their education networks and introducing innovations; and those that are more apprehensive about the use of technologies, placing them at the

service of pedagogical departments, exhibiting less leadership and more of a mediating role in prospecting for new equipment.

The structure of the IT area is equally heterogeneous and consequently, there are heterogeneous perceptions among IT administrators in municipalities and states regarding federal government infrastructure initiatives. While there is a greater reliance of the municipalities on the MEC's policies, the IT directors of the states seem to expect ministry actions to be more focused on administration, with more autonomy to execute their own initiatives.

2.1.1 Organizational design and the IT area's position

While the pedagogical sector is an "end-area" and a structural basis for the education departments, the IT sector is a "means-area" that gains increasing visibility with ICT integration policies. It is an area whose intermediation by broader departments such as planning, administration, logistics, turns out to be effective to a limited extent in the day-to-day, given the level of specialization of the field— even when, subordinate to many departments or divisions, the IT sectors are commonly accessed directly by the cabinet of secretaries.

The position in the organizational chart may affect, in any case, the scope of technology actions throughout the education network. It is important to understand the level of prioritization and the organizational and administrative models in the technology area of an education department, since these factors can influence the necessary conditions for the development of mobile learning policies.

In our study, some organizational design trends were salient: 1) centralization of planning and infrastructure purchases in a specific department of government, a tendency which encounters the challenges of lag times to accomplish tasks and communications failures resulting from having to access another government agency for ordinary and everyday actions; 2) the formation of governance committees, which implies the creation of mechanisms in order to involve different departments in discussions. The governance

committee helps in fighting the superimposition of the IT sector in the departments and efficiently involves the decision makers and other departments on the agenda of information systems and infrastructure; and, finally, 3) the most common, a department inside the education department itself, reporting directly to the secretary's office or to an intermediary administrator. The recommended caution, in this last scenario, is to have a well-defined role for IT as a means-area, and not as an end-area, that collaborates without overlapping with the pedagogical sector in education technology initiatives.

3 The protagonism of the educational area and promising results

When the pedagogical department and the NTE are proactive in seeking solutions for the integration of ICTs in their projects, dialogue with the IT area increases to quite productive proportions. The involvement of the pedagogical sector in ICT actions also tends to generate plans that approximate what may become a mobile learning policy, involving the provision of digital content and greater focus on teachers and their training. The pedagogical needs become more relevant in this case.

The experiences studied show that, without an educational sector that is empowered and sensitized to the changes that ICT can promote in the teaching-learning process and in curriculum reform, it is extremely unlikely that mobile learning initiatives will materialize.

In assessing the pedagogical department, its structure and the place of ICTs in this context, this study shows a consistent increase in the number of people dedicated to technology in the pedagogical departments of education departments, however, the most common actions are: 1) a concentration of new employees in departments responsible for educational technologies without institutionalizing their dialogue with other educational areas such as curriculum, training, and etc.; and 2) the quantitative expansion of ICT-oriented

staff, in general, but without being accompanied by an analysis of the roles of these new staff positions. The trend that can be seen is thus the amplification of specialized centers, which, as we have seen with the trajectory of the NTEs, their results may be limited due to the lack of engagement with other departments, and no certainty of continuity, since the necessary legal and organizational changes are absent.

With regard to the profiles of pedagogical administrators concerning the intimacy they have with the discussion of ICTs in education, we find two profiles: the first, more common, are those educators who feel uncomfortable with the subject, clearly exhibiting a substantive difference in comparison with the coordinators of educational technology nuclei, and their subordinates that are specialized in the subject. The second profile entails those of educators with experience in the topic, either because of their personal profiles or due to previous roles related to ICTs in their own department or in other organizations. Depending on the profile of these administrators, reflections on the role of the ICTs in education can reach different proportions.

Based on the evidence found, the construction of mobile learning policies can greatly benefit from the development of training and engagement approaches targeting educational administrators of educational departments. While the current focus of training initiatives for the integration of ICTs in education is on teachers working in the classroom, those teachers who occupy administrative positions in the departments have a potential for more comprehensive action but have not been included in these efforts.

Collaborative and immersive networks for stronger appropriation of digital technologies by these professionals can contribute to changing the intersectorial dynamics in educational networks between the pedagogical and IT areas, as well as tending to help mitigate against projects that are not firmly rooted and are ephemeral, which are currently developed by the educational technology sectors.

Chapter 5 – Infrastructure

In this chapter, we consider the scope of existing resources in the public school network in the field of infrastructure, considering basically hardware and internet connectivity, their importance, complexity and maintenance, as well as the challenges posed to their effective use as part of mobile learning policies today.

1. Visible and non-visible dimensions of infrastructure

There is no doubt about the need to focus specifically on the infrastructure of schools, since it is essential to enable the development of the other pillars of action, and imposes significant limits on the possible scope of initiatives.

Because it involves more visible devices for access (computers, laptops, tablets, 3G modems, Wi-Fi access points), and also elements of less visible layers (wiring in schools, power grid elements, cabling and antennas of municipalities and neighborhoods for receiving high-speed internet), the infrastructure is the pillar, which entails less governance by the education departments.

It is evident that while the issue of ICTs in education has gained space and has become an aspiration among administrators, the issue of the less visible infrastructure that enable technologies to function properly still lacks prioritization and room in the budget. The hardware, thus, has arrived prematurely to schools before the necessary infrastructure.

2. Infrastructure resources available in the public education networks

There are several elements that make up the infrastructure and this scenario tends to vary within the public networks.

Regarding the power grid, many school units must undergo intensive renovations, based on prior planning of the digital technologies to be implanted.

Regarding the internet, there is great heterogeneity among municipal and state departments in the different states and municipalities. The type of internet used, as well as the connection speed and the distribution of the band, by fiber optic or not—for its expansion capacity—are important aspects to be considered.

In schools, wired internet, 3G mobile internet, internet via satellite and via radio were identified. Each involves benefits and exhibits problems and challenges for improvement according to the characteristics of the states and municipalities of the education networks and the available services offered by providers in different locales.

One must also take into account the significant variation in internet speeds, not only within states and municipalities, but also within individual education networks. In the current connectivity landscape, the priority of education networks is to meet the administrative demands of schools. It is very rare to find wireless networks available for the entire school and, in the schools in which it was found, it was constantly out of order.

Thus, the evaluation of the existing connectivity in schools is inseparable from procedures that allow us to understand, among other things, its speed and distribution, whether or not wireless (Wi-Fi), its reach, frequency, and the uses of the internet. The fact that there are no complaints about the Internet speed in some educational systems, even from those most well positioned within the Brazilian context, currently at a 10 Mbps speed in schools, indicates the persistence of the low use of ICTs, rather than the attainment of ideal service for the good performance of mobile learning policies – which, according to the standards established in the United States

by the State Educational Technology Directors Association (SETDA), the speed recommended is, at least, 100Mbps for every 1,000 students and employees for the 2014-2015 biennial, and increases the recommendation to 1 Gbps considering the same quantity of users in the years 2017-2018 (FOX, WATERS, FLETCHER & LEVIN, 2012).

It is worth underscoring that the relationship of the education departments with operators is marked by demands for better services and connection speeds in the face of a limited response to requests. The scenario is one of deficient connectivity infrastructure that requires constant long-term negotiations, and, in some cases, within the context of regional monopolies in the provision of services.

Against a backdrop of many infrastructure challenges, the possibility of Wi-Fi use in the classroom of a public school is still a reality restricted to some schools units, which benefit from the availability of better quality internet.

Due to the spread of mobile devices there are increasing demands for a wireless networks in the classroom; but currently its pedagogical use is still sparse among students.

Among the types of equipment made available to schools by school networks are laboratories with desktops, tablets and notebooks, distributed to teachers and/or students, netbooks of the One Laptop per Child Project, which has been operating, in some schools, in exercises with students in the early years (from year 1 to 5) and without the use of internet, and has been reconfigured, in other education networks, from a 1:1 model to a mobile laboratory model, in order to serve more students in the same school.

It is worth noting that, when compared to tablets, notebooks arouse broader expectations of use in the departments; however, it is important to underscore that these expectations are not associated with more targeted educational programs, given that no difference was observed in the implementation of actions in relation to the specific types of hardware distributed, whether tablet or laptop.

In specific reference to tablets, the main recent initiative at federal level, the infrastructural context that surrounds the initiative to acquire these devices is very deficient in general terms, in regards to both the connectivity scenario and the characteristics of the acquired devices.

In the school contexts, ProInfo projectors were also found, which are coupled with a keyboard and Wi-Fi capacity, projectors and digital boards. Their adoption has been gradually increasing due to their resemblance to the ones used by newscasters on TV.

Finally, although students' own devices are widely used in the schools visited, we did not find structured projects of the departments that consider the students' own devices, especially smartphones.

2.1. Maintenance

Maintenance is a critical area within the sphere of educational technology policies. The maintenance model, whether centralized in the department, via an internal service team, or decentralized at educational boards or schools units, needs to be well defined and track the support calls, support time, recurrence rates, and etc. When centralized, maintenance requires much more control; however, if decentralized, mechanisms for monitoring need to be developed.

Few education networks consider the replacement of machines as a constituent part of plans for the implementation of digital technologies in education, and none had plans for the replacement of mobile devices that are being purchased for the schools. Additionally, issues related to data security and the privacy of users, teachers and students, need more extensive discussion and regulation.

In relation to the netbooks of the One Laptop per Child Program, maintenance poses a challenge, since the equipment made available for purchase, via contracting of the federal government, do

not allow replacement of spare parts and can only be handled by its manufacturer.

At this point, we reiterate the importance of thinking about organizations and periodic forums to discuss conceptual and technical models of infrastructure implementation, as well as to establish standards and references to optimize the planning time of the departments based on variables that serve everyone, such as equipment configurations and internet speed, thereby promoting joint solutions for the education sector.

Chapter 6 – Digital content

This chapter turns to trends in digital content, the experiences that have been developed by municipal and state departments, the forms of using these resources, and the partnership between the departments and actors in the private and the third sectors for the provision of content.

Two major trends stand out in relation to digital content in the school networks: 1) the acquisition of solutions on the market and 2) local and internal production of content. The latter case does not preclude the contracting of private sector specialists in certain stages of the projects. Each of these models implies specific benefits and challenges, and their mapping enables the understanding of points for necessary improvements and ways to expand the field.

We verified that most of the departments in our sample produce local content and do not guide the usage. Regarding this last point, it is important to note the conflicts that can arise over ensuring the teachers' autonomy in the classroom, and that policies with guided use may encounter resistance depending on the manner in which they are implemented. It is an issue that needs to be better understood by administrators leading educational departments. It is necessary to clearly delimit the boundaries between the autonomy of teachers in the classroom, who are responsible for deciding on the use of technology, and the establishment of an educational policy.

1. Acquisition of content on the market

There is a greater propensity to purchase digital educational content in departments that are in initial stages of planning ICT use in education and that do not have sufficient resources to produce content locally. In this case, the acquisition of educational software on the market presents itself as a great solution and brings benefits through permitting the construction of networks with other departments and private educational institutions, and for their more refined services. The challenge that exists is the investment capacity to serve the entire education network. Often a staggered deployment is used, yielding a large variability of resources available in schools and administrative challenges that are inherent to it.

Another challenging aspect for the administration of contracted services is that it creates a process that requires oversight and leadership of the pedagogical sector in various stages of the content implementation process, which is not always possible due to the lack of staff and structure of educational technology areas.

It is important to understand the purchase of digital content or teaching solutions involving educational technologies as an alternative to the composition of a plan for the use of ICTs by departments, requires clear definitions of the roles of departments, companies and the requisite monitoring by the pedagogical coordination. Otherwise, there's a risk of delegating responsibilities and of creating an unstructured project; in addition, the lack of protagonism on the part of the pedagogical area will unlikely yield positive results.

2. Challenges in the public-private relationship

Private and third-sector organizations interviewed, have quite diverse activities, and, with regard to digital content, are hired to provide already formulated products, ready for use, or to assist in the development of platforms for the production of content authored by the departments themselves. In some cases, the service may

involve teacher training and pedagogical counseling for the guided use of resources.

The mission expressed by all organizations considered is the same: to improve the effectiveness of teaching and the quality of learning of students with technological resources, through greater engagement of teachers and students and resources more in line with the reality of today's society, an approach that is complementary to the public sector.

One finds that the high level of professionalization and training of specialized teams evidenced in organizations favors the work of content production creation. A resulting requirement is the strengthening of administrative teams of the departments, so that their central role as the main administrators in public-private relationships are not undermined.

It is also necessary to pay attention to the differences in structure and approach of the public and the private sectors, in order to add achievements (existing and future) in the production of digital content, their implementation, use and administration. In public-private relationships, it is important to note that culture shocks are common with the integration of services of companies and social organizations in classrooms, given the increased focus on deadlines, procedures and measurable results. Adaptation periods are necessary, as well as sensitivity from the organizations to this approach. In all cases, public administration, clarity of goals and the boundaries of each actor, all exert fundamental roles.

The research identified three focal areas for improvement based on interviews with representatives of the private sector and social organizations: 1) public management –a tendency not to cover all the dimensions required for the effective use of new tools and to delegate to the educators, in the classroom, the role of thinking solutions with the available resources—unrealistic expectations about what teachers can offer in light of all the responsibilities which they accumulate; 2) administrative processes – given the particular

characteristics that technology products and services have, it is necessary to think about purchase methods that ensure impartiality and objectivity, but that are open to new types of acquisitions; 3) definition of roles in the relationship between the public and the private sectors - there are difficulties in establishing the boundaries of each party, since contracting private services in the technology area and for education does not necessarily entail less work for the departments, but brings new demands of a different nature, that require especially strengthened administrative capacity.

The crucial challenge is that it is not sufficient for the education departments to have third party coordinators when they hire services on the market, since the “service” must be integrated in the long term and the legacy of this integration should remain. Without a good administrator who has this scenario clearly in mind, the stability of the projects and the achievement of long-term results are possibly unfeasible.

3. The production of local content

Departments with a longer history of discussion on the use of ICTs in their school systems tend to have projects that value the digital content production process by teachers within the network itself, encouraging their involvement and adherence to projects that aim to expand the use of ICTs in the teaching-learning process. Their coordinators express pride in promoting local authoring and, usually, there is an ICT integration plan and an active educational sector in the project. There are also new departments adhering to this movement, buttressed by the defense of the collective construction of knowledge and the conception of the teacher as a key actor.

The preference for content production is motivated, mainly, by 1) the understanding that digital production is a dimension of training; 2) the uncertainty regarding products offered by companies; 3) a conviction in the need for stronger appropriation of ICTs; and 4) the

large amount of open educational resources available on the network. An emblematic example is that of Educopédia, the initiative with the greatest visibility in the context of local content production in the country, initiated in 2009, and which has served as a model for other recent initiatives.

Gains in local content production need to be considered in the light of the available organizational structure, of the budget and of the production and distribution means, so that the experience is sustained over time. Otherwise, the achievements may become sparse and start to wane, preventing the development of consistent policies that are built upon their foundations.

The production of quality digital content aligned with the objectives contained in an ICT use plan is considered a basic resource for implementing a mobile learning policy. Whether produced locally, or purchased on the market, such content gives meaning to the use of equipment in schools. The motivation for the use and its suitability can determine the frequency and effectiveness. This is one of the fundamental pillars, which requires strong involvement and participation of the pedagogical sector of the departments.

In parallel, it is essential to also develop an interest in the acquisition of, and establishment of norms for, digital content at the federal level, providing support and guidelines for the local departments of education.

Chapter 7 – Human resources and teacher training

In addressing the training of teachers in ICT and human resources, this chapter focuses on the challenge of on-the-job training for the use of ICTs and the roles and approaches of the federal government and state and local education departments in this context – taking on a responsibility difficult to fulfill in isolation. Other organizations

have emerged in the provision of continuing education, and given the universe of teachers and the difficulty of modifying the approaches and integrate ICTs into the curricula, this is a pillar that demands profound innovation processes to sustain effective mobile learning policies.

1. Training practices and their goals

Continuing education for ICT usage is not a complement to the teacher's prior training, but a foundational training that all the school networks studied are striving to take on.

If providing in-service training is considered a fundamental condition to serve the mobile learning projects of the departments of education and to modify the current teaching-learning procedures with ICT usage – as indicated by experts interviewed in the course of this study—it becomes necessary to rethink current training practices to reach such objectives.

It is also necessary to reflect upon the requirements and selection methods to enter the school networks – a topic that is currently underexplored. If entering public service is the only step, governed by the departments of education, that can transmit to the universities the expectations of educational networks in relation to the current professional profiles needed for the schools, this subject must not be neglected and could, possibly, bring varied repercussions in the discuss of teachers' roles nowadays.

Added to this scenario is the manner by which new digital tools have arrived at schools, preceding the training at the school units. In this manner, the technicians from the education departments interpret there to be a lack of basic knowledge of technologies among teachers, resulting in the belief that every new device requires new trainings for the teachers, multiplying the workload of the education departments. It seems to us, however, that the focus on the teacher's technological autonomy, or the development of

their digital literacy (ROSA & DIAS, 2012) – is the most effective way to consolidate ICT appropriation within the school universe, regardless of what devices are being used and the speed at which the technologies are updated.

On the other hand, it is worth underscoring training courses that detach ICT usage from the improvement of the teaching-learning process and their benefits to the work of teachers contribute little to change this scenario. Moreover, the segregation of ICT training courses is another factor that strongly impacts the results of continuing education and imposes a barrier to further progress. This model perpetuates the dichotomy between ICTs and education: if they are not together during planning or trainings, how can they be unified in the schools and in the classrooms?

From the perspective of day-to-day barriers, the workload of teachers is important. Furthermore, generational factors are also identified as a complicating element for training and the incorporation of ICTs. However, it is important to emphasize that although the mastering of new technologies by younger teachers tends to facilitate the incorporation of ICTs into pedagogical activities, it does not in itself guarantee effective integration within the teaching-learning process. In this sense, the challenge of education departments in integrating technologies pedagogically will not be solved by the shift of generations of teachers.

There is a need to facilitate the process for the teacher, making the use of digital technologies at schools practical and clearly define what is expected of them. In the same way one learns how to use Facebook, WhatsApp and cellular phones, though practical engagement, should be the approach taken for the continuing education of teachers.

2. Teacher training carried out by the departments of education and other organizations

With regard to teacher training for the use of ICTs, two approaches were identified in most education networks: ‘tool-oriented’ courses involving the use of software, but also hardware, such as how to connect mobile devices to TVs, computers, and etc.; and courses ‘oriented towards pedagogical practices’, involving the identification of available digital tools to facilitate learning with a focus on specific disciplines.

In all scenarios, the training provided by the departments of education follows very traditional formats. The inclusion of ICTs in teacher training curriculum has been characterized by segregation, with disciplinary courses set apart from the curricular training directed towards technologies.

A fundamental dimension that is lost in using this segregated model is the simultaneity between digital technologies – as a language and communication tool – and traditional languages. Just as it is not necessary to teach Portuguese to a child before introducing her to digital technologies—as those languages are nowadays learned in parallel—there is no need to teach Portuguese to an adult or to train them in any other subject to introduce them to digital technologies.¹ There is a linked simultaneity that could even synergize certain learning potentials, a result different to that one could expect from the addition of a new subject.

In mobile learning policies, there is a need for courses that are not necessarily ICT courses, but oriented towards pedagogical processes, that explore digital technologies as a language, and that transcend the curricular structure of the school networks while exploring their potentialities as transformative tools of the teaching-learning environment.

¹ The Teenager and Adult Education Courses (EJA) that follow this perspective and can inspire training activities are the ‘Luz do Saber’ (Light of Knowledge), of the government of Ceará (available at: <http://eja.luzdosaber.seduc.ce.gov.br/luzdosabereja/software/>) Last accessed on 25th May, 2015) and the experience of the Paramitas Institute in the municipality of Santo André, São Paulo whose description can be read at: <http://institutoparamitas.org.br/web/noticias.php?id=5704> Last accessed on March 25, 2015.

The approach that education technology coordinators expect to find in the classroom, with the resources currently available at schools, is also the same approach that should be delivered during the teacher trainings: understanding digital technologies as a language, focusing on the teachers and not on the tools; taking a practical approach aimed at uses that make their work easier and build class experiences on par with the possibilities that are currently being enabled.

There are innovative initiatives such as the ‘Educação na Cultura Digital’ (Education in Digital Culture) course, designed by the MEC in partnership with the Federal University of Santa Catarina (see Box 7.3), the EduPesquisa and EduTecnologia programs of the Curitiba Municipal Department of Education, as well as the administration and training program of the Colégio José Leite Lopes, the NAVE school, from the State Department of Education of Rio de Janeiro (see Box 7.4), which can be observed and provide inspiration for other contexts.

Regarding teacher training offerings from social organizations and private companies, they have been increasing in Brazil. In addition to their efforts to keep up with trends, their more flexible structures and the smaller scope of the projects they develop have favored successful attempts to introduce new approaches in the area.

In this sense, it is worth highlighting the investments made to innovate, by offering courses based on experiences and practices aiming to train teachers to personalize teaching, with planning and management that focuses on mapping student needs. Another aspect is the importance placed on *in loco* support for teachers, to demystify and demonstrate the benefits of the uses of available resources. A major focus of the training of these organizations is to stimulate and disseminate among teachers the planning of lessons, always permeated by the use of technological resources available.

3. The centrality of the curriculum for teacher training in mobile learning

To overcome the segregated training model, based on a curriculum divided by disciplines, it is necessary that those responsible for training teachers connect the technological resources available with the curricular content needed by teachers and utilize a practical approach in trainings, which elucidates effective teaching-learning methods, facilitated by existing technologies. When the understanding of the integration of technology into the curriculum is the focus of the teams responsible for the training of the education departments, the curriculum to structure teacher trainings for mobile learning policies will become more clear. As a result of this focus, the demand for varied digital content in line with the curriculum will also tend to have greater specificity.

The design of these resources, buttressed by the integration of ICTs, and focused on curriculum and new teaching-learning methods, is fundamental for teacher training. In this sense, collaboration between the education departments, the federal government and universities to set new continuing education curricula is a latent need.

Among the action strategies aiming to expand the scope of teacher training, pedagogical counseling and online education stand out.

The first has proven to be a method for personalizing and customizing the teacher's learning. But to be effective, it is essential to carefully plan a viable distribution of the number of schools and teachers and the definition of service periods. The use of administrative tools to diagnose the target audience under the responsibility of the adviser, and the monitoring of their progression is also an integral part of a successful initiative. The experience of the technology mediators in the State Department of Education of Rio de Janeiro is a great example in this direction (see Box 7.5).

It is further considered that using online advisory strategies can greatly assist these activities, as well as the development of monitoring platforms to measure the effectiveness of the approaches and shared content in teacher practices.

With regard to online education through courses made available as video-lessons, the reach of these materials is still understudied to allow for the evaluation of the effectiveness of these trainings - not just in terms of enrollments or views, but also in terms of impact.

Chapter 8 - The school perspective: the teachers

In this penultimate chapter, by opening up space for the perspective of teachers, we seek to outline their profiles and expectations in relation to ICTs as well as their vision of the school environment and their use of technology, in order to develop greater clarity on continuing education needs and the types of reforms that enable effective integration of ICTs in schools.

The analysis of the discourses of the 11 focus groups conducted in five Brazilian regions pointed to the possibility of conducting a study of qualitative classification of the interviewed teachers. The marked heterogeneity in relation to technologies, facing similar scenarios characterized by structural lacks in different cities, showed consistent patterns and behaviors that demonstrated the need for systematization. The synthesis of this classification of teacher ICT engagement styles is presented below and can be seen in full in section 4.2.1 of Chapter 8.

1. The scenario of reform implementation

The strong connection of teachers with the past, and with their own established way of doing things, is imbricated with reminiscences of effort, learning, achievement and evidence of success in their social environment. The education departments should not neglect these aspects in their attempts to reform.

Regarding the current condition of the schools, the teachers are unanimous in expressing the urgent need to improve the quality of the public education. With regard to learning, the educational use of technology is recognized by most as a possible ally for increasing student engagement.

In this context, the challenge posed to public administrators is to develop consistent plans, with clear objectives, that consider the involvement of teachers in the process and the relationship of trust required to implement this initiative. Therefore, it is opportune to have contributions aimed and providing more elements to develop initiatives, not of intervention, but of technological integration in a more promising way.

2. The not so distant future and the present reality

Outlined by the teachers, is a recurring image of a mediator-tutor, which signals a difficult and precarious “present” and a “future” that may be reasonable and sufficient.

In descriptions of the school environment, the presence of social problems and violence, indicates that any education project to be implemented can not ignore them, particularly the violence, given that it impacts levels of acceptance and trust of initiatives: If receiving digital devices means greater chances of the school being burglarized, or if allowing that students take their devices home can put their lives at risk, there is a possible impediment to the adherence to projects.

In regards to the relations established within schools, they are understood by the surveyed teachers, as too assistentialist, characterized by instrumental relations generated between parents, students and schools, where the main product at stake is not learning, but other important basic items and services for which schools serve as intermediaries.

In the broader context of attempts to reform education, as well as intense social transformation as an effect of the technological revolution (CASTELLS, 2005), the impact of ICTs on the lives of the teachers we listened to in this study shows non-linear scenarios of digital technology integration in personal and professional life, as well as spaces of anguish and conflict resulting from this transformation in course.

2.1. Teachers and technology

We have not identified issues of access to ICTs among the interviewed teachers, which is in line with the quantitative data presented in Chapter 2, that show that teachers have more access to computers and the internet than the Brazilian general population and the students. However, in regards to use, many classify their knowledge as basic.

Despite differences, all interviewed perceive the advantages of mobility as the great breakthrough in the use of technology. Tablets, however, are more rarely used than cell phones.

Technology, as a theoretical entity, in any case, is personified by teachers with very ambiguous features, but consistent with the very different ways in which they relate to it – at times approaching it, at times distancing from it. It is interesting to note that, the distancing for technology may already be the result of previous engagements, and not necessarily a rejection that prevents initial use.

2.2. The main profiles of teachers according to their attitude towards ICTs and their importance

Attitudes of teachers in regards to the ICTs in schools vary. Below, we summarize the main features of the five ICT engagement styles found among teachers in this study:

Table 1: Teacher profiles and their main features

Teacher ICT engagement styles and their main features				
Trailblazer	Receptive	Perseverant	Apprehensive	Avoiding
<ul style="list-style-type: none"> » Makes widespread use of technology (personal and professional) » Researches tools and new content » Looks for ways to make lessons more attractive » Aims to reach the expectations from above and builds rapport with student through technology 	<ul style="list-style-type: none"> » Makes widespread use of technology for personal matters and in the planning of lessons » Has a focus on fulfillment of the class program » Considers that it is not worth the effort to configure the ICTs » Values more the results than the experience itself 	<ul style="list-style-type: none"> » Feels fragility and lack of authority for not mastering the technological universe » Wants to engage with ICTs » Is willing to learn » Relies on others (including students) » Needs support 	<ul style="list-style-type: none"> » Feels that excess is harmful » Is afraid of losing control (over technology and loss of identity as a teacher / person) » Restricts the use of technological tools and internet access 	<ul style="list-style-type: none"> » Has no intimacy with the world of technology (neither personal nor professional) » Is not disposed to develop intimacy » Views access into the digital world as an imposition and is thus unwilling » Feels he or she has no skills and feels uncomfortable

Source: Self-prepared

Different engagement styles require different curriculum and may respond better to different continuing education approaches. By analyzing them, one can, more easily, think of a curriculum that responds to their levels of digital literacy and their pedagogical use of ICTs. Importantly, the generational issue may explain the level of digital literacy of teachers in general terms, but does not necessarily explain their propensity for the pedagogical use of ICTs in the classroom. Characteristics such as previous experiences and trajectories, associated with the infrastructure environment in the school, are more explanatory of the pedagogical use than age itself.

It was observed that infrastructural limitations, including equipment, combined with the lack of adequate training, are related to the infrequent use of ICTs in lessons and with low regularity by most teachers – which is in line with the World Bank survey, which indicates that only 2% of Brazilian teachers' time in the classroom involves the use of ICTs (BRUNS & LUQUE, 2015). For those teachers who have already stepped into the technological universe, the difficulty is to think of a planned and effective pedagogical use. An expression of this is that some of the examples of technological use provided by teachers are limited to reproducing already established teaching norms, mainly for content exposure. Pointing to other possibilities, we also see technologies being used as a communication facilitator, and for producing and publishing online content, and conducting online research.

2.3. Schools and technology

Considering the heterogeneity of teacher profiles and engagement styles, associated with variation in the – not always adequate – school infrastructure, the distribution of devices to the public school teachers, which are perceived by them favorably and positively, is also faced with the need for training and guidance on use. In this scenario, the deception with the notebooks and tablets received, and their subsequent neglect, are noticeable. According to the teachers, these deceptions are based on the quality and technological obsolescence of the tablets.

2.4. Teacher training: reality and desire

According to the teachers, continuing education should meet requirements related to the use of equipment, the content and the handling of available programs and applications, while maintain a focus on both teachers and students, each group with their specific needs. The practical approach, focused on real classroom situations, and on each teacher's subject, is often solicited, whereas the trainings they have today are widely criticized, with rare exceptions.

It is worth noting that such expectations from the teachers, regarding their in-service training are the same as the expectations of the administrators of education departments in relation to the teachers' lessons: both yearn for more stimulating lessons, and, in the case of teachers, for practical training that simulates activities that are applicable in the classroom. In this sense, the courses currently offered, whether those based on a multiplier model, or those aiming at professional development, are considered ineffective.

The teachers' testimonials explicitly express the difficulties that the departments of education have, with their limited structures, in meeting the increasing demands for teacher training for the pedagogical use of ICTs in the classroom.

Chapter 9 – Next steps

In this chapter, we discussed the lack of monitoring and evaluation in the programs involving technologies in education and the benefits of including this step since the beginning of the policy. We analyze trends for the future brought about by survey respondents, and we discuss recommendations and possible steps to reform towards more effective mobile learning policies.

1. Monitoring and evaluation

While monitoring and evaluation of education in Brazil are uniquely strong due to the existence of the IDEB, monitoring and evaluation of initiatives and routinely implemented programs with the aim of generating corrective actions have shown to be very rare in the studied departments, resulting in limited objective accompaniment of projects involving the implementation of digital technology in school systems.

Companies and organizations working on the implementation of education projects using technology, with learning improvement objectives, exhibit greater advances on this matter.

Considering an entire monitoring and evaluation cycle, following diagnosis, made on the basis of variables representing the policy objective, there is a need for the systematization of collected information, which enables the formulation of action plans. Its implementation should ensure adjustments and corrective actions so that new diagnoses are made in a defined timeframe.

Among the barriers to the development of monitoring and evaluation, is the discontinuity of policies, the lack of a results-focused vision, with a more process-focused vision, and the insecurity that the monitoring of results are considered the exclusive responsibility of their initiatives, ignoring other factors contributing to low-learning environments.

Nevertheless, we emphasize that the development of monitoring and evaluation is inseparable from the continuity of policies, composed from the beginning; and the dissemination of their benefits for ongoing actions depend on a results-oriented vision, with learning being the central node for measuring the effectiveness of initiatives.

Creating or strengthening the monitoring and evaluation capacities of departments of education departments is a crucial factor for the consolidation of an effective monitoring plan as part of mobile learning policies. Continuing education that focuses on administration based on these data will also be fundamental to generate a virtuous demand cycle for such results and their application.

2. Towards mobile learning

The education envisioned by administrators working in the departments 10 years down the line includes several possibilities and lots of synergies between ideas. Interviewees show a conviction in substantive changes towards a maturation that enables the desired

fluidity, thus, suggesting that there are fertile grounds for reforms. Nevertheless, to change it is necessary that we know where we are and where we want to go, which is why it is important for a detailed examination of the present, as shown in this study, in order to build an action plan with goals that cover the dimensions that you want to focus upon.

Based on the research results introduced in previous chapters, we present inputs to support three stages on the path to effective reform: 1) understand; 2) plan; and 3) implement. This entails knowing what exists in terms of infrastructure, digital content and teacher training, as well as the profiles of key actors in order to plan, with an eye to goals, the design of mobile learning policies, the necessary initiatives and the possible and appropriate strategies.

In addition to a focus on planning and the need for strategic vision highlighted by the authors in this section, it is crucial to pay attention to the implementation stage, since the latter is decisive for the success of public policies.

It is also beneficial to establish a commitment to the proposed agenda and be aware of the maturation time for the policy to be developed. Discontinuities may bring more losses than inaction may bring.

We emphasize, finally, that the models presented in this chapter, whether monitoring and evaluation, or planning for reforms, are flexible, allowing for adaptations to different contexts. The leadership of public administrators in the successful implementation of this step is crucial to support the construction of innovative and context-appropriate trajectories for local mobile learning policies.

Good Practices

A GOVERNANCE COMMITTEE FOR IT ACTIONS Chapter 4: p. 162	LOCAL SOLUTIONS FOR THE DIFFICULTIES OF INTERNET ACCESS IN SCHOOLS Chapter 5: p. 192
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INTRODUCTION

After nearly three decades of technology policies in education in Brazil and two decades since the emergence of internet use in the world, in order to understand the context and the trajectory of digital technologies in Brazilian education, three important questions merit consideration.

1. Should the use of digital technology, indeed, be disseminated in the school environment?

This is a frequently asked question and brings an implicit perception that it is possible to separate schools from technology; however, that is no longer possible. Studies demonstrate that a large portion of students and teachers in urban Brazilian schools have access to the internet and use the network inside and outside of school. Schools are also becoming more and more equipped, even though the usage, as we can see, is limited.

In response to this question, aside from the dissemination of research which has been carried out to evaluate the methods of using digital technologies more effectively for learning purposes, researchers argue that the use of technologies an impetus for important cognitive skills related to critical thinking and informational literacy. These discussions also show the positive effects of using technologies in the struggle against inequality, which tends to intensify in

the educational system if the staff from the public schools fail to incorporate digital tools into learning.

2. In which ways can digital technologies contribute to learning?

This question is intimately related to the previous question and is also commonly posed in the field of Education. Among those that pose this question, we see more progressive attitudes towards integrating technologies to pedagogical practices; however, within common answers, there is a prevailing vision that technologies should be adapted to already established pedagogical practices to make them more engaging and, consequently, more effective.

Arguments against such perspectives underscore the potentialities of new technologies to enable greater self-sufficiency and develop novel skills that are little explored in schools, which can be under-utilized if technologies are simply molded to current standards of teaching-learning.

3. How can we rethink the teaching-learning processes based on digital technologies?

This is an emerging, but also mobilizing, question in debate on new technologies. It stems from the perception that the technological revolution has altered several social dimensions, making digital technologies a part of the actual social fabric. On one hand, industries, financial systems, and other sectors have been transformed, altering individuals' notions of time to have access to products or services. On the other hand, new professional practices, like remote medicine mediated through technology, as well as social practices, like digitizing memory in the form of photos and documents, where digital devices become an extension of human capacities, have made the boundaries between humans and machines in contemporary society ever more tenuous. In this context, we should reflect on why can't technologies help us rethink education if other fields have been transformed through appropriating their benefits? And how can we not rethink education when faced with intense demands for improvements in the quality of education?

These three questions touch upon central discussions for the constellation of actors within the Brazilian education system, be they public administrators, educators, specialists in social organizations, or entrepreneurs in the field. We emphasize the last question and try to contribute perspectives that help formulate public policies that can respond to it.

We assume that the design of a policy has a fundamental impact on its performance.

This research takes a look at mobile learning as a public policy, trying to understand how the management of these actions has developed on a municipal and state level, as well as the role of the federal government, which - with certain institutional arrangements - impacts the decision-making of the states and municipalities. Furthermore, we try to elucidate the paths taken by decision makers to formulate this agenda in their educational networks and the dilemmas faced when implementing the policy in situations that are normally adverse.

With pedagogical, infrastructure, and educational technology implementers of the departments, we try to understand the bottlenecks encountered and the solutions developed during the implementation stage on the topics of 1) infrastructure, 2) provision of digital content and 3) ongoing teacher training. We examined the way in which the policies created impact the difficulties faced during implementation. This allowed us to identify some common patterns that can be foreseen, therefore permitting the avoidance of future shortcomings of expected results.

We also investigated teachers' perceptions of policies implemented. These actors have a considerable degree of autonomy at school and in the classroom, and with the unguided approach to the implementation of digital technologies within the departments of education '(i.e., without the standardized guidance on content and use time for ICTs, Information and Communication Technologies)'

the implementation depends on the individual acts of the educators, resulting in considerable heterogeneity, albeit with examples of good practices in all regions of the country.

We try to better understand the matter of teacher's 'resistance' – an oft-repeated mantra by almost all of the actors engaged with ICT policies in education – examining it less in psychological terms and more from the point of view of public policies. We created a qualitative typology of teacher engagements with ICTs, with the aim of contributing to more targeted training initiatives focused on the different educator profiles that currently exist within the school system.

The monitoring and evaluation (M&E) of public policies are also addressed in this study. We try to show the necessity of augmenting the focus on planning and including, from the start, diagnostic stages, systematization of results and ongoing corrective measures to policies, whenever necessary. In addition, we point to variables to be considered for the future monitoring and evaluation of the implementation of mobile learning policies.

We conclude with a focus on the future, bringing recommendations based on the research insights to actions in the field with the expectation of contributing to the creation of public policies for

mobile learning that reflect the essential interaction of the pillars – infrastructure, digital content, and teacher training. In order to do so, we focus on the different levels of complementarity, coordination, and long-term planning that are necessary among the levels of federal, state, and municipal management, bearing in mind the reality of schools today as well as the perspective of the future of society, that the dynamism of technological innovations enables. We believe these aspects are fundamental for the creation of more effective public policies, which can strengthen and innovate Brazilian education.

PART I

A STUDY OF EDUCATION

CHAPTER 1

THE FOUNDATIONS OF THE STUDY

1

THE CONCEPT OF MOBILE LEARNING

In studies and debates about the use of technologies in education in Brazil, a focus on equipment prevails. In regards to use, these devices have been typically seen as “accelerators of conventional education practices rather than the expression or possibility of new readings of the world, which precedes new readings of words” (SOBREIRA, 2012, p. 31). We face a still incomplete development of digital culture in the educational context.

In line with such a diagnosis, educators interviewed in this present study, often perceive digital technologies and their devices as similar to the pencil, notebook, pen, and chalk. Therefore, it is a passive means of production.

Using a different approach, UNESCO’s concept of mobile learning locates mobile technologies as a means to make learning possible. Their conception provides a more progressive view of technology, since it draws attention to its omnipresence and its empowering attribute in promoting learning. Mobile learning is defined as “the use of mobile technology, either alone or in combination with other information and communication technology (ICT), to enable learning anytime and anywhere.” (UNESCO, 2013, p. 6).

”

The equipment has to be perceived as chalk. The matter of its quality is what the teacher writes on the board with the chalk. (Administration, State)

Authors also associate mobile learning with the struggle against inequality since it allows access to learning materials and information – at any place and time – to improve the individuals' quality of life regardless of where they live, their status, or cultural considerations (ALLY, 2009).

In this vein, it is possible to think of digital technologies – especially the mobile ones – given their intrinsic ubiquity of as catalysts of a new teaching-learning process and not just as a tool to reproduce established pedagogical practices in which ICTs are seen as providing a hint of innovation. As Léa Fagundes' affirms *"This [digital] screen is completely different than any other written support we have because this screen is an n-dimensional space. Paper is bi-dimensional, it's linear (...) Not here, there are multiple dimensions that you can explore, which is a digital culture, new times, new dimensions. And it changes information, the registration of information, the transmission of information."*¹

To think of mobile learning, thus, means distancing oneself from the 'school computerization' concept of the 1980's and 90's, the focus of which was on the **process** of inserting computers in schools. It also means distancing oneself, in certain regards, from the idea of 'ICTs in education', currently, a predominant concept in the field, and that, in a similar vein to the previous one, focuses on the process: integrating ICTs and education and, at best, providing for their use for pedagogical purposes.

Mobile learning, as we understand it, entails a distinct perspective. It's **results-oriented**, in other words, focusing on learning, without tethering it to specific places. For the success of this approach, mobile technologies become an essential part of the teaching-learning process, an expression of digital culture (SOBREIRA, 2012), which has already played an important role in transforming other social dimensions. It stops being the means to be the actual message (LUHAN, 2005; SOBREIRA, 2012). Its full development is attained with the domestication of technology by educators, pupils, and

¹ Available on: <<https://www.youtube.com/watch?v=v9RmhhqSCUw>>. Last access on: 03/25/2015.

the school environment, where digital language gains meanings in the action of the subjects, with mastery for varied uses (BUZATO, 2007; MORI, 2011; ROSA AND DIAS, 2012).

Therefore, it is not about having ICTs as a means of learning, but as an integral part of it. Digital technologies **do not become invisible**, in such a way as to leave current practices unaltered, **nor take the spotlight**, in such a way as to undermine the importance of pedagogical practices. **Digital technologies become a catalyst in the teaching-learning processes.**

In the field of public policies, this shift away from the approaches of ‘school computerization’ and ‘ICTs in Education’ towards mobile learning entails a shift away from **efficacy indicators** – like the implementation of the ICTs in an educational network – towards a focus on indicators of **effectiveness**, such as the measurement of the students’ learning through their use of and relation to digital technologies.

Normatively, the concept of mobile learning proposed here requires guided use technology policies (ORTIZ & CRISTIA, 2014). Guided use is understood as actions that, in addition to providing devices and resources for the use of technology in schools, specify hours of use and the types of activities to be performed, which are defined through previously planned learning objectives and expressed on digital platforms that support these objectives.

Box 1.1. The proven performance of guided use technology programs

A study released in 2014 by economists from the Inter-American Development Bank conducted a meta-analysis of impact evaluation studies of 15 education and technology projects in Asia and Latin America. The results demonstrated that positive effects on the learning of mathematics in 13 of the 15 cases examined.

The same study showed that the technology programs with guided use approaches produced learning improvements four times greater than programs with unguided use. Comparing the impact of ICTs in education programs with other common strategies used to increase the academic performance of students, Ortiz and Cristia show that guided use technology programs are among those with the greatest impact on academic performance, while unguided technology programs are among the least effective. ICT guided use programs were found to have a greater impact on learning than actions targeting general teacher training in general, class size, the type of teacher contract, bonuses and other actions that have been commonly advocated for as effective interventions.

Focused goals (ORTIZ & CRISTIA, 2014), such as improving math or writing skills, and strong administrative leadership (WARSCHAUER, 2011) to encourage the integration of technology in education, are also cited as fundamental to the success technology programs.

For these factors to be met, the design of medium and long-term plans and their continuity are essential.

"Since the success of educational reform projects involves a change of culture in schools as well as the development of curricula, assessment and other elements to facilitate this change, they are most successful when carried out gradually over a period of several years, rather than through the sudden imposition of changes". (WARSCHAUER, 2011, pp. 103-104)

Thus, to support the public policies:

We define mobile learning as the promotion of learning at any time or place through using mobile technologies. To make it possible in the context of formal education, necessitates the combined: availability of infrastructure, digital content, and adequately trained human resource, along with policies that emphasize the guided use of ICTs in schools.

This definition gains more relevance when thought of in the context of “skills of the XXI century”, new skills and competencies that emerge from new social practices involving digital technologies, which have been systemized by several authors with the purpose of adapting school curricula and pedagogical projects to address new economic and social needs and challenges. Among these skills include: *ways of thinking* - which involve creativity and innovation, critical thinking, problem solving, decision making, learning to learn, and metacognition; *ways of working* - which involve communication and cooperation; *work tools* - among them are digital literacy and informational literacy, which include the ability to conduct research; and *ways of living in the world* - which encompass local and global citizenship, life and career, and social and personal responsibility (BINKLEY, et al., 2012).

Information from the World Bank shows tendencies in the evolution of the Brazilian work force towards non-routine skills or of a high analytical level, called “new economy skills”. Furthermore, the authors point out, it is known that there is an emphasized correlation among the students’ average learning levels and the long-term economic growth (BRUNS, EVANS, & LUQUE, 2012). To accept these skills as a new educational paradigm means to also rethink the teaching-learning processes, as well as the evaluative curriculum and processes, of which digital technologies gain

another dimension with views to sustain the growth of the country in the global economy.

Lastly, the concept of mobile learning, as we have defined it, also aligns to the emerging practices of hybrid teaching, which emphasizes the personalization of learning paths while focusing on the student, and which can be defined as:

a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home. (STAKER & HORN, 2012, p. 3)

Mobile learning, thus, becomes a normative concept which:

- a) avoids a narrow focus on devices in public policy, because it is bound to learning results;
- b) limits dysfunctionalities by synthetically considering the three pillars of policies: infrastructure, digital content, and trained human resources at the service of previously planned learning objectives;
- c) is an instrument to address inequality in the long-term, because it generates ownership of digital technologies by the subjects of the initiatives;
- d) allows for synergies with several current tendencies in education, that focus on pedagogical practices and curricular innovation.

The development of mobile learning policies, in any event, demands breaking away from current education models, seeing that it demands an approach to the future and this is an action of high political cost for public administrators. In public policies, even when the results are not ideal, the costs for change increase over the course of time since certain paths are being reinforced in detriment of others throughout historical inertia (PIERSON, 2004).

As Sobreira affirms, *"at least in the last two decades, the great absence in our theoretical-practical production in the field of education is*

exactly the futurist perspective” (2012, p. 46) The challenge for the agenda and implementation of the mobile learning will be to keep one eye on the future, understanding the world which will await youths who are entering the learning system in 12 years, while keeping the other eye on the present, which ensures consistent long-term planning for the advancement of changes.

2 METHODOLOGY

The goal of this research is to analyze, from the public policy point of view, the current overview of mobile learning in Brazilian public education, in municipal and state education networks.

At a moment in which the acquisition of mobile technologies for school use - like tablets and laptops - have been highlighted among the governmental investments, we try to shed light on educational policies regarding ICTs.. Mobile technologies encompassed here are characterized for being digital, portable, and having access to the internet, and the stationary ones, like desktop computers, focused on attributes like robustness but without mobility.

We elected two fundamental perspectives to be investigated. First, the public administration perspective - in terms of the plans, implementation, monitoring, and evaluation of actions. Second, the context of the school environments resulting from the infrastructure, digital content, and teacher training settings that are provided by the educational networks. Such approaches allow, not only to build an understanding of mobile learning in Brazil, but also to understand and characterize the varied teachers’ relations to ICTs in schools, and their attitudes and practices towards the existing contexts of technological integration.

2.1 Conceptual framework

Based on the literature (ORTIZ & CRISTIA, 2014; SEVERÍN, 2010, WARSCHAUER, 2011), we consider four pillars as the structure of a mobile learning public policy: the political/policy dimension, the infrastructure, the digital content, and the human resources for the use of the ICTs. The synthesis of the variables observed can be seen in the following illustration:

Figure 1.1: Analysis variables of the study

Source: Authors' creation

Based on Severín (2010), the political/policy dimension involves: the definition of an agenda and priorities, action plans, the processes of communication and visibility of these actions, the development of legal frameworks, which support the use of ICTs in schools and the incentives for its use.

The infrastructure pillar encompasses the conditions of the electrical grid, connectivity, hardware, and technical support.

The digital content pillar includes the integration of ICTs in the curriculum of the educational networks and the digital content

available in terms of pedagogical programs and platforms for the direction of the teaching-learning processes with the use of ICTs.

The human resources pillar encompasses the perceptions and relationships the teachers have with ICTs, their training to use them, the pedagogical use in the classroom, and the follow-up to give support for its use.

2.2

Research method and scope

For this qualitative study, more than 160 hours of primary data was registered, collected by means of in-depth semi-structured interviews and focus groups with the participation of actors involved with ICTs in public education, in different positions and functions, belonging to all five Brazilian regions. The target groups were:

Figure 1.2: Study target publics

Source: Authors' creation

This report aims to allow the reader to feel close to the research field and on-the-ground realities. Thus in addition to the analysis of findings, the report includes many quotes collected in the interviews and focus groups to supplement and enrich the analytical content. We recommend everyone read it for the richness shown in the diverse perspectives of actors.

The interviewees' identities are kept anonymous for most of the report, but are revealed in specific cases in which we deemed it necessary to identify the departments of education to which we are referring or the individual speaker. Throughout most of the report, however, the quotes are identified with initials, which are described in the "Identification of interviewees" summary at the beginning of the report.

Visits and observations in municipal and state schools that are part of the educational networks studied were also carried out, focusing on the organization of the school units regarding technologies and engagement of school staff in technological devices and facilities available at the schools.

Lastly, an online survey was sent to all departments studied, with questions about general data on school systems, focusing primarily on data related to infrastructure.

2.2.1 Sample

The core sample of the research are the **decision makers from the local governments**, who seek to represent the state and municipal departments of education that have the projects involving the pedagogical use of mobile technologies, implemented or in planning, at elementary schools and high schools.

To prioritize the larger educational networks, the study focused on state capitals. The selection of departments were guided by the following considerations:

- » *Regional representation (at least one city per Brazilian region, two in the most populated region)*
- » *Size of the population of the capitals (most populous cities per region)*
- » *Presence of projects with mobile technologies (information posted on sites)*
- » *Internet connectivity at over 70% of schools (CENSO ESCOLAR 2013)*

The twelve selected Departments are:

Table 1.1. Departments of education selected in the sample

Region	State	City
North	Amazonas	Manaus
Northeast	Bahia	Salvador
Central-Western	Goiás	Goiânia
South	Paraná	Curitiba
Southeast	Rio de Janeiro	Rio de Janeiro
Southeast	São Paulo	São Paulo

Source: Authors' creation

The regional distribution also generated a good variation in the Basic Education Development Index (IDEB)² shown in the sample.

Graph 1.2: IDEB 2013 – State networks, high school

Source: Authors' creation with data from QEdU and IDEB/INEP (2013)

² The IDEB will be explained in detail in the following section, but the scale of the indicator goes from 0 to 10, with a result of 6.0 being the long-term goal desired by the Brazilian government, based on the performance of developed nations.

Graph 1.3: IDEB 2013 – City networks, elementary school, final years

Source: Authors' creation with data from QEdu and IDEB/INEP (2013)

The sample of **decision makers from the federal government, companies, and social organizations** was defined based on referrals from local decision makers on the local level, bearing in mind the actions under way, partnerships, and contacts established day-to-day activities.

Aside from the Brazilian Ministry of Education (MEC) and the National Fund for Education Development (FNDE) and other representatives from the federal level, representatives were interviewed from the following organizations:

- » Evobooks
- » Fundação Lemann
- » MSTECH
- » Oi Futuro
- » Positivo Informática
- » Samsung

The **total amount of interviews conducted are as follows:**

Table 1.2: Distribution of interviews conducted

	Municipal	State	Federal	Total
Departments / Sub-departments of Education	5	4	–	9
Educational Coordinators	6	4	–	10
Infrastructure/ IT Administrators	5	5	2	12
Educational Technology Administrators	5	5	2	12
Companies and social organizations	–	–	–	7
Others (other divisions from the Departments, schools, etc.)	16	27	–	43
Total	37	45	4	93

Source: Authors' creation

The sample of **teachers** and the recruiting process for the focus groups are explained in chapter 8 – The school environment. In total, **11 focus groups** were carried out.

Finally, a sample of the **schools** were selected for site visits, which was composed of **24 school units**. For this design, we counted on the help from the departments of education to select schools that:

- » Were regionally distributed in the city
- » Included elementary schools in the city networks, and high schools in the state networks
- » Had ICT projects highlighted by the educational technology coordinators
- » Were equipped with standard educational network technological devices, but with projects without familiarity of the educational technology coordinators.

Figure1.3: Distribution of the schools visited in Brazil

Source: Authors' creation

Figure 1.4: Distribution of schools visited in the municipalities of Curitiba, Goiânia, Manaus, Rio de Janeiro, Salvador and São Paulo

Source: Authors' creation

The fieldwork research was carried out between **July and September of 2014**, and the interviews and focus groups were carried out in the cities of Brasília, Curitiba, Goiânia, Manaus, Rio de Janeiro, Salvador and São Paulo.

CHAPTER 2

THE CONTEXT OF BRAZILIAN ELEMENTARY EDUCATION

According to the Law of Directives and Foundations of Brazilian Elementary Education (Law # 9394/1996), education is a right of every citizen and is the responsibility of the State along with the cooperation of the three levels of government: municipal, state, and federal.

The municipal departments of education are responsible for children's education, which includes daycare for children from 0 to 3 years old, and pre-school for children from 4 to 5 years old. In addition, municipalities are responsible for "basic" education, which is divided into two cycles: elementary school (1st to 4th grade) and middle school (5th to 8th grade). Responsibility for high school (9th to 12th grade) falls under the state departments of education.

Basic education currently includes pre-school, elementary school, and high school, and has been mandatory for children aged 4 to 17 since 2013 (Law # 12.796/2013), in an effort to continue to expand the average number of years Brazilians study, which, according to PNAD (National Household Sample Survey) 2013, is 7.7 years for people above age 10, a higher average than the 7.1 years registered in 2008 by the PNAD (National Household Sample Survey).

Regarding the **financing** of education, states and municipalities are obligated to invest 25% of their revenue in education – an amount that is constitutionally defined. In order to distribute educational investments equitably to students throughout the whole country and to contributing to a greater standardization of policies federated policies, the federal government keeps the FUNDEB (Fund for the Maintenance and Development of Basic Education and for the Appreciation of Education Professionals). FUNDEB binds 20% of the annual revenue of the states and cities and redistributes it based on the minimum value to be spent per student on elementary education (ARRETCHE, 2014).

To help ensure the **permanence** of low-income children in school, the Federal government has implemented the “Bolsa Família”, an income transfer program for supplementing the income of poor families. Families whose income is lower than 140 reais per person a month (approximately 47 dollars) receive the benefit based on the quantity of children up to age 17, and one of the requirements of the program is that beneficiaries keep their children in school. According to the Ministry of Social Development and Hunger Alleviation, in 2015, 14 million families were beneficiaries of the program, receiving an average value of R\$ 167 reais per family (56 dollars, approximately).

Another highly emphasized aspect in Brazilian elementary education is its **evaluation system**, maintained by the Brazilian Ministry of Education which is considered *“superior to the practices followed in the USA and OECD (Organization for Economic Co-operation and Development) countries as to quantity, relevance, and quality of the information provided on the performance of the students and schools”* (BRUNS, EVANS, & LUQUE, 2012, p. 8), since it permits the regular comparison of the quality of the learning experience in any Brazilian school since 2007 by means of the Basic Education Development Index (IDEB). Since 2011, this information has been practically accessible to any citizen with access to the internet.

Such aspects of the Brazilian educational system indicate two important tendencies that establish themselves despite the country being federalist, with rules that establish prioritized responsibilities in elementary education among states and municipalities. The first factor is that, by means of diverse institutional arrangements, **the federal government aims to influence the agendas of the local governments, inducing the adherence to certain public policy trajectories, be it for its regulatory capacity, or its expense power** (LOTTA and VAZ, 2012; ARRETCHE, 2014). The second factor is that the advances in the indexes of quality in Brazilian education in the last years have benefited from the regulatory and financial role of the federal government, which has promoted consistent reforms for the structural improvement of the system (BRUNS, EVANS, & LUQUE, 2012).

The expectation, given the heightened economic growth in Brazil over the past years, is that the quality of elementary education follows this process, allowing a sustainable and long-lasting development, in sync with the progress that has been reached in other social areas in the country. Changes in the job market, including more intense requirements for skills and competencies related to problem solving, critical thinking, new forms of communication and cooperation, and a corresponding demand for digital literacy and dominion of new technologies, convey the expected transformations in the educational systems of the country.

1

IN SEARCH OF QUALITY BASIC EDUCATION

The results Brazil shows are still short compared to the OECD (Organization for Economic Co-operation and Development) teaching average and from Eastern-Asia, and there is no reason for any kind of complacency. However, few countries made faster or more sustained progress. (BRUNS, EVANS, & LUQUE, 2012, p. xx)

According to the 2012 PISA (*Programme for International Student Assessment*)¹ report – which tests students' skills in mathematics, reading, and science – Brazil has shown more consistent results and progress. The average performance in mathematics has improved from 356 to 391 points since 2003, which makes Brazil the country with the highest number of points gained in performance since 2003. In reading, Brazil went from 396, in the year 2000, to 410 points, in 2012, while in science, from 2006 to 2012, it went from 390 to 405 (PISA 2012).

Despite these improvements, these results place Brazil between the 54th and 60th positions in 65 countries. In all of the subject areas, the country has had lower results than Chile, Mexico, and Costa Rica. In Latin America, only Peru has scored lower in all of them.

Within Brazil, there is the IDEB (Basic Education Development Index), which, since 2007, measures and stipulates goals for the quality of elementary and high school education, considering the subjects of mathematics and Portuguese and goals by educational

¹ The Programme for International Student Assessment, PISA, began in 2000 with the goal of evaluating educational systems in participating countries in different parts of the world, testing the skills and knowledge of 15-year-old students in mathematics, reading, and science. Since the year 2000, more than 70 countries have participated in the exam. Taken from <http://www.pisa.oecd.org/>. Last accessed on: 01/20/2015.

networks and schools². Since the results are biannual, great expectations surround the release of the data, which allows a reading by state - in the case of high school - and by municipality or school - in the case of elementary education. The scale used goes from 0 to 10, and a 6.0 result is the long-term goal set by INEP (National Institute of Studies and Research), based on the performance from developed nations.

Today, high school is considered, due to its results in proficiency, attendance, and flow indicators, the main educational bottleneck in Brazil. It is for this level of education that the Brazilian Ministry of Education has channeled its most concerted efforts in recent years. In the first national-level initiative for distribution of mobile technologies for teachers, for example, the high school teachers were those provided with tablets.

The attendance rate for this educational level is still 85% - lower than the 100% determined by the Constitution. The age-grade distortion is highest at this level as well: In 2014, it was 28.2%, which is lower than the 44.9% registered in 2006, but still very high considering that more than $\frac{1}{4}$ of students who start high school do not complete it after 3 years.

Regarding quality, in 2014, the IDEB (Basic Education Development Index) for high school reached 3.4 - lower than the goal of 3.6. However, the quality of education in elementary school (1st to 4th grade) reached an average of 5.2, overcoming the goal of 4.9 in 2013, while in middle school (5th to 8th grade) registered at 4.2 - lower than the goal of 4.4.

This is the challenging scenario of Brazilian elementary education. The improvements to date, in terms of financing mechanisms, universalization of elementary education, reduction of age-grade

² The IDEB is a composite indicator which gathers two variables: the students' grades in standardized tests in Portuguese and mathematics, and the average passing rate of the teaching stage in question - elementary education (up to 4th grade) and middle school (up to 8th grade). The federal standardized tests are: SAEB (Brazilian Elementary Education Assessment System / Primary Education Evaluation System), created in 1997, which allows reading the data by unit of the federation, and the Prova Brasil (Brazil Test), created in 2005, which allows reading by municipality and school. The SAEB test is applied in a sampling manner in the final years of elementary and high school (4th and 8th grade in elementary school and 12th grade of high school), while the ProvaBrasil is a census and is applied only to those in elementary school (4th and 8th grade).

distortion, are very important and essential to give support to the challenges currently faced, but the performance of educational quality, be it in the IDEB (Basic Education Development Index) or in PISA (*Programme for International Student Assessment*), and the difficulty of system in elevating the performance of the students at the base of the pyramid to better levels (BRUNS, EVANS, & LUQUE, 2012), show the need for new approaches.

Graphs 2.1: Evolution of the IDEB (Basic Education Development Index) - Brazil

Source: QEdu with data from IDEP/INEP (2013)

In this scenario, a reform is in progress, guided in the National Education Plan (PNE), approved in 2014, with one of the actions addressing the quality of education being the increase of hours at the classroom. By 2020, the goal is that 50% of elementary schools and 25% of enrollments in high school are “integral” schools (i.e., full time), which puts even more pressures on the creation of more dynamic and welcoming school environments, with technologies and cultural and comprehensive activities that are integrated with the students’ everyday life.

Figures 2.1: CETI Eng. Sérgio Alfredo Pessoa Figueiredo and its surroundings, Manaus, Amazonas

Source: Amazonas State Educational Department

These schools are spreading. According to the “Observatório” from the PNE (National Education Plan), until 2013, 34.4% of the schools were already considered as being of integral education³. In São Paulo, there exist more than 180 units that integrate the high school curriculum in more than nine teaching hours a day. Even though they represent little more than 3% of the universe of schools in the state, the resources mobilized and the transformations to school environments achieved are notable.

³ Available on: <http://www.observatoriodopne.org.br/metaspne/6-educacao-integral>. Last accessed on 04/20/2015.

The discourse of educational quality comes with the demand for improved infrastructure and availability of resources in schools. In this scenario, digital technologies are often mentioned and, in the projects of new integral schools, they are always present, including the availability of mobile devices for teachers and/or students, the installation of smart boards in the classrooms, Wi-Fi in the common areas of the schools, and etc.

2 INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ACTIONS

2.1 ICT access among the Brazilian population, teachers, and students

Brazil has approximately 203 million inhabitants, according to the estimates from IBGE (Brazilian Institute of Geography and Statistics), and ICT access in the population has been gradually evolving. In 2014, there were 138 cell phone lines and 22 landline phone

subscriptions for every 100 inhabitants. Access to cell phones has grown. Four years prior, in 2010, these numbers were approximately 103 cell phones lines, and the same 22 landline phone subscriptions for every 100 inhabitants. (TELECO)⁴.

The rate of 1.38 cell phone lines per inhabitant is the result of the possession of more than one chip per individual, but research studies, that examine the proportion of possession in the population that account for individual user redundancy show that 85% of Brazilians own mobile phones (CETIC.br, 2014). Furthermore, 31% state that they use the internet on cell phones, be it via 3G or 4G mobile internet (75%), or Wi-Fi (62%) (Idem).

Regarding the possession of computers, 49% of Brazilian households have a computer, 63% of those are desktop computers; 57% are laptops or netbooks; and 12% are tablets. The migration to mobile devices, which has emerged in recent years, is very evident. In 2010, the number of households with computers was just 35%, with 88% of those being desktops and only 23% being portable computers (CETIC.br, 2011; 2014).

The internet is available in 43% of households, 66% of that percentage are broadband connections while 22% is via 3G or 4G mobile internet. The use of the internet, regardless of the location of access, reaches more than half of the population (51%), based on surveys that examine having at least one access in the last three months (CETIC.br, 2014).

The Brazilian population's access to ICTs is a good baseline for us to analyze the scenario of access for teachers and students in public schools⁵. Teachers have more access to computers and the internet at home compared to the general population and to students. The students, however, also have more access than the general population; they represent the group that uses the internet on cell phones the most.

⁴ Available at: <<http://www.teleco.com.br/estatis.asp>>. Last access on: 01/20/2015.

⁵ The research TIC Educação 2013 (Education ICT 2013) is conducted annually by CETIC.br. The data corresponds to urban city and state schools which represent the regular elementary education school units in all of Brazil. The interviewed students represent 4th and 8th grade students from elementary school and from 10th grade of high school. The teachers are educators (generalists) or conductors of the subjects Portuguese and mathematics. All of the data used for teachers and students considered the total of the public network. The data about internet use corresponds to students in 8th grade from elementary education and 10th grade from high school.

Graph 2.2: Access to ICTs among the general public and public school teachers and students

Source: Authors' creation with data from TIC Educação 2013 and TIC Domicílios 2013 (CETIC.br)

As for the types of device, the three groups display similar tendencies in possession, but the teachers have greater access to desktop computers and tablets than others. While 48% of them say they acquired the tablets with their own resources, 45% received theirs from the government.

Graph 2.3: Type of household devices among the general public and public school teachers and students

Source: Authors' creation with data from TIC Educação 2013 and TIC Domicílios 2013 (CETIC.br)

Graph 2.3: Mode of device acquisition among teachers in the public network

Source: Authors' creation with data from TIC Educação 2013 (CETIC.br)

As for the frequency of use, teachers from the public network stand out for higher daily internet use: 88% state they use it every day, having a higher rate of access in 2013 than in 2011, when 79% stated the same – an increase in use that is in line with the trends for the general population from 2011 to 2013.

Graph 2.4: Daily Internet access among the general public and public school teachers and students

Source: Authors' creation with data from TIC Educação 2013 and TIC Domicílios 2013 (CETIC.br)

2.2

A quantitative snapshot of ICT access in schools

*There is a national call for the necessity of inserting information and communications technologies (ICT) in schools and in teacher training. The National Education Plan (PNE) 2014-2024⁶ - which establishes educational goals for the country and provides guidelines for the design of state and municipal plans, as well as the definition of budgets - mentions educational technologies as a strategy to reach the promotion of basic education, as well as others, and establishes as a strategy, "to universalize access to the world network of computers in high speed broadband by the fifth year of this PNE (National Education Plan), and triple the student/computer ratios in basic education in the public network by the end of the decade, **promoting the pedagogical use of information and communications technologies**" (EMPHASIS ADDED).*

Aside from the access to the infrastructure, the Plan's literacy goals for children up to second grade of elementary school, mentions stimulating the initial and continued training of teachers, "with the knowledge of new educational technologies and innovative pedagogical practices".

Although the PNE (National Education Plan) displays a view of digital technologies in the school environment are seen as allies to improve the quality of the teaching-learning process, the question of **how** its integration should be done is left largely undefined while also focusing on the **process** - incorporating ICTs in pedagogical practices-and not on the results - learning. In individual actions, frequently with the support of the federal government, municipal and state networks have experimented with implementations, starting

⁶ Available at: <http://www.planalto.gov.br/CCIVIL_03/_Ato2011-2014/2014/Lei/L13005.htm>. Last access on: 04/21/2015.

out by buying mobile devices to complement the equipment distributed by ProInfo, which we will approach in the next section.

According to TIC Educação 2013, only 57% of the public schools studied had an adequate electrical grid to connect several devices simultaneously. This information is important to understand other very high figures on device availability.

Among the public schools, 99% have computers, and in 85% of them, this equipment was installed in a computer lab, and 6% in classrooms, **which shows the broad range of ICT policies of schools** carried out until now. Aside from that, 95% of the public schools state they have access to the internet; 94% have wired broadband, and with 5% depending on mobile internet as the primary mode of connectivity

The available internet speed, however, as well as the electrical grids of more than 40% of the schools, is still not adequate for mobile learning. Half of the schools have a connection of up to 2 Mbps, while only 8% of the schools stated having a connection higher than 8 Mbps, as can be seen in the following table. As a basis of comparison, in the United States, the State Educational Technology Directors Association (SETDA), recommends that the speed is, at least, 100 Mbps for every 1,000 students and employees for the 2014-2015 biennial, and increases the recommendation to 1 Gbps considering the same quantity of users in the years 2017-2018 (FOX, WATERS, FLETCHER, & LEVIN, 2012).

Table 2.1: Internet connection speed of public schools

	Up to 2Mbps	More than 2Mbps to 8Mbps	More than 8Mbps to 10Mbps	More than 10Mbps	Does not know/ Did not answer
Public schools	50%	9%	4%	4%	32%

Source: Authors' creation with data from TIC Educação 2013 (CETIC.br)

Tests carried out by the TIC Educação have allowed for more precise evaluation of connection speeds and have confirmed the limited connectivity. Out of the 525 schools tested, 73% had a measured connection of up to 2Mbps, and only 10% were above 8Mbps (CETIC.br, 2014).

Box 2.1. Internet speed in Brazil is in 87th place in a global ranking

It is important to point out that internet speed is a national issue. Brazil is in 87th place in a global ranking, with an average of 2.6Mbps, while countries with higher averages reach 23.6Mbps (South Korea), 14.6Mbps (Japan), and 13.3Mbps (Hong Kong). The average speed, considering all of the countries that were measured, was 3.9 Mbps, and several countries in Latin America present better average connection speeds than Brazil, including Uruguay (4.3 Mbps), Ecuador (3.3 Mbps), Chile (3.3 Mbps), Argentina (3.2 Mbps), Columbia (3 Mbps), and Peru (2.7 Mbps)¹.

¹ Available at: <<http://www.fucapi.br/tecnologia/2014/07/01/brasil-fica-em-87o-em-ranking-global-de-velocidade-media-de-internet>>. Last accessed on: 04/23/2015.

Even with this speed, 71% of public schools report having Wi-Fi. As we will see in chapter 5, such wireless networks have often been installed without proper planning and end up having access limited to some areas and people at the school, like the teachers' lounge, or end up having very limited functionality.

Due to this scenario regarding the availability of the internet and equipment and the low quality of connections, teachers and students typically access the internet outside the school, especially at home, as can be seen in graph 2.5.

Graph 2.6: Most frequent location of access to the internet by public school teachers and students

Source: Authors' creation with data from TIC Educação 2013 (CETIC.br)

The current scenario encountered in schools regarding the relatively high availability of equipment, especially when we consider the size of the country, is the result of federal government actions since the 1990's, (i.e., ProInfo). It is important to understand the historical trajectory of this program since, in public administration, the first steps are much more important than the last ones for us to better understand the results of public policies (PIERSON, 2004), and exert an important influence in subsequent ones. There is no doubt that we can see continuities and vestigial consequences from ProInfo and the program's initial strategies in contemporary policies and initiatives.

2.3

The National Educational Technology Program (ProInfo)

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“Our goal is to fulfill the directives of decree 6.300.” (Federal Government)

ProInfo (National Educational Technology Program) is the federal-level action that focuses on placing information and communication technologies in Brazilian schools⁷. Coordinated by the MEC's Department of Basic Education (SEB), with logistical, technical, and financial support from the FNDE since 1997, the program seeks to place ICTs in schools and promote its pedagogical use in the public network of elementary and high school education. From the point of view of local administrators, ProInfo is especially known for equipping schools with computers (ProInfo labs), and for making it easier to purchase equipment for municipal and state education networks, by bulk purchasing agreements, along with tax exemptions from the government for certain equipment. Among the devices encompassed by the program in the last four years are educational laptops, from the ‘Um Computador por Aluno’ (One Laptop per Child)⁸ program, the interactive computer (a technology developed by the government in partnership with universities), smart boards, and tablets.

Figure 2.2: Models of the educational laptop, interactive computer, and tablet made available through ProInfo.

Source: Internet

⁷ The most recent legislation of the program is Presidential Decree Number 6,300 from December 12th, 2007.

⁸ Instituted by Law 12,249, from June 11th, 2010.

There has been a noticeable shift in ProInfo in recent years towards a focus on mobile technologies and on the introduction of technologies in classrooms, in addition to the ProInfo labs comprised of desktops. In parallel, through ‘ProInfo Integrado’ (Integrated ProInfo - National Continued Training in Educational Technology Program/National Program for Continued Training in Educational Technology), the federal government also provides courses for educators and technicians of the elementary education networks.

If we consider the four pillars of a policy for technology in education, ProInfo addresses the financing and easing of the purchase of equipment, as well as the availability of content, involving a database of educational tools, a site with public domain projects, the educational programming channel TV Escola (School TV), and the Portal do Professor (Teacher’s Portal), as well as making available training courses for teachers.

Our research shows, however, that **ProInfo has not been prioritizing the provision of directives for local administrators and systemic and structured planning to achieve its goals has not been evident**. ProInfo, facing all of the transformation caused by its own program of consistently increasing ICT access in schools, has sought to expand their actions to involve not only fixed technologies, but also mobile ones, and not just schools, but teachers as well. The focus, however, due in part to the absence of a plan to guide its actions – there is only one decree from 2007, a very different moment than the present – continues to be on processes rather than results, and on the equipping of schools, with responsibility for the integration of equipment for pedagogical practices being in the hands of municipal and state departments.

On one hand, this preserves the autonomy of the states and municipalities to create their own policies, while at the same time influencing them by the equipment and financing at their disposal; however, it limits control over the investments made. **Discontinuities**

at ProInfo are common and noted by local governments, since its priorities change as directions change. This brings negative consequences, since some actions end up not having time to mature and deliver results.

A consistent monitoring and evaluation plan has not been identified as part of the formulation of the actions of ProInfo. Even if there are evaluations in progress and that have been carried out – like the one carried out in the UCA-Total step from the “Projeto Um Computador por Aluno” (One Laptop per Child Project)⁹ – they are project-focused, without integration into a bigger plan which causes a chain reaction for the several actions in progress. Aside from that, Lavinhas and Veiga (2012) draw attention to the lack of use of previous surveys and studies in planning and the fact that the technicians from the federal government are not very receptive to negative results.

The respective roles and functions from the FNDE and the MEC are not totally clear in the program for the departments of education. When we request indications from local administrators of ProInfo, the common orientation is to speak to technicians from the FNDE, renowned for their longstanding involvement with the program. These are commonly sought out by local technicians from the departments and schools, although MEC is the policy coordinator.

Perhaps because the actions which have been carried out by ProInfo have had more of a technical scope than pedagogical one, since they are more visible in financing the acquisition of equipment and technical support to help performance, and there are no programmatic directives which give support to the adoption of devices, the MEC has its role reduced before the FNDE, with this pedagogical function becoming a responsibility of the departments, with support from the Educational Technology Nuclei (NTEs).

⁹ This step was carried out in six Brazilian cities, with the distribution of laptops to all of the city and state schools, and all of the students. The research was engaged by a department of the Presidency, the Department of Strategic Matters (SAE), and not by the Brazilian Ministry of Education.

2.3.1

The Educational Technology Nuclei (NTE)

The Núcleos de Tecnologia Educacional (NTEs), Educational Technology Nuclei, are decentralized structures that serve as coordinating bodies of ProInfo at the local level. They are linked to the departments of education, with a coordinator in each state for the state network and a municipal coordinator per state, linked to UNDIME, (National Union of Municipal Secretaries of Education). The main role of the NTEs are to act in teacher training; however, in documents, the expectation is to also give pedagogical and technical support to schools, including in the development of projects for the pedagogical use of the ICTs, in the follow-up and support of this use, and in the research and dissemination of educational experiences. “Interacting with the Regional Coordination from ProInfo and with the National Coordination of the Program at the MEC, in the sense of ensuring homogeneity in the implementation and success of the Program”¹⁰ also appears as their functions.

To be created, an NTE must have a coordinator, a trainer, and a technician, hired by the local government, aside from a physical structure, normally equipped by the MEC. According to the directives, an NTE should support 10 to 25 schools, depending on the condition of the territory of which it is being implanted. The state and municipal governments can give more or less attention to these requirements, creating latent regional inequalities.

We have 867 NTEs (Educational Technology Nuclei) today. Three states have almost 50% of the NTEs (Educational Technology Nuclei) and are in the south and southeast. In the north, there are states which have 4 NTEs (Educational Technology Centers). (Federal Government)

What this research shows is that there are NTEs with many difficulties in carrying out their functions, mainly due to the lack of human resources. The expected proportion of service per NTE does not happen – which creates less capacity to carry out extensive activities. The scope of the centers ends up being limited to technology trainings, however, restricted in reach, given the number of trainers they have¹¹. **Also as a consequence of the limits of its**

¹⁰ Can be read at: https://www.fnnde.gov.br/sigetec/upload/manuais/cat_crit_NTE.doc. Last access on: 12/26/2014

¹¹ The state department can be mentioned as an example, with only one NTE to service approximately 500 schools, counting on 5 trainers and two maintenance technicians to do so.

institutional capabilities, the NTEs eventually carry out localized activities, that are sparse and of limited effectiveness, which, for more attentive administrators, shows their shortcomings. ■

At the same time, what draws attention is the siloing in teacher-training programs that the presence of the NTE has incurred in states and municipalities. While there are training schools, or departments responsible for training in traditional school curriculum subjects (Portuguese Language, Mathematics, Science, etc.) at the studied departments, the training for ICTs is the responsibility of the NTE. With structures that are typically limited and unconnected from the schools and training departments, the NTEs end up having a low success-rate in integrating ICTs into the curriculum.

It becomes evident that the actual training structure (NTE versus subject training), influenced by the model introduced by the federal government at the end of the 1990's, ends up being responsible for discriminating the conception of ICTs in its pedagogical use thereby limiting actions for mobile learning, as we conceive them.

Some NTE coordinators, who have noticed this negative effect, have tried to build stronger relations to training centers; however, once the local actions are constituted, they depend on an agreement from both parties, without the mediation or direction from a policy that encompasses the department as a whole.

In addition, as a result of the lack of structure, the NTEs do not necessarily have an important role in the local policies, which can develop in isolation from these centers, given the distance between the pedagogical sectors of educational technology and the NTEs within decision-making spaces about ICTs and infrastructure within the local executive. ■

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We have an NTE that I consider very active, it has done several projects... Usually, I end up neglecting it a little... Because it's like this: you buy 400 tablets, it is a traveling business, you put the tablets in a different school each time and do a project and everything. One thing that is hard for me to see is the result. What is the point of all this, what are you going to achieve with this, how are you going to ensure the way this technology gets there and what is it going to contribute to the students' learning in these schools? (Administration, City)

”

There are 4 of us, but the focus of the project is very concentrated on myself and someone else... So, it ends with us unable to handle what we would like to, which is thinking about the public policies, encouraging discussion about it, following up on the work that goes on at the schools. (ET, City)

”

Teachers are the ones in the departments, we are not others, we are the same, and we need training as well... The administrators are teachers and are not trained in administration. It is very hard, and sometimes the decisions do not depend on us alone, there are higher levels than ours. (ET, State)

We do not need to have an NTE. We need policies that think of the use of technologies in education regardless if the NTE is going to be there or not. With this, I think about training, distribution, maintenance, substitution, electronic waste. There are states that establish that a technology is going to be used for two years and then they are going to have to change it. And in these two years, it has to be used and evaluated. There are states that do this, and states that don't.

(Federal Government)

The atrophy of the NTEs over the years has not been a target of action of the federal government, and their meetings have become less and less frequent. Although there is a perception, on a federal level, about its minor importance, they stay in operation, giving the impression to local directors that the matter of technologies is being coordinated by the federal government. Since the federal government considers this as a responsibility for the local governments, we have a gap to fill, but for this, it has to be acknowledged as a problem first, which has yet to be the case.

We underscore, therefore, the need to rethink the functions of the NTEs in view of the initially established goals. It is necessary to consider that the existence of these centers, whose operation has fallen short of expectations, contributes to the continuing segregation of ICTs from the curriculum, since the NTE lack integration with the traditional training structures.

2.4 Articulated Action Plan (PAR)

Complementary actions on the federal level in the operation of states and municipalities are established in the All for Education Commitment Plan (Plano de Metas Compromisso Todos pela Educação)¹², where a pact for the improvement of educational quality is defined, to be periodically evaluated by the IDEB (Basic Education Development Index). As one of the instruments to establish the connection between demands from local and federal governments, the PAR - Articulated Action Plan - was created.

¹² Instituted by Decree number 6.094, from April 24th, 2007.

The PAR is the group of articulated actions developed to receive technical or financial support from the Brazilian Ministry of Education, aiming to fulfill the Commitment Plan. For technicians from the FNDE, the PAR has operated as a powerful tool for mapping the demands from all federated entities. If an item is recurrently called for in the PAR, the federal body may take actions to help purchase that product at a low cost. Among some local administrators, the expectation is that the PAR will also work as a tool that contributes to administrative continuity, as it is a register of intended actions and is financed by the MEC.

In short, it is a pact that links local government plans to the need of federal financing. However, there is no monitoring by the federal government to ensure that the proposed action and complementary commitments are being fulfilled or not.

It was through the PAR that the federated entities indicated the quantity of tablets they would like to purchase for their educational network and received resources to directly acquire the equipment through approved vendors, after the bidding was carried out by the federal government in 2012. The resources are transferred to state or municipal accounts and is their responsibility to establish a contract with the companies and administer the purchase and delivery.

The local governments have the autonomy to request, or not, financing via the PAR for any purpose, including for the tablets. However, all of the Brazilian states made such a request and adhered to the pricing established. Among the reasons for this is the fact that if a local administrator chooses not to adhere, essentially they are indicating that their government is renouncing this sum, since it is an available federal resource and limited to this specific purchase.

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We are the ones [who adhere], but we are also not going to miss the opportunity. We know that resources are not always available, there aren't resources to buy thousands of tablets, I am not going to have that, only the Federal Government does. Now, this is pre-established, either you buy a complete set or you get nothing. Either you get this television, even though the space you have is for a different kind of television, or you get nothing. We have to make some adaptations. (ET, State)

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The federal government determines which are the projects, and the states adhere to them. There was the technology project and you could ask for tablets, and nothing else. At the time we needed projectors and Wi-Fi, but that's not possible, you have to ask for what they have, if you don't, you don't get it. (ET, State)

Therefore, due public opinion, of comparison or with other entities, or of resources available to invest in mobile technologies, such a renouncement is an option given little consideration.

As we will see later, such an institutional design has important impacts for the implementation of public policies at a local level, since the equipment has arrived before the planning of actions, causing them to, most of the time, be underused.

The actions for the integration of mobile technologies at schools have developed from the history of these policies, their results and their institutional memory. Before going into detail about them, we provide a synthesis of the current situation.

2.5 Current situation of the actions from the "ICT in Education" approach

Figure 2.3: Current situation of actions from the "ICT in Education" approach

Source: Authors' creation based on Severín (2010)

Despite the efforts made during the over fifteen years since the creation of the first Brazilian technologies in education program, according to this research, the scenario of ICT policies in public education can be found in the first stages of its development, when viewed through the interpretative model of public policies described by Severin (2010).

The **infrastructure**, which includes the physical structure like the electrical grid and furnishings, as well as connectivity and its technical support, is characterized by its restricted access to students and teachers at schools. The computer labs and, more recently, mobile technologies exist, but are underused or rarely used, while access to broadband internet is, typically, restricted to the administrative area, making it a rare to have free Wi-Fi access for the entire school, since the available speed is usually slow. The provision of mobile internet through the departments, on the other hand, is ad hoc.

Box 2.2: The indicators of access to infrastructure may overshadow the lack of indicators of use

Access indicators are not synonymous with use. As discussed in previous sections, while 99% of teachers and 98% of students in public schools are users of the internet¹, only 9% of the teachers and 7% of the students stated that the school was the location where they accessed it most frequently. Furthermore, the fact that 95% of schools report having access to the internet does not mean that the speed corresponds to the needs of the entire school community, as we will see more in-depth in chapter 5. At the same time, if 85% of schools report having computer labs and in 84% of them the labs are reported to be used, the frequency and regularity of use tend to be lower than this figures suggest and is restricted to some teachers, as we will see in chapter 8. The same occurs in 82% of the schools that report that teachers use the internet for pedagogical purposes. Because there is a very strong urge to have teachers use the digital technologies available in schools, they are utilized, but without sufficient understanding of or attention to the educational outcomes of their use, the number of teachers that use them, or the frequency of their use.

¹ Used the internet in the last three months prior to the research TIC Educação 2013 (CETIC.br, 2013).

Digital content has been developed in a decentralized manner, with the public and private sectors operating in parallel and also together – a fact that has noticeably increased the offer of platforms with educational content, games, and support programs for learning. Educational sites from the departments of education show an increasing variety of content, including virtual learning objects like video-classes, class planning, blogs, etc. There has also been an increase in the number of organizations that produce educational software. **The difficulty remains, however, in the integration of ICTs in the curricula**, not only in terms of competencies, but in terms of achieving transversality of technologies with disciplinary content. In addition, the frequency of content creation and the reconstruction of learning objects in collaborative ways are limited – although the authorship tools, as we will see in chapter 6, have had increasing demand. Finally, education is still centered on the teaching staff.

The teachers, **who form the human resource base of the educational departments**, are developing their ICT skills via private training or in-service training. In the first case, the main means are private courses for the use of tools and not specifically for pedagogical use, as well as the help from relatives and friends. In the second case, they are courses provided by the departments in which they operate. Initial teacher trainings, do not incorporate the practice and pedagogical use of ICTs, making it more common to have just one subject on the matter, as an addendum to the curriculum. In general, there is no local pedagogical support for the integration of the ICTs in everyday life at school, resulting in a heterogeneous universe of educators, with teachers commonly making limited use of technologies in the teaching-learning process, as will be discussed in chapter 8.

Box 2.3: The current approach to training of teachers calls for the need to rethink existing models

The survey data available (CETIC, 2013) indicate that 48% of teachers in the public network have learned how to use the computer and internet by themselves, 52% took specific courses, and 20% have relied on the help of relatives and friends. Among those who have taken courses, 78% paid to do so. Only 22% took courses provided by the government and 11% took courses provided by the school.

In addition, 53% of teachers in the public network indicated that they have not taken any specific courses about computers and the internet in their initial college education. In addition to this low percentage, it is important to point out that a course taken as part of the curriculum for initial training will rarely develop the educators' capacity to rethink their pedagogical practices with ICTs – in a manner similar to the limited impact a disciplinary course in the basic education curriculum will have on teaching-learning context.

An important variable in analyzing the teacher trainings is the type of approach used in the courses that teachers have attended: if these are oriented towards tools (learning to use the resources in a basic manner) or focused on pedagogical tasks of the application of ICTs in the teaching-learning process.

At the same time, teachers report having received support for skill development from trainers from the department (33%), computer teachers (23%), and work groups formed at the school (20%). The type and frequency of support which we encountered in this study, even in networks that have the support of technicians, shows a limited individualization of services and, because of the quantity of schools they serve, and a limited frequency of support necessary for the development of longer term planning. We will approach these topics in chapter 7.

In conclusion, the **ICT policies in education** are typically partial and generic, characterized by a casual and experimental development, and do not consider the pillars that should structure initiatives in an integrated manner. There exists a lack of policies or budgets with long-term horizons, with projects typically being ad hoc. In addition, guidelines and policy documents that establish norms in the field of ICTs in education are lacking or underdeveloped.

This is the context in which mobile learning policies develop.

PART II

MOBILE LEARNING IN BRAZIL

CHAPTER 3

THE POLITICAL DIMENSION AND THE AGENDA

1

DECISION-MAKING AT THE FEDERAL LEVEL

In the decentralized model of education in Brazil, different decision-making levels coexist, including Federal government agencies in addition to state and local governments.

Figure 3.1: Key agencies and departments involved in decisions involving digital technologies in education

Source: Authors' creation

When it comes to technology, there are different institutional arrangements involved in the actions of the central government together with federal agencies. There are actions that occur in direct relationship with the schools, and those that go through the coordination of education departments.

The acquisition of tablets in 2012 and 2013, through a Federal Government prices registration policy, was an action carried out with the Education Departments via PAR. The departments defined their priorities, were given the funding and made purchases directly from the companies that won the tender at the Federal level. The purchase of other equipment may occur in parallel and directly by Local Governments.

In the case of providing Internet access, the arrangement does not include Education Departments, reaching the schools directly through the action of the Ministry of Communications and the operators for the Broadband Plan in School (PBLE) - parallel to government programs in this local area.

The focus of this section is to understand how the mobile learning agenda has emerged in the country, its management aspects and the federative relationship that involves these actions.

1.1 The batch purchase of tablets for high school teachers

In recent years, mobile devices have been highlighted in the actions of ProInfo, drawing attention to the choice of equipment occurring at the highest levels of government. Lavinias & Veiga (2012) point out, for example, that it was an initiative of the former President

Lula da Silva in 2005, the decision and the public commitment with Nicholas Negroponte¹ to the project for the distribution of low-cost **laptops** to students, known as the ‘One Laptop per Child Project’ - it was a strongly rooted program at the presidential level, in order to expedite its implementation.²

In the case of **tablets**, according to our interviews, it was primarily the enthusiasm and the propensity of the former Minister of Education for new technologies that, starting in 2008, resulted in the mobilization of the FNDE to evaluate the market and the definition of possible equipment appropriate for elementary school students. The initial focus was to have low cost devices with electronic book reader function (e-reader).

According to the normal flow of information, the MEC asked the FNDE what the future device should contain to meet an educational use, for example, watching a video lesson from the Teacher’s Portal. The more technical specifications concerning the device configuration are the FNDE’s responsibility.

Increasingly frequent studies to evaluate models and equipment have been made through partnerships with federal universities, accompanied by the coordination of the MEC’s ProInfo team and the FNDE. The specification of the first tablet model to be part of a MEC’s bidding was completed in mid-2011, when the specifications for the tender were started. Only in 2012, four years after the first analyzes, the bidding considering tablets as part of the One Laptop per Child Program (PROUCA) was finalized.

That same year, a **ministerial change** lead to a change of the target audience for the use of tablets, which again shows the **level of centralization of decision-making**. The target public shifted to high school teachers, instead of students. The rationale was to promote teacher access to ICTs as a support tool for research, as the

¹ Nicholas Negroponte, a professor at the Massachusetts Institute of Technology (MIT), is the founder of the nongovernmental organization One Laptop per Child (OLPC), which developed the XO laptop model aimed at children and initially released as the ‘\$ 100 laptop’ - a value that, in the end, was between 300 and 350 dollars per unit in Brazil.

² For more information on the UCA, see chapter 5, item 2.5.7.

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The idea was to use the tablet to give the teacher the possibility to access resources produced by the MEC, which he/she wasn't able to use in the classroom before, because he/she had no equipment. With his tablet, linked to his CPF, he can, for example, connect to the ProInfo projector and present a video of TV Escola to students.

(Federal Government)

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The aim of the tablet was to give mobility to the teacher and give him the possibility of studying and conducting research.

(Federal Government)

latest technologies are already present in the school due to student initiatives. It is understood that the equipment already included in the bidding is compatible with the new target audience, but **the expected use of the new tool in terms of educational policy was not defined clearly and publicly.**

As you can see in the quotes, amongst the technicians responsible for defining the equipment at a federal level **there were different and complementary interpretations and expectations on the use the tablet would have when reaching teachers.** No public document was created, at all, to point out the objectives of use since the federal government positioned itself as a financier and catalyst for the “computerization of schools”, leaving it to the local school systems to create the settings for teaching use.

Despite the federal government’s attitude of not addressing the use of the equipment, there were expectations going around. Other technicians believed that the main function of the tablet would not be to connect to the Internet, given the connectivity constraints in the country. Thus, the tablet would work rather as a mobile repository, accessible to teachers, where access to the Internet would be useful to load it with the necessary information for later use.

The different opinions concerning the formulation are trying to show the effects that the absence of a plan can cause to sediment and guide a goal. When implementing, teachers, beneficiaries, who receive the task to define the use of the equipment in the absence of a prior plan of their own departments, are adding to these new insights, forming a little coordinated scenario of ideas and expectations.

1.1.1

The definition of the first models

The two tablet models, 7 and 10 inches, object of a tender in 2012, relied on the minimum specifications of a 1GHz processor, 512 Mb RAM, 16 Gb HD, back camera with 2 Mp resolution and front camera with VGA resolution of 640 x 480 (same resolution for recording). Regarding connectivity, tablets with Wi-Fi without support for 3G Internet were chosen.

For the selection of the models placed in this first call, aspects such as commercially available products, production capacity of enterprises and costs were reported by respondents as strong factors in decision-making. Concerning the connectivity of tablets, which did not consider mobile Internet and was limited to Wi-Fi, the decision was based on the information that, at the time, only around 1800 municipalities³ had 3G Internet, which would not justify the higher investment.

1.2

Unaddressed pillars: content and teacher training

It is important to highlight that **the focus of the federal government's action in the procurement of tablets in 2012, was the acquisition of hardware**. Specific actions focusing on content and teacher training were not developed – those actions were considered to be the responsibility of local governments.

³ This is equivalent to approximately 1/3 of the municipalities in Brazil, currently with 5,570 municipalities.

In the 2011 notice analyzed⁴, there is no mention of specific programs or educational content to be made available, although there is a concern specifying that the tablet should have software that allows reading electronic books (e-books), files produced in a text editor, spreadsheet and presentation software, besides ensuring access to e-mail, YouTube, Google Maps, and applications for writing and drawing.

In the latest bidding, held in 2013, to continue the deployment of tablets in schools, the focus on hardware remained.⁵

With regard to teacher training, the “Integrated ProInfo” offers general courses, including, for example, Introduction to Digital Education, Project Development, Learning Networks and One Laptop per Child Project (UCA), but none was specially developed to accompany the reception of tablets on education networks.

At different levels of government, the consensus is that, under the scope of ProInfo, to provide digital content and teacher training is the responsibility of local governments, given the existing federal and decentralized relations, including in the formal education curriculum. As we shall see, the difficulties of the federal entities to cover such needs are many.

From the point of view of the management role of the federal government, whether by monitoring the progress of the content and training pillars in the local government in order to release the funds for hardware acquisition, or by creating lines of action to support local governments in these areas, an action seems necessary. Among other strategies, one can act by consolidating the common problems faced by states and municipalities, providing technical assistance to guide actions in these fields, leading discussion forums and implementation of programs, etc.

⁴ Electronic Auction Notice N° 81/2011 of the National Fund for Education Development (FNDE).

⁵ Electronic Auction Notice N° 63/2013 of the National Fund for Education Development (FNDE).

By focusing mainly on the “computerization of schools”, aiding the acquisition of equipment, and choosing to outline a policy more timidly addresses the pillars of training and digital content, the federal government fulfills possible efficiency indicators, as the tablets have come to teachers, but does not promote advances for state and local governments to achieve the effectiveness of their actions and consistent mobile learning policies. Nevertheless, the federal government is a major player and has great influence on the implementation framework of the new devices currently in public schools.

1.3

Connectivity: the Broadband in Schools Program (PBLE)

In the field of infrastructure, The Broadband in Schools Program (PBLE) aims to connect urban public schools to the Internet. It is direct federal action in schools. Launched in 2008, the PBLE resulted from a change of obligations for the operators that have a concession for fixed telephony operation. Instead of installing telephone service stations (public telephones), as required by a previously signed term, they begin to take responsibility for the installation of Internet connection infrastructures for high speed in the cities, and for connecting urban public schools with the best locally available connection. This agreement covers all the Brazilian municipalities and all urban schools mapped by the MEC's Education Census. According to the program, the services provided should be extended free of charge until the year 2025.

Besides the Ministry of Education (MEC), the management of the program involves the National Telecommunications Agency (ANATEL) - responsible for monitoring the established goals - the Ministry of Communications (MiniCom), the Ministry of Planning (MOP) and the Departments of State and Municipal Education.

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We have the MEC link, of the Broadband in Schools project. They put broadband in all schools and didn't tell anyone ... The company technicians would arrive and say: 'I'll put the link here', it was something like this. The link is there. It began in 2008, today we have it in almost all [the schools].

(IT, State)

”

The federal government launched the Broadband in Schools program, and we already had fiber optics. In our network we launched with all the logistics and security and, when broadband came to us, it was a problem, because it was a second connection that came without security, and brought that lack of security into our network. We went to talk to the MEC to readjust the broadband in the state, because, as we have a network, the intention was that this investment could have increased our band on the same network. But this was not possible, it's all very closed and they don't hear the opinions of partners, in this sense it is very bad.

(ET, State)

”

*There is the Broadband in Schools Program, and the deadline [for the operator that won the bid] to place the antenna in all schools ended 2 years ago. **(Administration, State)***

”

*Some schools connect computers to that link. They hire some guy and have him install a local network ... With funds from the APM [Parent Teacher Association] they can do it. **(IT, State)***

As stated by the IT managers from the surveyed departments, the information flows and the management of the parties involved in PBLE are quite deficient. Among the problems faced are: non-compliance by operators of agreed targets, requiring the application of legal proceedings, including fines; the installation of Internet points in the area outside the school without the department of education's knowledge – a situation that causes the signal to be unused for a while, besides the lack of communication regarding each department's connectivity needs.

Some schools, with their own resources, have also taken on the task of installing the link in their facilities when they are aware of the resources, but, as we shall see in Chapter 5, without proper planning.

Another important aspect concerns the monitoring of the program. As stated above, the fact that the Internet access point has been installed by the operator does not indicate that the school is effectively connected, and the monitoring reports do not cover the installation completed at the school, but the available link⁶. Also, if the school was able to connect to the link of the PBLE, there is missing information about the availability of the connection, which, due to its speed, may be available only for administrative purposes and not for educational purposes, for example.

In large capitals, the PBLE connection can be complementary to the existing connection in some schools and may be underutilized because of it. Local departments are in charge of defining the conditions of use of the new connection and, in the absence of such guidance, the school has autonomy to act, but, overall, there is no monitoring.

⁶ Follow-up reports are available on: [http://www.anatel.gov.br/Portal/exibirPortalPaginaEspecial.do?acao=&codItemCanal=1957&codigoVisao=\\$visao.codigo&nomeVisao=\\$visao.descricao&nomeCanal=Universaliza%E7%E3o%20e%20Amplia%E7%E3o%20do%20acesso&nomeItemCanal=PBLE&codCanal=289](http://www.anatel.gov.br/Portal/exibirPortalPaginaEspecial.do?acao=&codItemCanal=1957&codigoVisao=$visao.codigo&nomeVisao=$visao.descricao&nomeCanal=Universaliza%E7%E3o%20e%20Amplia%E7%E3o%20do%20acesso&nomeItemCanal=PBLE&codCanal=289). Last access on 11/12/2014.

1.4 Problems

1.4.1

The centralized purchasing via federal government impacts the decisions of local governments

The benefits to local governments for adhering to ProInfo's certificates of price registry are many: transfer of the costly bidding process to the federal government, savings in the price of equipment and the safety of acquiring equipment already evaluated by experts from the federal government are some of them. Such benefits, linked to institutional purchase arrangements that will be discussed later, eventually show a high influence of the federal government in the agenda of local governments in terms of policies for digital technologies in education, given its regulatory authority and purchasing power.

Through centralized purchasing, the MEC together with the FNDE, have contributed to the encouragement of investments of local governments in certain policy areas, focusing on hardware...

However, one very important factor is that the arrival of mobile equipment to a school's network is unlikely to change its characteristics if a policy that covers all the necessary pillars of mobile learning is not formulated.

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The Ministry makes a public hearing. It takes previous research to adapt the equipment to the pedagogical field. Therefore, it's much easier because, as they have several researchers who do all this, it already makes it much easier. So I ended up choosing not to bid here and join nationally instead. You get the equipment for teachers and then you can also buy [with resources] from the Ministry itself, or purchase under BNDES funding, which has such a credit line both for the teachers and the students. (Administration, Municipal)

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The MEC's role is that of an inductor. It is up to the state and local government to make the decision. When the MEC makes a decision, for example, as it did recently, releasing tablets for high school teachers with funds from the federal government, it is simple: the state adheres, the MEC transfers the resources to the public expense and makes the contract with the company that won the bidding. In that case, it is the MEC as an inductor that is backing the technology at first. Recently, we published a new edict for tablets and it is now up to the states and municipalities, if they want to join, to buy the tablet for that price, which was established on the certificates of price registry, with their own resources. In that case, it is the MEC that makes things easier for municipalities, because it has a greater bargaining power with the private institutions that will provide the equipment.” (Federal Government)

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The tablet [from the federal government] is not for everyone, but only for high school teachers. Then, afterwards, a state program decided to also consider elementary school teachers. (Administration, State)

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It's better for us to stay in line with what the Ministry is working on than to try to stand on our own. Since they have the computer lab, they already change the equipment; they already have an entire work plan in that area, so I think it is better that we work in the same line. (Administration, Municipal)

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“Just due to the fact that the MEC encouraged high school teachers to have them, some networks have already begun to think about expanding the purchase, with their own resources, to other teachers of the network and to the students themselves.”

(Federal Government)

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We considered that the notebook for the teacher would be better than the tablet, due to the features it has... For example, we have teachers who might not have computers at home, and then the notebook would be better... It will store more data. So, at that time, we thought about it. It was not a formal consultation... but, listening to that teacher, the notebook was clearly needed. [Only] that, today, we cannot buy it yet. But now the idea is within the PAR. We have a forecast for the purchase of nine thousand tablets for teachers. We have this notebook process being handled internally and the tablet in the PAR. What we get first is what the teacher will receive. (IT, Municipal)

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For this here [the tablet] to actually be useful, it needs to improve its usability. I need to create more user-friendly interfaces. Technology is fast, so I bet on the question of time... Today you have IDE - Interface for developer, to [program], write the code - which runs for mobile. Only it's just awful. [Students] want to do something, I even let them, but it gives us so much work to do it, that it's not worth it. There are interfaces [mobile for programming] nowadays, but these are very bad. It may be that, in the future, if these ideas improve, they will help. Not now. (IT, State)

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We never distributed or made a certificate of price registry for notebooks because it was a decision of the Ministry. (Federal Government)

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The tablet and mobile devices besides being a tool for reading and content use, have to also be suitable as a content production tool. Now, some constructive criticism: perhaps the tablet is not the best tool for producing content. Do you feel at ease to write a dissertation on a mobile device? To edit video, audio, image, it is not so easy if you do this on a mobile device (ET, State)

It is important to stress that the definition of a device in the upper echelons of decision making of the federal government, without the involvement of local and state governments, and no connection to local policies, ends up being placing pressure for the adoption of certain policy designs in detriment of others at a local level.

The hardware is not neutral, and also the processing capability, storage and memory have great impact on the use of a machine.

From the current trends in the choice of tablets as a device by the federal government, some questions stand out. Will the characteristics of this equipment, arriving to schools without any other peripheral equipment, really favor more consultation or the production of digital content? The production of photos or text? Editing materials or the production of drafts? Is it suitable for programming classes or not?

Depending on the history and trajectory of local policies, a type of hardware may or may not be appropriate. **In the current decision-making model of the federal government, however, this aspect is less important than the price, the influences of market and media.** There are currently no notebooks with the same financing conditions as tablets, for example, although some local managers of educational technology consider this a better option for their school systems.

A local government may bid, independently, for the notebooks, including requesting funding via PAR for the purchase of equipment by its own bidding. However, the potential the federal government has to influence that can change projects in another direction.

It is an aspect of high relevance, deserving more attention.

Box 3.1. Technical problems arising from the acquisition of tablets via the federal government

A statewide network acquired an educational software product on the market. The goal was that the program would work on the recently acquired tablets via PAR (Articulated Action Plan) from the federal government. More than 5,900 units were acquired for high school teachers; however, the storage capacity and memory of the devices was incompatible with the software. The state government then opened a new tender to buy tablets with a better configuration and distributed these tablets for primary education. But high schools received the tablet acquired via the federal government, and without the initially planned content, due to incompatibility.

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We also have a project for buying a computer... now we have opted for the tablet, now that the Ministry of Education is working more with the tablet... (Administration, Municipal)

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This machine here [department's tablet], from a mathematical point of view, it is 10 times, 11 times better in 3D than the MEC's machine. So, I think that when teachers start using it, they will put it under pressure, and the department will end up replacing this equipment [from MEC], since the contract allows it. You can reactivate the contract by up to 25%, and the amount is large; it would be enough to suit the teachers. Then the question that remains is what you said: what will you do with that equipment there? (IT, State)

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The TV Escola is streaming, it does not download. It just needs to have Wi-Fi. The books in there are PDFs. It can download them. Now, if I buy some content from a company that requires a more powerful equipment to run, I'll have to give conditions for this teacher to do so. And then, it is not a machine per student or teacher. I need to have equipment in the school that will give me tools to use in the classroom with lighter, simpler content, or run a more far-fetched, more powerful content, which doesn't depend on a tablet, but on a desktop or notebook. (Federal Government)

1.4.2 Consequences of the focus on hardware

At the federal level an implementation plan for the integration of mobile technologies in schools was not set. The purpose of the use of new devices in terms of local policies should be defined in each education department, in the states and municipalities, according to their federative autonomy and responsibilities. In departments where an implementation and tool integration plan was not developed, the teachers themselves take on the task of defining the applicability of the devices in their day-to-day role and this was the most common scenario found in this study.

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I was waiting for the Ministry to make a bid because they had a tablet [bid], but it had no 3G. For me, without 3G, it has no use, because the Wi-Fi at school never has enough speed, or access. Then, at least, you must have 3G for you to have your little chip... and have easier access.

(Administration, Municipal)

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I used my son's [tablet], and when I received the [one from the government], I felt a huge difference, because it is too slow, heavy... We received a very outdated thing! Mine had issues and, when I contacted the technical support, the warranty had already expired, that is, I got something with the warranty already expired! I would not spend any money on that. It was something that was supposed to be working.

(Teachers, High)

The lack of guidance for the use of the equipment makes the hardware more suitable to various criticisms and generates various demands that are difficult to manage: like emails sent to the federal government by teachers dissatisfied with the performance of the equipment, suggesting that the tablet was from a specific brand..

In addition, as we will discuss in chapter 8, the quality of the tablet distributed in the first batch was considered poor. According to teachers, given the processing speed and the tablet's memory, browsing the Internet is slow. The camera resolution is also low compared to the latest cell phones highly disseminated in schools of the studied capitals. The lack of Wi-Fi or its low quality in most school networks also makes Internet access limited and restricted. Faced with these complaints, some local managers and teachers considered the use of 3G, but this was not a feature available on the devices purchased. Thus, the equipment ends up receiving negative evaluations from teachers, its target audience.

However, technicians from the federal government think that the model of tablets distributed to teachers corresponds to the expectations they had (technicians) – although not documented or expressed by other levels of government – showing a difference of opinion that may ultimately limit corrective action. They believe that the action of the federal government will continue to have a tendency to broaden the range of options for devices, so that states and municipalities, with their own resources or from other sources, can acquire the equipment that is best suited to their educational networks via MEC's bids. They wish that the teachers follow the market innovations in the ICT field and want to streamline the ownership of this equipment by the teacher.

The action of acquiring the tablets was not complemented with guidelines for their pedagogical use, leaving up to teachers in schools the task of defining the purpose of the new equipment. Given the lack of direction and digital content that would allow to check the utility of devices for specific uses for which they were acquired, criticisms of all sorts have emerged, making it difficult to counter them because there is no publicly established basis for comparison of the expected purpose of the equipment.

1.4.3 The bidding processes and their impacts

The time for definition of the specification of electronic equipment, the adherence of states and municipalities to the price registry, and the delivery of equipment influences the currentness, the price and the perceived cost-benefit of the equipment being purchased. There is a need to speed up the flow in the pre-bidding period, in the federal government, and in the period of post-adhesion to the certificate of price registry in the relationship between businesses and local governments.

Some managers express a desire for the trading to be more diversified, both in terms of participating companies and in terms of settings and available alternatives.

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“When we launched that tablet, it could run all of [MEC’s] applications, all the content!” (Federal Government)

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What the MEC does is to put a menu of options for managers who can use PAR [Articulated Action Plan] to request equipment such as laboratories, tablets or the antenna for the TV Escola. So I have a list of technologies that are available and it is up to the manager, both state and municipal, via PAR, to request and justify the choice for those technologies they want. And it is also up to the MEC and to the FNDE to research new technologies to give more options to the states and the municipalities. (Federal Government)

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What we would like is to have the technologies available today, those already in the hands of students, also available in the classroom, within the school. We know that the market is very strong. When the iPhone 6 is launched, as it was last week, we know that a month from today we will already have a student with an iPhone 6, using resources that may even be of educational interest. But until that arrives to the teacher’s hand and becomes available, it can take too long. (Federal Government)

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The federal tablet, I don't know if it is the delay of the bidding time and delivery, because can you imagine taking two years to deliver equipment; the technology inside the tablet, especially, is already quite obsolete. The federal tablet, its settings are very limited. The state program's tablet, which we are using now, has above average settings, so much that teachers who received the federal one are already complaining because they have technically inferior equipment.

(Administration, State)

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How to force a company that won the tender of the MEC tablets to provide maintenance in the depths of one of the northern region states? Do you think they will? They will not! Because the government makes a bidding and says: "Look, we want a similar price for the entire Brazil". The guy goes there, looks up and says: "I'll do it, all right, I'll do it." So the MEC tricks them by paying the guys, the guys cheat by delivering a product and service that we know that they will not keep.

(IT, State)

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From the moment you make a trading session where you create that dynamic that only some companies win, you get too tied up with that company, in general, because when it sells the resource to the federal government, it is already offering the software, already offering maintenance. It's always the same company that wins, and it ends up connecting several issues, including policies. That's the reason for the care we need to have. I think even the international scene has to enter this dialogue.

(Administration, Municipal)

The suggestion to conduct sectorized bids also exists, which allow companies to charge more for regions with more challenging maintenance, for example, ensuring that the work will be accomplished.

1.4.4

The factors considered for defining equipment specifications should be expanded

By taking an equipment purchase arrangement via certificate of price registry, to which states and municipalities deliberately can join or not, it is assumed that each location may have different needs and should make decisions based on their unique contexts.

In the case of bidding for emerging technologies, as was the case of tablets at the time, **the focus on the majority**, in a very diverse and regionally unequal country like Brazil commonly leads to the purchase of a less robust equipment or with less functionality. On the one hand, there is a positive side of savings and lower product prices. On the other hand, it ultimately fosters a perception of the equipment's faster obsolescence, in addition to leading to deficiencies in supplying larger cities, where the available infrastructure is more comprehensive.

One example is the availability or not of access to 3G Internet on tablets subject to bidding in 2012. Due to pricing issues, and because 2/3 of Brazilian municipalities, at the time of the specification, did not have 3G Internet available, this feature was not included in the model. Uncertainty about how teachers would use the equipment also influenced this decision. Nevertheless, the scope and availability of ICT services has increased and, in 2013, the number of municipalities with 3G coverage increased to 3,003 - which corresponds

to approximately 54% of Brazilian municipalities, including the most populous ones.⁷

It will always be a difficult decision to define the specifications of an electronic device with the information one has at the moment, but having clear goals set for the equipment purchased, accompanied by a survey among teachers and education departments and studies of future scenarios on the development of ICT, can help to ensure the best choices in the field of digital technologies.

2

DECISION-MAKING AT THE LOCAL LEVEL: THE VISION OF EDUCATION SECRETARIES

2.1

The profile of administrators

The sample of education administrators in this research includes secretaries, undersecretaries and administrative secretaries for 9 of the school networks. These included university professors, primary school teachers, a former finance manager, a former senator, a career civil servant, and a trained public manager. They hold degrees in political science, economics, education, engineering, among other areas. Some have worked in education for over 30 years and some are new managers in the field.

⁷ Available in: <<http://www.fn-de.gov.br/portaldecompras/index.php/produtos/servico-de-tecnologia-3g/servico-de-tecnologia-3g-precos-registrados>>. Last access on: 11/12/2014.

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WhatsApp, I would even say that it turned into a new way to manage, because, nowadays, there is a group for everything. For example, at the level of the municipal government, there is the department group with the mayor.
(Administration, Municipal)

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I try to have the information synchronized in terms of computer, Internet, mobile phone, in order to have the management of information within easy reach. So, my focus is productivity applications. I have tested many and, in fact, I'm almost looking at developing one to suit my needs.
(Administration, State)

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Sometimes, at school, I kept expecting something from the student; for example, if he had read a particular book, written a specific essay, but without making use of anything he produces on social networks on the Internet. If you were to add the amount of tweets that a person does a year, what is the production we would come to? Or the amount of emails that the person exchanges. It looks like it's all thrown away. And also, you have the prohibitions, we have many states, many municipalities, that prefer to prohibit than to regulate in favor of learning, the use of cell phones, for example. (Administration, State)

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From the moment we see technology as a policy, and you come to promote various purposes, many goals. It has to come together with what we defined as a larger project for our program. Then, you also create mechanisms for this to arrive to schools, so it uses the student as an instrument, using the teacher, of course, as mediator. So, if it [the technology] doesn't come from the political angle, it becomes another activity. (Administration, Municipal)

Regarding the personal relationship of these players with ICT, although we have found that managers say they are little accustomed to new technologies and that they prefer to write, for example, articles by hand, all of them are connected to technology in varied ways and use mobile devices at work, mainly smart phones.

There are also those who demonstrate a more advanced use of tools, including the customization of tools.

Interviews show that **decisions regarding investing in ICTs or how this will be done do not depend exclusively on the personal profile and proximity to new technologies of the managers themselves**, considering that there are several centers of influences that surround these players, including advisors, technology directors, companies, the MEC, and a recurring demand for investment in technology, which comes from the mayors in cities themselves and, sometimes, the governors in the states.

Administrators that are personally more adept at ICTs in their day-to-day, however, tend to have more progressive views regarding the use of technology in the teaching and learning process.

On the other hand, the personal trait that stands out and shows different procedures and more programmatic actions in relation to ICTs is the **managerial ability** of those in charge of the departments, and that can be described by: **systemic vision, leadership in the design of projects that include ICTs, concern with control and results-oriented vision**. In school networks that rely on this type of management, ICTs are addressed in broader projects, closer to the concept of mobile learning involving integration with the curriculum. Since these are still quite recent actions, however, in the practice of schools, there have not been differences verified due to the departments' management approach, with the exception of schools with distinguished projects such as the integrated schools where different approaches promote better educational environments.

Finally, an important point to highlight is the lack of stability of administrative positions in education. Considering not only the administrators interviewed but also the administrators of all departments studied, we encountered a considerable number of secretaries with less than two years of experience in office, when they should be finishing the fourth year of government. **The turnover in departments demands attention from any area, including mobile learning programs: without a robust and appropriate design discontinuity is a consistent challenge.**

2.2 Factors considered to invest (or not) in ICTs

The propensity of local governments to invest in ICTs to improve the process of teaching and learning of their networks varies. Although there is no way to ignore these technologies the agenda of basic education appears to be quite complex and always under a crisis scenario - which necessitates setting priorities.

With budget constraints, choosing to invest in technology is a difficult decision and despite being dreamt of by many managers, ICTs are not listed at the top of their priorities and most urgent demands.

The lack of prioritization of this investment is also justified by a minority by the lack of a clear and direct feedback on learning.

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I asked that question to the Council recently. I wanted to know, since I started [2011] until now, how many secretaries remain in office. Of the twenty-seven, we have five. Some states changed [administrators] three times. We have secretaries who have been in and gone out, have been in and gone out again. We have cases here [in the city halls] in which the secretary has changed three times in two years. I have received all three to talk about the educational project and to each I repeat the same thing. (Administration, State)

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The average term for a secretary was of one year, one year and seven months. The last one that stayed here for four years was here from 79-82. Look, what nonsense! This is absurd. (Administration, State)

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So, it's not that the technology issue was not important, but it does not even exist if it has no structure; if the schools' electrical network is not working right, the hydraulic network not working properly, the roofs not working well, everything is very difficult. (Administration, Municipal)

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A major challenge, for example, when September comes, is to beat the climate inside classroom; we have power outages, the air conditioning breaks, it takes a while to repair, this also interferes, it is a constellation of things. (TE, Municipal)

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In the education department, you have a range of actions in which you have to set priorities, where a budget constraint is on. You have to take into consideration the cost, investment, construction of schools, maintenance of schools, student transportation, meals... (Administration, State)

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You cannot play with the people's money so we meet the priorities depending on the size of the demands that we have. Technology is fundamental. I think it's fundamental in some works, only that we also have other demands that have to be taken into consideration, and you have to combine everything from that. (Administration, Municipal)

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I think that there is not, unfortunately, sufficient evidence and forms already tested and proven of working technology in a way that really benefits the students, student learning. So I think it's still something that people do not know the how to do and that has high risks because it is linked with politics. Politically it is very attractive to place a lab, inaugurate ICTs, have computers in all schools... and how to do this to benefit learning is still quite unknown and challenging. (Administration, Municipal)

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For a school to be part of the twenty-first century, it has to be, somehow, connected. The amount of information you have on the Internet is absurd, almost infinite, and we cannot leave the school out of this movement. (Administration, Municipal)

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I believe it is fundamentally because of the price [decided by tablet]. I see the tablet as being more limited. Now, you have the price. To give you an idea, that tablet which was distributed to teachers costs two hundred or so reais, it's almost the price of a book, two, three textbooks that you buy in a bookstore. So this, to me, is an issue. (Administration, State)

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I'm a bit nosy; I go around; I go back, I see, 'hey, this here is very expensive for us, we cannot', but the idea lingers, I bring it and see what can we do within our budget. It is also this: creativity has to be part of that context as well. (Administration, Municipal)

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That bid we opened to buy a mobile laboratory, it all came at the end of last year due to the need to comply with the [spending] of 25 percent [of the budget for education]. So, these are things that come up, not from planning and yes, we have some emergency, some fire that has to be put out and then something comes up. (Administration, Municipal)

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So, we did not expect several things. I did not want to invest anything in technology, because the Internet in our network is bad, 128K. What can I do with 128K? Nothing. So why am I going to have to invest in a computer lab, if what is really enriching nowadays, and what technology can help us with, is that access to all learning objects that are there, but online? Suddenly, we received a call and "Oh, the carnival's sponsor, [as] a quid pro quo, will install 10Mb in 100 schools." I said: 'Gee, wonderful'. We did not expect it. (Administration, Municipal)

Nevertheless, all **administrators are quite open to technologies** and cannot imagine a school disconnected from the benefits of the Internet.

Among the main decision factors, when the theme is technology, is the understanding that technology can **improve the quality of learning** by enriching the education of students.

When the tendency to invest exists, another very important factor is the **price and the amount to be spent**, given the size of the networks and the investment planned in other areas. In any case, contact with existing offers awakens interest and stimulates investment.

Another aspect considered by some administrators regarding investment decisions is the **sense of modernity and currentness** that technologies add to education and that to them is already present in private networks.

We also find networks which investment was due to **factors outside of the department itself**, as windows of opportunity open by negotiations in other areas of government, or even budget issues where the purchase of equipment was seen as a good action.

Another very important external factor, as extensively pointed out, is **the actions conducted by the federal government**.

When the decision to invest exists **without a clear vision of educational goals** to be achieved, besides a poorly-planned action, the most common is to have an **action limited to hardware**, which gives the impression that something is being done in this field.

Within the hardware distribution scope, and in the absence of a plan for the use of ICT, technology enters the network from the viewpoint of **enhancement of the teacher and student awards** accompanied by almost no execution of goals and direction.

Since 2010, it has been recurrent that local governments develop their own programs to purchase tablets and notebooks. Municipal networks such as those from Manaus and Salvador gave every one of their teachers a notebook in the last four years. In the Amazon, fulltime students also received notebooks. Tablets were also distributed to students in some networks, ranging from being for all students in a given year to being prizes for students with the best grades.

In such cases where there was distribution of mobile technologies without focusing on the other pillars of mobile learning, we can see, first of all, rewards or a human resources policy, which, given its characteristics, cannot lead to expectations of direct results in student learning, although it may have positive effects on the beneficiaries' self-esteem.

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I will make a mea culpa. We have made a big mistake in the past... To the students, I think we had 70,000 [distributed tablets]. And then I said, 'Well, if there are 70 thousand, let me see where that will stop in terms of grades' and it was under 4! I was rewarding failed students. So, this makes no sense and then we ran out and said, "Look, there are 10 thousand machines a year to award to students and that's it." Because obviously you have to make the list from higher to lower and stop in a grade that is at least, positive... so the teacher's machine has a motivation and the student's one has another. But upfront we want them to work together; then, as it is already in some schools in which they interact, he takes the machine, he knows how he will use it; so... that's what we want and this is what we strive for. (Administration, State)

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[The notebook] would be a working tool, let's say, the most complete that we could offer to teachers, which was available in the [MEC's] price registry and we that we could get on short notice... And we really wanted it to be understood because that's how we see it, as a value, a worker's reward policy. (Administration, Municipal)

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From experience based on [our] own network [of teaching] the distribution of the notebook to teachers back then, after the netbooks, did not bring repercussions directly to use in the classroom. I believe that the investment has [to be] directed to classrooms, because then you are sure you will have it in the classroom. The teacher does not have to carry it from one side to another; it is already at school, it belongs to the classroom, the projector is even stuck on the ceiling, the structure is assembled there. (ET, State)

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The laws on bids have to be updated. If you're checking it out, we have difficulties up until today. When you purchase a software license, people do not know what that is: if it's a product or a service. What are you getting? The other day we were talking about running a microchip that had certain content.

This week, a process stopped here because they lacked the receipt in a deposit but they were talking about some software like one kilo of rice for the school meals. There is no provision in the legislation for a clear role for technology, and then what happens? We have delays, it is outdated, and technology is moving at a much faster rate. Even with regulations, the legislation is from 1993. (Administration, State)

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The Board of Education, which regulates certain laws and approves certain opinions, is retrograde. It is not conducive to innovation in education; then the school coexists with the limitation in legislation. And you also have the national matrix, which often brings proposals to enlarge the curriculum. We must have some 200 to 300 new subjects moving in Congress from time to time, to add to the curriculum. So, therefore, there is a gap in the movement for change of younger students and the teachers who are engaged in this movement for change, and the gap is a negative point. Even legislation needed to allow more. It was recently approved; for example, the National Education Plan, and we do not have a very different vision of the future for the next ten years regarding the use of technology. (Administration, State)

In order to intensify (rather than simply make possible) the personal access of educators and students to the digital world – since, as seen, they are already connected – and increase their self-esteem, equipment distribution appears to reach its goals. On the other hand, to increase the use of ICTs in the classroom, **school networks' coordinators who have gone through many experiences claim that equipping the classrooms tends to bring better results.**

2.3 Factors that discourage investment in ICTs

Legislation, either in the sense of curricular regulation, or to allow more flexibility in the purchase and management of equipment, is one of the points raised by managers as a limiting factor for innovation and reforms using ICTs. There is criticism of the PNE due to its limited vision of the future in the integration of technologies.

Another fairly frequent point in several departments concerns **workplaces and their characteristics not always being akin to changes** within departments. Project coordinators who gained prominence in the environments in which they operate note rejection from peers and lack of support.

In addition, the fact that there is no **national guidelines program** in this field discourages the prioritization of ICTs, especially in municipalities with more limited budgets and structures to handle the demands.

Anyway, this research considers obvious that one cannot expect the demand for technologies to arise from schools, because it is precisely the problem to solve: the integration of technologies has been largely an activity relegated to a few teachers, those personally more accustomed to the subject, as we shall see in chapter 8.

2.4

The factors and influences that impact decisions about ICTs

It is known that education administrators that are using management tools in their school systems – and therefore monitor their schools, teachers and students – decide more confidently and deal with external factors with more awareness and knowledge.

The school systems featuring or developing an ICT usage plan commonly have **secretaries participating on the project layout**, as well as a direct influence of staff members. Meanwhile, lower participation levels of administrators in monitoring those decisions apparently lower the chance of having a structured plan on mobile learning. As a consequence, this increases the chance of disarticulated actions.

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And then they gave me another responsibility. Maybe people listen to me a little more now, because of my position, but until then what you had was a relationship even of jealousy. Why some specific projects, sectors, work out and others do not? So, what comes from there [our sector], people already had this... this reaction. (Administration, State)

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Some questions you have to ask because there is a determination from the MEC. [In the technology area] it does not exist. What do I imagine? Since technology, among all challenging aspects, is the most recent one, it ends up being brushed aside. It's not that you do not need it, but we still have so many unsolved things... (Administration, Municipal)

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That is, the demands that comes to us here regarding school programs, all right, I will not say that there are none regarding computer labs; but if you look closely, among those arriving here, the percentage [referring to it] may be amongst the minor. So, I imagine that when this starts happening, the team that was made up by two or three people, not many, will certainly not grow. The demand will force us to do some structuring. (Administration, Municipal)

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One computer per classroom does not necessarily mean better performance. This relationship does not exist. However, it is indeed related with well-planned and utilized technology. But what does that mean? Working with a great deal of management and control. And also the pedagogical support tools. We worked on those two fronts because this is what gave the better results (Administration, State)

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A [supplier] comes by with [some technology] offer every other day. I just stop by for a moment, check it and send it to the IT and then IT sees what's going on... it is very difficult to have a clear definition because everybody claims to have it better than everybody else. That's why IT defines our needs to some extent.

(Administration, Municipal)

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I evidently pay attention to what he [the IT manager] says from a tools and equipment perspective. But when he presents a new content product, for instance, I talk to the pedagogical coordination staff and also their technical staff. They have a small center with two or three people specialized in this sort of thing. We already had products that were utterly unacceptable from a pedagogical point of view but were technically OK [from an IT point of view], and vice versa.

(Administration, Municipal)

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*The pedagogical department is always reluctant because they have a very romantic perspective. Saying that the "school generates conscious people" and the like, that I came by for months during the diagnosis phase. We try to talk with some of them and even academia itself states that "one must think of a school that prepares citizens, because that's the school of the future." But what does prepare citizens mean? That's why it is a lot of talk and not a lot of substance. Then we said "regarding the pedagogical sector, we will establish goals for each and every school." [and they replied] "but you can't do that because the school is a parallel universe. That's very unique, there is no school like another." "Minimum Study Program?", "[They always said] no, a minimum study program sacrifices pedagogical freedom and the schools must have their own study programs." Then we proved again and again that it is not true, that this school system prepares no citizen, but a bunch of unemployed people, the 57th place on PISA, a middle school IDEB grade of 3.2, a workforce bottleneck, the "More Doctors" (Mais Médicos) Program and in some years will also be responsible for the "More Engineers" Program. As such the education system is responsible for a 13% share of the Brazilian population that does not study and does not work, a 53% disapproval rate in middle school. In other words, this school system that you advocate for does not work. Otherwise such horrible figures would not exist. **(Administration, State)***

Administrative participation is mandatory to attain a consistent mobile learning policy, not only at a local level but also nationwide. Isolated actions with no strategic planning will hardly generate results at scale.

The **IT departments**, sometimes also known as **infrastructure departments**, are herein referred to as IT and play a major role, close to the staff, no matter if the school system features a strategic plan for ICT integration or not. They are also considered responsible for suggesting software with pedagogical content to which they have no direct responsibility.

Regarding ICTs, the **pedagogical departments** have varying levels of relationship with the staff. They have a lesser impact on most departments mainly because they are not very familiar with it- that is normally dealt with by the aforementioned IT departments. The secretaries that push reforms for greater ICT integration in school management claim that this initial contact with the pedagogical department generates some conflicts. They also affirm the necessary role of the administrator in integrating these areas within reforms:

Exceptions to this rule occur when those responsible for the pedagogics enthusiasts with a history in the ICT field. Such was observed in two Municipal Education Departments. In one of them, the Secretary of Education is fully aware of this and of the increasing technology presence in elementary school because her Principal has worked with education technology before.

Most departments have **specific divisions focused on education technology** that are normally within the pedagogical department. They may have connections with the NTE (*Núcleo de Tecnología Educativa*, Education Technology Nucleus) of the federal government or be an entity of a higher hierarchy. Anyway, those entities are normally very small and feature only a handful of people responsible for stimulating ICTs in education and in classroom usage. Despite being part of the pedagogical departments, these entities are unable to foster a general ICT integration within the department and end up working independently.

The Departments in which ICTs are more valued as a basis for the education system **tend to have better structured education technology sectors with different management systems that are more connected with the network training centers**. They also have a more direct contact with the administrators, which impact their decisions.

Among the Departments analyzed, the least developed in this field has only one common manager for IT and the NTE and this manager is a subordinate to the pedagogical director. This way, they are given tasks not immediately related to their position, but it helps the dialogue with the pedagogical sector.

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Nowadays, the biggest player on the elementary school is the Principal herself. She was one of the people who pioneered this technology project when she was the head of the Technology Department. So, when she gets transferred, she creates a unique interface for elementary education.

(Administration, Municipal)

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I really don't feel this integration, neither in the pedagogical support coordination body itself, nor between the NTE team and all the others. I think it is left somewhat as an aside and at a distance.

(Administration, Municipal)

For more consistent and solid action, the NTE should have a less purposive approach and a more mediating one, impacting other departments and other sectors of the pedagogical department. With a more purposive approach, such departments and sectors could implement ICTs in their actions and procedures. The way most NTEs currently work, trying to make “whatever is possible” with a very limited staff numbers, generates little external impact.

2.5

The lack of plans to support mobile learning in school systems

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And what's wrong about this? It is believing that a digital whiteboard in the classroom would increase proficiency. It won't. If there is no content and it isn't clear what you are going to do with the whiteboard, it will simply be just another electronic thingamajig.

(Administration, State)

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I don't believe that delivering equipment without an established pedagogical project is a good idea... we must decide what equipment to put in the classroom after establishing a pedagogical plan. "What's the pedagogical project?" and, pursuant to this pedagogical project, define what equipment should initially be in the classroom so that the implementation of the pedagogical project is viable. That's what the education department did: create a pedagogical project.

(Administration, State)

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[Our program] outlines every possible usage of such technologies. It had various courses and no clear structure. Those courses had no clear relationship with the Elementary School, with the children's education or even special education... it was totally closed and isolated. When you come up with a program, you do so that all of these actions converge into a clear perspective of our goals, which are: making the best use possible of our teachers, an increased but conscious usage that impacts the way the child attending the computer lab relates, enabling use of available resources in an unique manner.

(Administration, Municipal)

"... being able to establish guidelines in face of uncertainty is being able to establish guidelines under severe doubt. This is just the opposite of establishing accurate guidelines." (MATUS, 2006, p. 126)

ICT education plans are even more important today because the policies implemented in the 80's and 90's caused school computerization to reach significant levels. Such policies inspire ProInfo activities up to this day. However, only four of the dozen Departments surveyed had documented guidelines for the school systems activities.

These plans usually consist in articulating infrastructure, i.e., training, equipment and the availability of digital content for study programs related ICT usage, in line with the concept of mobile learning.

The current plans of the surveyed school systems are recent. That means that, in practice, they are established after the equipment is delivered in order to given them meaning and utility. The length of time that the plan has been put in practice also requires caution to analyze the impact on schools, as it might not yet be possible to assess such impact via a qualitative survey.

It is possible to find two different approaches on the schools systems that lack an structured plan: recognizing the need for a project and tackling the challenges to establish it – adopted by most of them – or underestimating the need for a plan, deeming an ICT usage project as less important in the face of other pressing needs.

Box 3.2: ICTs as drivers of inequality

Given that access to ICTs, especially to mobile technology, shows a consistent increase among the Brazilian population¹, it is possible to take the limited usage of learning technologies in schools as a factor that contributes to long-term **increases in inequality**. While the higher social classes have support from their educational institutions to implement ICTs in their daily lives for diverse purposes, neglecting the potential of such learning tools for the public school students means leaving them on their own to keep themselves updated and also not taking into account the consequences related to it and limiting opportunities for developing the cognitive skills associated with internet usage, like informational and photovisual literacy, and the literacy to reproduce and extend knowledge (ESHET-ALKALAI, 2008).

Invalid source specified. "If governments and teachers don't solve the bottlenecks to the acknowledgement of contemporary 'digital nature' soon, we might stumble upon a contradiction where students whose families are covered by the Bolsa Família program (Family Allowance) will come to the classroom with their so-called 'homework' solved and printed digitally. At this point, [...] our only choice might be the conservative approach to only accept handwritten work from these children, who would still be socially segregated and vulnerable to economical and education inequality, but still have 'native digital proficiency,' so to say". (SOBREIRA, 2012, p. 52)

¹ Among computer owners from the higher social class (class A), the mobile technology ownership rate is clearly superior to that of non-mobile technology (90% versus 64%). The same can't be said about classes D and E (44% versus 57%) yet, but there is a tendency for it to increase in the future: in 2011, 70% of the computer owners stated they owned desktops, while 33% stated they owned a mobile computer. (CETIC.br, 2012; 2013)

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I think I have no plan, even more so due to our inability to have a plan. No matter how much I have tried, we couldn't make it... there is still no pedagogical proposition. But I think we already have a structural proposition, that is having equipment for every teacher and then extend it to the students. That's all set up... We already have the internet. That's clearly not ideal, but if you keep waiting for the ideal, you won't begin anything. And if you buy a 3G tablet, the owner gets a chip for it. I mean, if he or she so wishes, that's not mandatory. I think, however, that that's the deal: each one gets their own chip. That's because it's not up to us to increase the speed in schools. (Administration, Municipal)

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Is there is a plan on technology usage? No, there isn't. In my opinion, some things are much more necessary than a "teacher and technology" plan. We only have pretty basic stuff in our school system. We are focusing much more on literacy, on the issues that really are our priority (Administration, Municipal)

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What we want is neither computers alone nor traditional education in the schools. That's why people hesitate to follow this mixed path, which is a whole new science, if it can really be referred to like this. It only appeared a few years ago, perhaps not even 15.
(Administration, State)

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Indeed. I believe the NTE already created a work project proposition and we actually started to train the teachers, so that they can use those schools' computerized environment. That's why this process is a little bit more time consuming than anticipated...
(Administration, Municipal)

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It is implemented like this, with little schedule and pressed by necessity. (Administration, Municipal)

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I had a meeting this week. We have the MEC price record. And the idea is to work with what we call 'themed room.' The student does not keep the tablet, but he uses it in the classroom focusing on the subject taught, the learning objects and the exercises. That's where the idea of one tablet per child comes from. This plan is already... I met the Under Secretary this week and allowed him to begin the implementation.
(Administration, State)

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I notice that after we start the implementation, we keep trying to solve problems that weren't thought of beforehand. This lack of planning might not be exclusive to the teacher, but indeed be an aspect of our culture, as the planning for the project under implementation has to be established beforehand. If I wish to use a web portal, I have to make sure that the 400 tablets being used at the school have sufficient bandwidth to operate at the same time. There's no use in taking 40 tablets with a 1 Mbps limit, it just won't work. That's why studies of such projects have to be conducted before we even think of what equipment we should buy. (Organizations)

The discourse of administrators without established plans end up being limited to internationalities.

The actions taken are not documented and there is no established strategy, even though the equipment is already available at many schools in such networks.

Even if there is no plan or schedule, there might exist a **published decree or ruling** intending to direct the usage of these new resources within the Education Departments whose teachers and/or students received the equipment. With content that is more administrative than pedagogical, however, these documents provide only an overview and are not significant references for the school network teachers.

On the other hand, **some school networks are developing their own plans.** Especially in the state school systems, technological resources are a great asset within efforts to create full-time schools.

The deficiencies of mobile learning actions in public schools is starkly visible because at the moment there is a lack of plans to guide the usage of the equipment

that is being made available, especially to teachers. These plans tend to be established after the devices arrive, but might also never have been projected within the Education Departments, just like what happened with computer labs, which even today are not adequately utilized. In addition, the limited or absent tracking of ongoing actions contribute to limiting the possibilities to assess results.

Considering that the Federal Government has been funding such acquisitions, should they track the local governments' projects? Or maybe guide and assist creating plans that support comprehensive policies? The actions have been sent through incompletely, without considering important basis for digital content, teacher training and infrastructure prior to hardware. All of this limits the possibility of integrating the equipment and modifying the teaching-learning processes.

2.5.1

Mobility in education

Mobile technologies, especially devices such as notebooks and tablets, are emerging as a trend and a desire of the great majority of those who are currently involved in education. Fixed laboratories, an asset currently prevalent in most schools, have lost supporters and have ardent opponents now.

Some school networks are creating mobile labs to complement or replace the stationary ones. The mobility of devices is regarded as a way to:

- » Reduce costs
- » Bring technology to every environment in the schools
- » Solve the lack of space in school buildings, liberating some of the rooms for support

”

I was never very fond of laboratories because I always thought of them as appendices. It seemed like you only could use technology in the lab. In a certain way, it failed. In my opinion, mobility is here to stay. But it requires better planning in education, the system and the schools because technology can also distract the students. If you don't have a clear path to follow, they will definitely go another way and get lost.
(Administration, State)

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We have non-mobile equipment and computerized environments in the vast majority of our schools, but I believe there is an ever-increasing need to work with mobile technology. I think that currently it is possible to access data and the Internet even with the cheapest mobile phone available. I believe it will be easier to work with such technology than with non-mobile assets. (Administration, Municipal)

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A lot of schools have computer labs that don't work and the Mayor has been pushing us a lot to put them to use. We studied the costs of putting a lab to use in comparison with simply adopting another policy as a mobile labs policy. We discovered that in most cases it is cheaper to simply create a mobile lab.
(Administration, Municipal)

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There is one device per child [In mobile laboratories], and this allows me to give my lesson pretty much in the same way I would without technology, but aided by technology.
(Administration, Municipal)

”

The tablet was only a consequence. The objective was [to have] the mobile device. There is this issue of a lack of room space... but what has been going on in practice? They just go to the school [located in prefabricated buildings, leased property or whatever], and say, 'Look, there is this small room which can be adapted into a computer lab.' Sometimes the small room has space for 30 computers, for example, which is ideal, but some of them have space for only 10. So that's why it's a problem for the teacher to bring in 10 students...
(Administration, Municipal)

Figure 3.2: Stand charger

Source: Manaus Municipal Department of Education

The published studies show varying results about the most effective approaches to distribute the devices. While Warschauer (2011) argues that the one-to-one approach is the most appropriate, Ortiz & Cristia (2014) argue for shared machines as more effective alternatives for Latin America.

Mobile laboratories make it less complicated to choose, as they allow a 1:1 approach in every classroom, instead of a single one for the entire school. This is seemingly the easiest solution for the problems that Brazilian public schools have been facing, with a much lower cost than the previous alternatives. The Municipal and State departments of education still providing equipment to students via

a 1:1 approach usually do this in a localized, non global manner – providing them only for the 3rd year of high school, for instance.

The pedagogical managers that focus on technology and abide to a free technology philosophy defend such laboratories because they allow working in a less individualized manner. However, no education secretary has implemented this philosophy as of yet.

The usage of **mobile phones** among teachers and students has been increasing more and more in daily pedagogical and communication activities, as we will show in more detail later on. This is due to the high adoption rate of mobile phones among them, **but education administrators don't see their vital importance because they act without taking into account the devices that the very same teachers and students already own.**

Mobile Internet, is regarded as a viable alternative because of Wi-Fi unavailability in schools. It would be a second option, more affordable at the present moment.

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I believe the usage of mobile phones is futile, unrelated to the class subject in 90% of the cases or more. The student is there, but thinking the class is boring as hell or is simply addicted to the mobile phone. It's that old issue: he or she doesn't stop using it. Some locations have laws banning mobile phone usage in the classroom, yet there is no similar legislation here. I believe it is possible to overcome this by using technology. I mean mobile technology, there are tablets that can be used in the classroom.
(Administration, State)

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That's because our non-mobile alternatives unfortunately don't work and we have to resort to what's feasible. That's the reason why mobile is prevailing, not really because we choose it. (Administration, Municipal)

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We provided notebooks for the teachers. We expect they use those notebooks to plan their classes and download material if they have access to the Internet... We didn't provide 3G access for them. And we would like to offer this idea because we believe it will open up a wider range of possibilities, but... it's not possible at present time.
(Administration, Municipal)

2.6

ICT evaluation provided by the school network itself

Administrator with established plans for ICT usage in their school networks that prioritize investment in this field tend to have a more positive attitude towards technology integration within their school networks. Most of them, however, feel they are lagging behind and wish they were more advanced in this process. Those that have no established plans have many weaknesses that are not necessarily exclusive to them.

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Just take a look: there is a computer but there is no table. Sometimes there is a table but no computer. Some other times there is a computer AND a table, but no Internet whatsoever. And there are even occasions when there is a table, there is a computer and there is a table, but the energy supply is single-phase and not three-phase. I mean, we face every type of problem to implement it.
(Administration, Municipal)

On the other hand, it must be highlighted that a plan with goals and guidelines does not necessarily mean that the implementation will be carried out properly, as there is little tracking of the ongoing procedures and some of them depend on factors that are outside the reach of the Education Departments. Such activities are very important to a successful mobile learning policy within a school network.

2.6.1

Technology usage in the administration of school networks

An effective and through usage of the knowledge access and improvement opportunities provided by ICTs involves developing new education management practices, as well as implementing new teaching strategies and methods. There are many documented cases of such technologies being implemented as new tools to do the same thing, generating little or no educational impact whatsoever. (SEVERÍN, 2010, p. 7, freely translated)

In some states and municipalities, there are pedagogical management systems that have been implemented recently or are currently being implemented to increase the analysis capacity and to track the students learning process.

The online class logs are the main trend in management. The states of Amazonas, Rio de Janeiro, Paraná and São Paulo have already implemented such systems. Despite being less structured and having a shorter budget, the Municipal Governments tend to follow suit. The Municipal Government of São Paulo, for example, was beginning to implement their new system in 2014.

The online class logs tend to integrate the bulkier administrative programs whose purpose is to manage all school data, ranging from enrollment rates to grades. The teachers then input the data in the online system – basically attendance and nonattendance

figures, a description of what was taught, activities and grades.

Some systems feature an area on which the teachers can interact with parents and students. The latter are also asked to conduct self-evaluations. This is the case of the SGP (*Sistema de Gestão Pedagógica*, Pedagogical Management System) in São Paulo and the transparency platforms whose purpose is to get parents closer to their children's school experience in São Paulo State. Sophisticated management systems such as those of the Amazonas States, Rio de Janeiro and Salvador also include exams, such as exams provided by their own education departments or the Prova Brasil, along with its guidelines, descriptions and the students' grades. This allows the pedagogical sector to view the data more easily and create corrective plans.

During this study, there were management systems being developed in Bahia State and in the city of Salvador.

The gains obtained with their deployment are, from an administrative perspective, overwhelming. That is made clear by the enthusiasm displayed by the administrators:

Despite that, there are still school chains, especially municipal ones, that have no computerized management and are not satisfied with their situation.

But the implementation of such systems does not come by without issues. Teachers often complain that some activities accumulate because of a lack of equipment and adequate internet at the school to insert the date, as the systems cannot support thousands of hits at peak times, such as those requesting the training or collective schedules.

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Technology has to be useful in controlling and tracking the school chain, as it takes a good portion of my budget and receives heavy investment. As a policymaker, I need to know what's going on in that specific chain. Without technology, it is impossible to know such a large chain in depth. That's why we invested heavily and today I'm able to assess how any student in any school or classroom is progressing in any skill. (Administration, State)

”

If you take a look at our strategic plan, you will notice that our priority is literacy; expanding access to early childhood education so that we have better conditions to educate the students when they enter elementary school at age six; having an evaluation policy to check if they are acquiring the skills required for each year. We use a lot of technology to do all of this, an information management system with an online control panel through which we input the evaluation data. We also use a lot of technology to make the teachers have access to such data. (Administration, Municipal)

”

For you to have an idea, if I wanted to access the data regarding a specific student or school, I had to bring the CPU [from the corresponding municipal department] or go there with a USB stick to copy it. I couldn't access it from here. We managed to make all of that available on the Intranet today, but in 2011, when I started, it wasn't available. So we are lagging behind significantly as far as technology and network technology go. (Administration, Municipal)

”

We have a cyclical system here. Sometimes we insert no grade, but add data on how the child or youth is developing, with notes on how he or she is progressing. And it's all done on paper. As a consequence, a teacher that has the equipment on hand and already did everything as expected can send the grades and attendance rates to the secretary of the school and we can access it all from here. (Administration, Municipal)

”

At the time of the pedagogical management system [implementation] we had a lot of problems with the Internet, we faced system problems and also a lot of training issues. You still don't know how to use it, but at a certain point you decide to use it and then the Internet fails. Or maybe the system was overloaded at the time. Then you don't even go back to the system and say it is garbage. (IT, Municipal)

”

I was very hesitant with this control because sometimes some people weren't used to it, although they should: there is this classroom log and it is mandatory to fill it. But some make a "yearly log" instead of a daily log, do you understand? Then, at the end of the term, they just state that everybody attended every class and insert a random grade. I have already seen a lot of people doing just that and then closing the system. It really needs to be controlled better. (IT, Municipal)

The administrators present the results that will be attained with the implementation process as a way to skip the problem. As the benefits to the pedagogical department become apparent, the positive results of ICT usage are demonstrated to the schools and teachers, creating a virtuous cycle:

In the mobility sector, some school chains have been developing mobile apps for the community that help finding services like telecenters (Telecentros) in the schools.

There is also a trend of **classroom management software**. When using mobile or non-mobile labs, those are very useful tools that make the teachers feel ahead of the procedures and in control of the students. It ends up being a highly regarded asset for ICT usage in the classroom.

There is a minority expressing criticism about the dependency on the current programs. They highlight how important it is for personal authority relations to overlap the artificial authority of program usage, so this transformation is not very well accepted by some of the people involved in pedagogical relationships.

The management systems usage in Education brings about the ICT experience applied to the pedagogical field, being an important step towards a more solid tracking of the students learning process and in building effective mobile learning policies.

2.6.2

The discontinuity risk

The maturation time reaching ICT incorporation in education systems relates significantly to the kind of changes and depth they may infringe in application contexts. Therefore, there is an increase in usage intensity and its impact while the incorporation efforts are kept along the time. (SEVERÍN, 2010, p. 10, freely translated)

Discontinuities in administration and the schedules are a common thing in public management. It is quite prevalent in local governments, as there is no stable staff in the higher positions, which makes the Institutions have a “low memory” about programs. That causes anguish amongst the administrators.

The local government’s mobile learning projects are all very recent: the mobile devices were acquired at the end of the previous mayoral term or during the current state governor’s term.

One of the Municipal Governments surveyed took part in the One Laptop per Child program tender when their previous Mayor was in office and bought about 20,000 notebooks for their schools. For this reason, they also bought a proprietary software system to make content available to the teachers and students, focusing on the Prova Brasil studies plan.

As free and open source education resources advocates, the next Municipal governors took office in 2012 and cancelled this contract. Thereafter, they created a new project to use those machines, choosing free software and content to be installed on the bought devices.

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What scares me in all of this is that there is an almost complete and sudden change in everything when they change the staff or the Secretary of Education... even that poor little watchman of that small country school is changed. I think that’s really the main problem in the education field.

(Administration, Municipal)

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When you establish a policy, you also create the operation guidelines. And then we presented this perspective on free software and open education resources usage. We presented a new perspective on using such devices.

(Administration, Municipal)

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There are two main reasons for this [changing from proprietary software to free software], one of them is ideological and the other is financial. The Federal Government has also been presenting strong actions in this sense with the ProInfo labs. There is a national free software usage policy. Being both a teacher and a teacher trainer in this school, I’ve used both and have absolutely no complaints.

(ET, State)

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It would be irresponsible of us to simply discontinue a good project created by the previous governors out of self-importance. It would be unacceptable. If the project works and has a good usage perspective, we have to continue it. But I made it clear to every team from the beginning: we won't discontinue anything that's giving good results, but it's time to give a new meaning to the usage and the actions.

(Administration, Municipal)

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So you just give an end to that idea that those netbooks are just a tool for Prova Brasil and to get those desired results on Prova Brasil. You broaden the use spectrum of that device located at school.

(Administration, Municipal)

”

Every school has those notebooks, for instance, but what happens? And I say this with confidence: they were bought by the previous Governors and without due planning because you can't implement the notebook if the school power supply isn't ready for that. In other words, some schools have a faulty power supply and it makes it very hard to recharge the computers. Some schools don't even have Internet available. We have plans to provide Internet to those schools.

(Administration, Municipal)

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[I thought] I had to find a way to put structural projects ahead of them, the school teachers, like obviously resistant perennial structures that you have to establish in sectors... teachers can be highly resistant.

(Administration, State)

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I see it like this: everything starts and stops. From an outside perspective, we see these 'starts and stops' as a kind of governorship dance: if the opposition takes over, everything will come to a halt. [But] these 'starts and stops' actually happen either because the school Principal retired, they changed the education secretary, the year is over or due to a new political structure... I think this is a very serious problem. By saying this, they make a vain and generic criticism of the public sector. But I believe it is even more serious than that. We have a real problem in education and we find a lot of ill structured stuff daily... there is a need to make education administration something professional.

(Organizations)

In this case, as the change came from an already established and extant ground, there is a continuity trend and also the creation of a new identity, a new usage.

In addition, as other experiments demonstrate, having the devices available is not enough for the school chain to implement technology. The money spent with such devices can go to waste if the next Governors do not make the appropriate diagnosis and discontinue the project.

One of the suggestions proposed by administrators to avoid this problem is to get public tendered teachers in charge of the coordination of program lines and to fill the commissioned positions. Respondents from partner organizations highlight the importance of a well-structured administration.

This situation of possible discontinuity becomes even more serious due to the lack of proper middle and long term plans from the teacher's side. Those plans should be able to go on even if other Governors take office.

2.7

The relationship between local governments and the MEC

The relationships established among the different levels of government are very diverse and can involve overall political projects, influence on decision making through funding and institutional arrangements.

As for **funding**, MEC is praised for the treatment they grant with the PAR and FNDE online systems, creating a non-personal relationship and a trustworthy and professional communications channel.

In addition, the Education Department staff have positive opinions about the funding from the Federal Government and research support agencies that is distributed to develop various projects. They funded many projects for Bahia schools. Among them, the project “A Física e o Cotidiano” (Physics and Daily Life) which made it possible to develop 130 Physics educational media with resources obtained via the Ministry of Education Condigital announcement, and the first version of *Portal Ambiente Educacional Web*⁸ (Education Environment Webportal), made with FAPESB (Bahia State Foundation for Research Support) resources.

Despite being a minority in the studied population, union-active managers that take part in MEC open meetings also praise the public queries regarding the **overall policy guidelines**.

At the administrative level, there is an explicit expectation for a stronger **focus** on local policies. Aided by local autonomy, such a focus could help driving states and municipalities towards a common direction that the Ministry established with grounds on a national development project.

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When I took office, there was nothing [from this education department] on PAR. So, while we organize and put up what we need and send it to the Ministry, the Ministry makes everything available. Our relationship with the Ministry is very good, they have been contributing a lot.
(Administration, Municipal)

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You just go to the FNDE website, knowing what is or not there, everything you can get and not get. It is a system, the Mayor's party doesn't matter, there is no such problem.
(Administration, Municipal)

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Before establishing a policy, the Ministry holds meetings with the managers, CONSED, UNDIME and Confederação dos Trabalhadores da Educação (Education Workers Union). They listen to those three groups to implement the policy.
(Administration, Municipal)

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But the best way to influence MEC is CONSED, Conselho Nacional de Secretários de Educação (National Council for Secretaries of Education), and MEC opened themselves a lot to this. It is an executive board with a president and four regional vice presidents... the conversations with the Ministry of Education have been very fruitful. If you take a look at the Pacto do Ensino Médio (Middle Education Pact) project, for instance, you will see that it was structured after talking to us, the secretaries of education.
(Administration, State)

⁸ In order to learn more about this experiment, check chapter 6.

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What overarching national project does our country have for education? I really don't know. And you, do you know? Have you read it, is it written somewhere?

I haven't seen it, even though I am a Secretary of Education. I've been here for four years; they didn't call me and say "Look, you need to get your children prepared because in a few years we will need engineers, researchers and scientists to work on our oil and gas industry, which is very important, even strategic..." There is none! For this reason, we guide our actions by the news and sometimes on some research. (Administration, State)

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We can go to a school only to find a Gesac antenna, an antenna for our program and yet another antenna from some Internet provider. Three internet sources.

And, you find none if you go to another school. We have this issue because there is poor communication between Federal programs and State programs to avoid such overlaps. The worst thing that can happen is having bad distribution, bad network access panning – something that should already be present in every school, but some don't have it while others have two or three [internet spots]. It happens a lot. (Administration, State)

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But that [labs not used correctly] is a result of a very misguided policy created within the Federal Government by the Ministry of Education, without thinking of any implementation at all. It's complicated if you don't think of the end point. Being obligated to invest in a badly planned project doesn't please me. (Administration, Municipal)

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ProlInfo has a very good purpose, but generates great jealousy for being a Federal initiative set forth in partnership with State Governments. That gives us this impression that State and Municipal Governments carry on the program all by themselves while the Federal Government advertisement makes everybody think that they are the only ones responsible for this. (IT, State)

The secretaries also talk about the lack of communication in MEC actions, which makes the **policies less efficient** because of overlaps. In this sense, local administrators criticize the direct MEC action on schools, showing a lack of harmony between federal action and the gains from a widespread communication for the initiative, as well as for making local governments liable for the policies results without due public recognition of their role.

Another issue raised by the local governments is the fact that federal actions are **general, parting from an average** – leaving some of the federal units aside, no matter if they are one of the most developed or have a lot of special conditions.

Managers suggested that MEC should keep funding the various projects proposed by the federation units, providing guidance but not implementing those policies directly.

Considering that the results obtained in ICTs have been incomplete so far, it is necessary to think once again about the relationship among federated units to create comprehensive long-term mobile learning policies. As the MEC has a privileged position all of this, they could, for instance, provide research and guide actions to increase the effectiveness of municipal and state initiatives. All the “computerization” focused funding granted since the 90s, including that for more recent teacher “computerization” programs, is a very limited action. It does not take into account all the steps necessary to establish consistent mobile learning policies with the local governments.

2.8

Perceptions of federal government tablet acquisitions

Managers have divided opinions on the tablets acquisition by the Federal Government. Most of them criticize it, claiming that the procurement had no link whatsoever with any programmed action that could avoid the devices under-utilization. They believe the federal government could have had more control and been more selective with that expenditure.

As noted earlier, the MEC Plano de Ações Articuladas (Articulated Actions Plan) requires an established plan in order to approve the federal entities funding. But this prerogative is not only generic but also isn't tracked at all. This fact and the quite ineffective results reported to the local managers feed the idea that the federal government has little control over the tablet procurement activities.

A minority group of managers have established plans on technology usage within their schools that include digital content provision and infrastructure project. Because of this, they don't give great importance to the federal government lack of direction. They take such devices procurement as yet another incentive to teachers employ ICT in their activities.

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Almost all of the national programs don't take the regional peculiarities into account. Such an average isn't adequate for us because we are in an isolated area, a bad area. We have access to some of the power grid and the communications network, but everything is more difficult and more expensive. For this reason, we are unable to implement the projects.
(Administration, State)

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There was this ad claiming that "federal programs assure internet access to 87% of Brazilian schools." So we're among the 13% [left]. If it was 95%, we would be among those other 5%. If it was 98%, we would be among those other 2% because we have entirely different levels of challenges. So that's exactly what happens: the people creating federal programs don't know about our local issues, unfortunately.
(Administration, State)

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In my opinion, it was a mistake because they're sending the wrong message to the system. By participating on such a program [that of the tablets], you should at least state what they [the tablets] would be used for and only then present the project. And only then the supplier could tell if it makes sense to send the devices. It should work like this: "Show me the action program so that I can see if it makes sense for you to buy this tablet or whatever device." Yet it doesn't work like this. But how do they do it today? You just go there and add "I want 30,000, 20,000, 50,000 [devices]" to the list. And that's all. Got it? I don't like it at all. (Administration, State)

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In the first place, you naturally shouldn't be obligated to participate. You only join if you want to. And that's good. But I'm critical of the way it is presented. In my opinion, a lot of money goes to waste and you end up spending too much resource on technology. Because technology goes like this: if it's not used well, it's wasted money. I only believe in technology distribution if there is an effective usage project. Let's say, for example, that a certain state distributed those tablets. I remember of their Secretary of Education. I was with him at the time he bought them saying "No, a tablet is always a good thing, even if it isn't put to use..." to which I replied "Okay, if you want to present the teacher with something that they can do whatever they want with, that's okay." But if you want to put it to educational use..." I [recently] asked [a businessman] about his current experience with tablets. "It's a tragedy, Mr. Secretary of Education. They are calling us to try to improve the situation because they practically aren't being used in the school." That's what he said. (Administration, State)

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If the teacher has a tablet at his or her disposal, I believe he or she is being inducted to see that as another tool being made available to him or her. It's not a [federal] program that must have a pedagogical project, they are only distributing devices. It doesn't matter because it is a teacher at one of my schools. And we have a pedagogical project for our schools.

If we had no pedagogical project whatsoever, we wouldn't provide tablets for the teachers because it would generate no result whatsoever.

(Administration, State)

And there are also those who are resentful, wanting a **better coordination between federal action and the locally implemented projects**. As there is no infrastructure requirement to buy those devices, the local governments have no incentive to postpone their adhering to complete an eventually incomplete infrastructure project if there already is a pricing proposal established and funded by the federal government.

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The federal government gave the tablets, for instance. If it was coordinated, we could have made this Intranet project before, but we didn't... We didn't because time obviously isn't easy to get. Such projects need a maturation stage, that's vital. Then they go to the Attorney General and the Attorney General sends them to MEC... (Administration, State)

In some cases, there is some **self-criticism arising from the local governments** regarding the adhesion to such devices procurements.

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The federal government recently registered the price and centralized resources for us to buy tablets to the teachers. Yet it isn't being used effectively, it isn't being used at all. You distributed the tablets but didn't attend to the requirements to use those tablets. This is a serious problem. That's something we are looking forward to being organized. (Administration, State)

When the price register offer that was initially for states only, is made available to the cities, some of the municipal governments willing to buy tablets already have ICT usage plans and report their prior planning perspectives, while some others are still in the early stages of implementation and don't seem capable of planning the usage of such devices.

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The tablets were delivered to the state teachers, but the teachers got no training at all. As a consequence, that tablet is only being used to log into Facebook, which is just awful. (Administration, Municipal)

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This preceding movement for ongoing training to get some self-knowledge. If the material is delivered and the usage gets more complex, it must be done. They shouldn't just bring their material and let us on our own with them. I think that this is not adequate to school chains like ours. No. We must provide support. (Administration, Municipal)

It is important to highlight that the local governments do not present a different approach if the tablets and notebooks are bought locally, without participation from the Federal Government. Approaches that value the teachers and also compensate the students' efforts tend to stay valid even if there are programmatic plans to receive the equipment. Therefore, the Federal Government is not the culprit. There is a need to establish new models to allow the various government levels to implement more effective mobile learning policies coordinately.

2.9

Attitudes towards institutional partnerships with third parties

2.9.1

Private companies

One of the trends observed in this study is **establishing partnerships with private companies** to build and equip schools with ICT resources, themed labs and technical courses. Such projects are still in their infancy in most states, but are in advanced stages in some others, e.g., Amazonas and Rio de Janeiro. There is some variation in those partnerships, but in most cases the State is responsible to provide the staff and studies plan, while the companies finance the infrastructure, including equipment and maintenance.

Some State Governments turn to the private sector, while some companies seek out the Governments because education is one of the main aspects of their social projects.

One of the cities studied had a direct partnership to increase their schools bandwidth. By partnering with the local Internet provider, they made a deal by which they got **fiber optics Internet** into the schools inside the reach of such cables in exchange for sponsorship in a local event.

There is also a mention of partnerships with technology companies, by which they provide software and licenses to be used on the schools.

On the other hand, it is necessary to contract products (hardware) and services (software, internet provision, maintenance) and **the managers display varying degrees of doubt about it, especially at the municipal level**. One example is the local technical limitations to evaluate what's being offered.

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You don't need to do exactly what the company wants you to do, but you have to convince them that what you want is also important for them. It's not like that. It's not like I'm going to open a school and the companies will come by putting their billboards...
(Administration, State)

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I put a lot of faith on such partnerships. I really do. Especially when the partner comes without that desire to sell their stuff or to push their own projects. In such school systems, you first need to see if there are teachers available and then you have to persuade them to collaborate with the projects. And that's no easy task. (Administration, State)

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Our interests must come before those of the companies and they shouldn't say what we should do. We know our students and what we want, despite all the challenges, unlike a private institution that has its own demands and commitments. Public policies should be aimed at the people. That's why the companies have to do what we want. (Administration, Municipal)

There is an additional doubt related to the private companies, based on the assumption that those have their own interests that are not always compatible with those of public institutions. This doubt is accompanied by fears of contract abuse and services exclusivity or even related to the policies targeting.

2.9.2 Non-governmental organizations

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We issued official announcements that also allowed the departments of education to use the platform. We presented all the requirements and also the guarantees we expected from such Departments. The program is free, i.e., the Foundation receives no funding or resource, despite the costs. The department of education must provide the structure so that the program can come to life, whereas we provide all the training, the progress tracking and the platform. I currently have 44 municipal school chains in Brazil scattered in Rio Grande do Sul, Ceará, Paraná, São Paulo and Bahia. There is a certain diversity. (Organizations)

There are many voluntary sector organizations working with the departments of education to improve education. The most referenced ones are the Lemann Foundation, due to their Khan Academy project, as well as the Ayrton Senna Foundation and Parceiros da Educação (Partners of Education) on the pedagogical and management sectors.

Khan Academy is a project that has got increased visibility. In 2014, the number of users surpassed 1 million, 60,000 of which are due to school partnerships established with the department of education.

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As we have no certificates or anything similar from someone that could deserve [this partnership], we have our worries. As a consequence, there is bias in everything we have been doing in this sense. We haven't implemented anything in any school actually. We always implemented it by taking a random number of schools and seeing how everything goes. (Administration, Municipal)

There are also new Non-Governmental organizations and companies working with the education departments, with special focus on innovation, via pilot projects. There were references to Global Education Leaders Program, Inspirare and Itaú Social Foundation along this study. As for the fields of digital culture and pedagogical use of mobile technology, there are references to Casa da Árvore.

Those organizations have diverse approaches to act in the schools, being able to implement projects created by themselves or work with the schools to create a project within previously established grounds. **These diverse approaches can influence the teachers and be more or less accepted by such important actors on the implementation process.**

The managers see those partnerships as a welcome support. However, in some departments, **those projects are limited to only a handful of schools and generate little structure.**

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I think they are present in about five schools. It is a small universe, but it's a partnership that has been giving results and the schools have been working on it. It's very interesting. (IT, Municipal)

Those partnerships with businesses and nonprofit organizations have the clear purpose to transform the school environment and bring together diverse audiences, as well as companies and schools. Those differences and eventual conflicts may generate good changes in the long term that could be replicated in other contexts. Expectations, insecurity and overall positive impressions prevail among the public managers.

CHAPTER 4

STRUCTURAL ASPECTS OF IMPLEMENTATION AND MANAGEMENT

1

THE IMPLEMENTATION HORIZON

The political dimension, clarified by the analysis of the training agenda and the administration of initiatives at the federal and local levels of the previous chapter, points to aspects of great complexity to build effective mobile learning policies:

- » Planning difficulties and vision for the medium (four years) and long term (over four years) at all levels of government
- » Constant discontinuity framework, even during the same administration or party
- » Limited use of both the accumulated experience of the technicians of the federal government, and of the institutional capacity of the MEC to assist local governments to create plans to support mobile learning policies and enable consistent monitoring of their actions
- » ICT deployment plans are not prioritized in the face of other pressing educational demands, with low consideration for the contribution of frameworks for increasing inequality.

- » Policy trajectories defined by contingency on institutional arrangements that encourage responses from local governments to actions of the federal government without involving all the necessary pillars and not including long-term planning.
- » Divergence between policy actions (stimulus) and expected results (response): distribution of equipment based on human resource policies, with the expectation that the improved self-esteem of students and educators will directly cause the use of equipment for educational purposes and learning improvement.
- » Unfavorable functional structure of departments, with technology groups and experts segmented through workgroups of low institutional capacity to mediate the integration of ICTs in teaching departments and consequently in schools.
- » Use of ICTs for administrative and monitoring purposes still limited to a few teaching networks.
- » Low awareness of the administrative problems of public policies for mobile learning and consequent accountability of schools and teachers in not using ICTs.
- » Partially equipped schools with low speed Internet.
- » Few educators motivated and technologically prepared to use the equipment available in schools.

We will cover these points in the following sections of this report, observing how they are manifested during the implementation of the policies.

2

PLANS, CONTINUITIES AND DISCONTINUITIES

“Since successful educational reform projects involve changing of the culture of schools, as well as development of the curricula, assessments, and other elements to facilitate such a change, they are most successful when carried out gradually over a multi-year period, rather than through attempts at sudden imposition” (WARSCHAUER, 2011, pp. 103-104)

A successful public policy for mobile learning requires:

- » That the three supporting pillars are covered: **infrastructure, digital content and teacher training**.
- » That there is **continuity and maturation time** for the parts to take hold, both in relation to technologies or the established project.
- » That the **monitoring** of the policy development is done, in order to **assess** its results.

Many projects are considered flawed without even having their three pillars fully implemented; others, without having had enough time for experimentation and adaptation to the school system. Often, such incompleteness in the implementation of the public policy is interpreted as a failure of the technology itself, which are faulted for not bring the expected benefits for education. It is thus a case of administrative problems that are expressed in the implementation.

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[The secretary has been here for] four years. It's rare. Never before in history. Unfortunately, I always say this, either it's good or bad, the first step for the project to work is to allow it to continue. It may not be the best project, but it has to be continued. Even to come to the conclusion that it was not [good], it has to be continued. We didn't even have that parameter. (ET, State)

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When there was a change in government, even though from the same party, the UCA was abandoned. And if the federal government abandoned it, and the program is a federal one, you can imagine what happened throughout the state ... We wanted to follow-up to see if it had good results, if learning had been improved, if it was worth investing in; but things started and then just stopped. That is why schools are so resistant; they no longer believe that they will start the pilot project and it will continue over time; they already have a discrediting opinion on the continuity given to things. (ET, State)

Administrative changes are fertile moments for the emergence of proposals for change. And, considering that the time for the implementation of a project is not a short one, a few more months without definite and structured classroom experiences are likely to happen at the beginning of a new term in the event of disruption, preventing the consolidation of mobile learning policies in the country's public school system.

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Amateur action, inexperience, “I think it will work” won’t fit in here. A program must have 70% to 80% planning, and a percentage of this planning in conference, feedback, retro evaluation – what we do not always see in public projects [that have] 10% of planning, 30% of patches and then, again another patch, and back ... So, it doesn’t work ... I don’t see major public studies, as I don’t see, in a long time, great public administrators. Finally, I see some people who suddenly are concerned in putting their ideas into practice, without much planning. (IT, State)

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When you change the administration, you have a higher risk [of discontinuity]. In 2011, the opposition [won]; but this opposition came in and kept this structure and kept the policy in the technology area. There was [continuity], because the people who came in were doing research on what had been done, what had worked, what had not worked and [decided that] “technology is important, we will continue investing”. (IT, State)

Mobile learning policies in education require medium and long-term projects, given the high investments needed to execute them and the still early stage of the development of connectivity in the country.

This research shows that infrastructure projects, if any, tend to be developed by the **initiative of directors of IT departments, with or without a pedagogical plan for the use of ICTs in the educational departments**.

It is important to emphasize that an isolated infrastructure project is not considered here as a mobile learning policy for education, but as a necessary part of it.

In the presence of an infrastructure project, the main action areas are the power grid, connectivity, content storage and equipment. **The state departments are the ones that are more structured in these regards**, but their representatives point out a difficulty in uniting administration and planning.

In departments that have gone through an electoral political transition with a plan in place, we can see administrative changes with continuity of some program actions.

Anyway, **the experiences observed in the field that evidenced continuity demonstrated that, the greater the reach of the project and its appropriation out of the administrative office, the greater the chances it has of prevailing.** Opinion polls and forum for collaborative planning are some of the instruments used not only to assist in the project's planning, but also to engage educators.

On the other hand, in the absence of a plan created and absorbed by the school system, we have **constant adaptation in the face of new situations** and in case of administrative change, the equipment might remain idle, and already developed applications may be removed, waiting for a new direction for the school system.

It is important to note, also, that the absence of a plan favors the possibility of developing non-coordinated and sometimes incoherent actions, affecting the consistency of projects and reducing their potential impacts.

The lack of plans to create conditions for lasting projects prevents the evaluation of results. This is one of the reasons why it is necessary at this time to focus on the analysis of the implementation of current public policies in order to enable decision makers to draw comprehensive and continuous plans, considering the trajectories taken to date.

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We're trying to put together a technology policy. We have a pedagogical policy project, [where] the actions to be developed are outlined; it has a design, it has a line of thought and all that, but what we are trying to build, we just did not yet consider due to lack of time. It is a policy that can stop or limit the acquisition of some projects that are coming, but differ from all we believe in; they go against everything we believe in as a technology concept.... A basic computer project for primary school students in early childhood education – we do not believe that, no way. Where is it written that we don't believe in that? There is no document at the Education Department to bar that. (ET, Municipal)

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Usually, it would work like this: we had an idea, we would create a Power Point presentation, then we would build a questionnaire in SurveyMonkey, or we would use the social networks – Facebook, Twitter – to present the idea and to ask for opinions – what could go right, strong points, weaknesses, opportunities, and so on. With that, we had some feedback, the idea would mature and we would present it to [the secretary], and she would add a few things. In the end, we had a product that was made by many people. (ET, Municipal)

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We followed the reference document that was created back in the administration [of the former secretary], but there was already a very strong discussion on the network; so, before that reference document created [by that administration], already a whole discussion existed and was started on the matter of media and new technologies in education. These conversations were frequent and this might be very strong, very secure in my speech because I've been in the network for twenty years. Then, for twenty years discussing this on the network for twenty years. In fact, it is almost by osmosis. (ET, Municipal)

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The department of education purchased tablets for schools. A tablet and a multimedia projector for each classroom. A set was purchased in 2012, and they started arriving to schools in 2013. I had a proposal for the use of tablets per class; if the school had 20 classrooms, it would have 20 tablets and 'X' number of multimedia projectors. But because there was a change in administration, many of these tablets stayed in boxes during the last year because many administrators were wary of opening and spoiling them and by the time they finally did it, the battery would no longer get charged. (EC, Municipal)

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During that change in administration, they started by pedagogically evaluating what was the purpose of the system, and concluded that the way the system was designed did not meet their expectations in relation to the pedagogical proposal. Then the system was taken down to be remodeled. This administration says that the student does not have to be a consumer but a producer instead. So, he has to produce content and not just consume ready-made content. That was the biggest criticism that [the new administration] had. The student must be able to assemble his/her exercise and continue producing the content. They believe this is a better way of learning. It was a system already in use, some schools were using, but I don't know in what proportion. (Organizations)

3

THE NECESSITY OF
INTERSECTORIALITY: THE
RELATIONSHIP BETWEEN THE
IT AND PEDAGOGICAL AREAS

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The key person [for the decision on equipment] belongs to the infrastructure [department]. But his vision is a technical one. So, he is consulted, yes. And, on the other hand, the director of educational policies, which would be the main department in the office, taking care of basic education, won't be consulted. Perhaps she should be. Because that is what causes a gap: the pedagogical sector will only receive the equipment, they will have to go into training, into incorporation of schools; we are still doing this wrong. (Management, State)

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I think [the main focus of influence of those actions] is in the information management work-group [of IT], which is the work-group that does not think about the pedagogical possibilities, but has autonomy to make purchases of equipment; that is one point. (ET, Municipal)

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We received the terms of reference [of the project that is being implemented] [from IT]. We at [the educational technology work-group] don't even agree with that. Because the proposal is very technical, very closed, doesn't give the student any autonomy to produce anything; but, in short, I don't know the material, I can't speak, I don't know if they are objects, I don't know what subject matters are included. I must choose the schools, but I don't even know to what the target public will be. (ET, Municipal)

As technology is the main concern of the IT¹ sectors, this is a subject that competes with many other segments for the attention of educational administrators from departments, and usually remain outside of their most urgent priorities. In addition, the interaction between the educational and IT areas, to think of the integration of ICT in schools is very rare. For such proximity to occur that would be beneficial for the consolidation of policies in this area (WARSCHAUER, 2011), research shows that it depends primarily on:

- » The intermediation of the education secretary
- » The propensity of the pedagogical board to integrate ICTs in the teaching-learning process and to rethink the curriculum based on them
- » The institutional arrangements created to establish the dialogue between the IT management and the pedagogical area.

Technology actions in education with a **focus on hardware** – the most common, as seen before – are normally established through **dialogue between the education secretary and IT management**, with less decisive participation of the pedagogical manager – be it the education superintendent, the director of elementary school, or high school, etc. As an example, we have the distribution of notebooks and tablets to teachers and students in several of the studied school systems where **educational managers are often more involved as formal supporters after the decision has been initially developed, rather than as the entrepreneurs in the development of the action.**

¹ Area, sector or IT area are terms we use to describe the sectors of departments who work directly with infrastructure, information technology and information systems, without distinction between them or other existing nomenclatures.

Interestingly, we can see, that this is a **pattern that is also replicated in the federal government**, where the FNDE, responsible for technical definitions, has established itself as a major link next to the state education departments and municipalities in actions related to the distribution of equipment from the MEC.

Communication difficulties between the educational and IT sectors are often cited.

Changing this setting requires a mediation that, almost always, comes from the administrative cabinet and includes highlighting the importance of ICT in the planning of the Department and the joint work between sectors.

Of course, even in this mediation scenario, the IT sector can continue to dominate procedures, due to their proximity and level of expertise on ICTs. It is also a responsibility of education directors, to increase the role of the pedagogical area when the subject is relative to mobile learning policies.

The implementation of education policies going beyond the focus on hardware must become increasingly frequent, so that the results also become most satisfactory. Such a measure requires a constant dialogue between the IT and educational sectors, with the mediation of education administrators in order to ensure a more active role of the pedagogical area in the design of action plans and the integration of technology in the school curriculum.

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They [the IT sector] are the ones who have the database. They are the ones who have access to the office management system. I can only see, I cannot take data and stuff. So I relate with them only because I need them. If I didn't need them, I wouldn't have any relation with them. If I could do it myself, I would do it alone. (EC, State)

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Because, sometimes, situations occur where it's necessary to involve the technological area into the planning of that project action ... At the last minute, do you remember, at the same time as the hurricane, at launch time or on the day before: "Ah! I had to involve the technological area in this matter". (IT, Municipal)

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The pedagogical and infrastructure coordination are at the same level in the organization chart ... And the person making the liaison was the undersecretary, due to the knowledge she brings, both from technology and the pedagogical area. So she made the link between the pedagogical and the technological, which we didn't have. Let's say that, if I had to buy something, in another administration, something that pertains to technology, only the technology coordination would opine. Not today, today they always call the pedagogical. Then, he [IT manager] produces a broader evaluation and the girls here produce the pedagogical evaluation. (EC, Municipal)

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Now, it has an action that will be, one way or another, encouraging and almost forcing sectors to dialogue, which is this project for the modernization of schools. We will install local networks, and this is a project that doesn't belong to any specific sector of the department, it is a general project; the entity in charge of the project is the secretary's office. (ET, State)

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This is still a lot of personalization inherent to public management, and that is a complicated issue, as we were begging for four years to see this working group formed, but probably we didn't have the necessary influence to motivate people to join. From the moment the undersecretary and the secretary took over the management of the project, they implemented an intense working rhythm with, on average, three meetings a week. (ET, State)

3.1

Why the IT area has played a stronger role in education projects focused on ICTs

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The government took a decision and I think we have a lot to do with it, because we ended up saying that it was possible, yes, we will do that, and the government purchased and distributed notebooks to all teachers. (IT, State)

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The use of technology in the administration of this mayor is part of a larger plan, an education plan, but I think it is not only that; I think it would require a dialogue [with us], as we are the ones who think on pedagogical possibilities. I suppose they don't have that understanding. People who have been here longer develop work with technology. (ET, Municipal)

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As Gilberto Gil says, you have to give a ruler and a compass to teachers and encourage them. A teacher is a student of the school system in themselves, we have to give them a ruler and a compass and allow them to get out of the box, to let them try and do things differently. (IT, State)

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Whenever we bring something here, when we research and think a new solution has come out that can improve teaching, we go to the pedagogical sector to talk to them and it works. It's no use for the technological sector to think about something that will improve the action or the life of the teacher... But we understand technology. We try to align this with the pedagogical part, with the nucleus [NTE] that includes teachers focused on technology. It gets easier. They are more open to information, to new ideas [because] it is also difficult to bring novelty and innovation, to change paradigms. It is hard to convince if you don't have a person who is open to that. (IT, Municipal)

The most common scenario found in this study is where there is an initiative of the IT department in ICT integration projects for education. This has happened, in the first place, due to the hardware focus of actions of departments, where the IT area is more dominant, and the educational sector, even the work-groups on educational technology, are seldom consulted.

On the other hand, IT initiatives also respond to the **wishes of some directors in the sense of catalyzing the use of technology in schools**: as the internal appraisals show an under-utilization of equipment that has already been distributed for a while, and they think that something has to be done, with suggestions for educational content emerging from IT.

Interesting, in this case, is that normally the NTEs become the interlocutors for the pedagogical area to dialog with the IT people. This is the most interdisciplinary territory in the educational sector to discuss new possibilities, showing that increasing the profile of teachers from the NTEs, in other educational sectors, such as kindergarten, elementary and secondary education, can help radiate the discussion from within the departments.

Demands for change, in terms of using technology in schools, have not emerged from local educational departments, including the NTEs, according to the results of this research. In addition to the aspirations of education administrators and the federal government policies already mentioned, **the influence of IT managers has also had an impact on the adoption of mobile technologies in education**. However, the low effectiveness of actions seems to

lie on the deficiencies of the less visible layers of the infrastructure that will be analyzed in Chapter 5, in combination with a lack of leadership from the teaching staff in those procedures.

It is essential to think about the role of IT in mobile learning activities and on how to leverage their integrated knowledge into the experience of the pedagogical sector. There is a need for new organizational models that favor this dialogue and offer paths for innovation.

3.1.1

The profile of IT managers

"...IT and instructional technology leaders are separated by a wide gap, with only the later concerned about educational issues and the former attending only to technical matters. Yet when IT directors also have a broad educational vision...they can contribute a great deal to educational reform with technology." (WARSCHAUER, 2011, pp. 103)

Amongst the functions of the departments of IT and infrastructure in mobile learning policies, is the task of structuring schools to receive new equipment and Internet connectivity, helping to decide on the best technological options - including equipment and, in some departments, also educational software.

The IT directors and managers in the departments are key actors to build solid ICT policies in education, by clarifying to education and pedagogical managers the infrastructure requirements for this.

They have very diverse backgrounds. There are computer engineers, electrical engineers, economists, graduates in computer science, information system managers, system analysts. There are also those who came to this area through experience with technologies in their own school system. Among these, we find physical

education, chemistry, and geography teachers of early levels. Half of the respondents come from the private sector, they were running businesses or were providing IT services in other sectors of the economy.

3 of the 10 respondents were women, showing that despite the greater number of men in these positions, there is room for greater gender diversity in the sector.

Among the diversity of IT manager's profiles, we have found two cases positioned on the opposite sides of the continuum that merit description. There is the profile of the manager who foments the use of new technologies, **personally committed to having an active role in the inclusion of ICTs in their teaching networks** and in bringing new features.

On the other side, there are IT managers with a stronger educational focus. They are more concerned about the **use** of technologies and will play a more directed role at the service of teaching departments, providing **less leadership and more mediation** in the identification of new equipment.

Those are complementary profiles, and their differences are fundamental to explain the importance of having higher-level administration that drives IT services for the pedagogical goals of the department.

3.1.2

The IT area and its structure

As you can guess, the internal structure of the IT sector is very different from department to department. In municipal departments, usually more functions are joined together than in state departments, albeit with less staff. In such cases, the management of enrolments and school census information, for example, are added to the infrastructure management.

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For this to work, it only needs the participation of human beings in the process. One always sees the hardware, the software and the people-ware; what is really missing is getting it right with the people-ware. Because, you see, we offer a lot to schools; MEC provides a wonderful package, in the notebooks we deliver 70GB of learning objects for teachers – videos, video lessons, handouts, several games for all ages. What is still missing is to have this guy really using this new tool. (IT, State)

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When they start talking about the integration of tablets in education, I just tell them to calm down. A previous discussion is needed before that resource arrives. In what ways is this different from other resources: from puppets, books, from what they historically have always had. Because my teaching behavior also has to be different compared to what it was with the other resources. (IT, Municipal)

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Today, the concern is to offer more and better. There are schools with ample technological structure, but that use only 1/12 of what they have. I have to change the educational format. (IT, Municipal)

In some **larger and more structured** state departments, we see a high level of professionalization, with different internal departments, dedicated and outsourced teams, as well as the decentralization of staff regionally.

In more structured departments, mainly the state ones, there is a combination of career professionals and third parties who build the IT departments' capacity for development and support. Also, it is important to mention the reports of recent changes and reforms, which show the increasing importance of this area for the education departments.

In municipal departments, institutional arrangements are simpler, but they can also rely on outsourced services to increase their capacity for action. We found cases where the IT manager is also the manager of the NTE, connected to the pedagogical department. While this dual management assists in creating synergy between the technology and educational sectors, the lack of personnel hinders the ability to structure and execute planning in the medium and long term. The urgency to respond to immediate questions that emerge daily, is gaining greater relevance.

Because of these structural differences, the views of IT managers in municipalities and states are very different when it comes to the perception of federal government actions concerning infrastructure. **While there is a vision of greater reliance of the municipalities as to the MEC's own policies, the states seem to expect ministry action that is more focused on administration, with more autonomy to develop their own actions.**

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We have spread, over 91 management boards, a center that responds to the educational board, but it's like it is our department there, the NTE. These 91 persons [directors of the NTEs] are in direct contact with me in here. Each board has a team of five interns, a technician and now also 2 computer analysts, who will be included in August, coming from the official recruitment procedures. So, in theory, in the regional departments, we have a structure in order to make things work at the end. (IT, State)

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If you count all third parties who work here, I'm talking about 200 people or so. They are in another building. Today, here at the department, you can even operate things faster and also keep a structure to begin growing sustainably, as in other departments. The [Department of] Finance, if we only consider career professionals, includes 200 people in the IT field. Here, there are 20 career people, if we add all of them up. (IT, State)

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There are municipalities that only have actions from the federal government, without any initiatives of their own. Most municipalities don't have. I think all municipalities depend on this policy. Of course there are a few things ... For example, many of these policies are transfers of responsibilities to states and municipalities and when it comes to this, the municipality cannot afford to comply with that counterpart, that is the infrastructure itself, especially the poorest municipalities. Perhaps that policy would have to come complete. Is it for technology insertion? Then, it should come with electrical network support; it should include a forecast for working these issues over the electrical network, logical network in every way. (IT, Municipal)

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I personally believe that the model [purchase by lots by the federal government] is interesting for obtaining lower costs and enable large projects, but it is flawed because it does not listen to those states who want to define the technology or training themselves. We only receive an unopened product, when in fact, as a partnership, as the owners of the resources... [Because] the money transfers that go to the federal government are from the states! And that, for us, is a complicated issue, because the solution that was thought for one region in Brazil is not the same that we need in our state. (ET, State)

3.1.3

Organizational design and the IT area's position

While the educational sector is an ‘**end**-area’ and a structural basis for the education departments, the IT sector is a ‘**means**-area’ that gains increasing visibility with ICT integration policies. This movement requires special attention from the education administrators to the organizational design of this expanding area.

The organizational charts of the departments do not necessarily correspond to the reality of the day-to-day of governments. IT sectors, even when under various departments or divisions, are commonly accessed on a daily basis by the secretarial cabinets. It is an area whose **intermediation by broader departments such as planning, administration, logistics, turns out to be little effective in everyday life**, given the level of specialization of the field.

The position in the organizational chart may affect, in any case, the scope of IT actions. Since there are many investments to be made in non-visible layers of the infrastructure, these demands may not duly reach the leaders of the portfolio, restricting or hindering more consistent and long-term designs for technology for education.

In the figure below, we have an example of IT as a division of the Department of Planning, in parallel with the Contracts and Agreements Monitoring Division and the Computer Management and Statistic Division. Whereas all areas are critically important, some may be more strategic, depending on the goals of the department, requiring different organizational models.

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The administrative coordinator has never treated the nucleus as a subordinate, which only communicates with him. I always had autonomy to communicate with the secretary and undersecretary, advisers and heads of cabinet. (IT, Municipal)

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I think we would need a discussion closer to the secretary himself, so he could understand a little more the importance of certain technology investments. (IT, State)

Figure 4.1: Example of an organizational chart for an education department

Source: Authors' creation

It is not the case of defending a specific position for the IT department in the organization chart. It is important, in any case, to understand the priority level and the organizational and administrative model in the technology area of an education department, as these factors can influence the necessary conditions so that mobile learning policies are developed.

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These are two issues [on the difficulties side]. First, they are two departments and, sometimes, the Department of Science and Technology has a different view from ours, and they think we should not have to bid on a system, that the Department of Science and Technology itself should develop the system for us, but they cannot do that at the speed we need. And another thing is the equipment itself; we've prepared three or four times the terms of reference for the equipment, but until it goes from department to department and returns, then goes to another department and returns, when it finally goes for tender, the equipment is already outdated. (Administration, Municipal)

In three municipal governments, we noticed a trend towards **centralization of planning and infrastructure purchases in a specific department of government**, whether at the management or planning department, or at the department for technology and innovation. It is assumed that centralizing resources under a single structure tends to reduce costs and facilitate processes. In one of the city halls, this was a transition in progress at the time of the study. In the other two, this was an already established model, which brings difficulties, mainly related to **delays and communication failures resulting from having to access another government department outside of education for ordinary and everyday actions**.

Box 4.1: A governance committee for IT actions

Another organizational design is the **constitution of a governance committee**, as found in the State Department of Sao Paulo, where the IT sector has a very robust structure. Composed of coordinators from different areas of the education department, besides the central administrative office and the secretary, to whom the information technology sector reports to, this is a **model that creates mechanisms for involving different departments in the discussions**, besides providing different checks and balances in situations that require impactful decision making, such as medium and long-term IT plans, without losing sight of the participation of the education leader.

The governance committee helps in fighting the superimposition of the IT sector in the departments and efficiently involves the decision makers and other departments on the agenda of information systems and infrastructure.

Source: Authors' creation

Despite the heterogeneity of experiences, the most common organizational model of the IT area we could find can be described as a **department inside the education department itself, reporting directly to the secretary's office or to an intermediary administrator**; but even in this case, with direct and constant contact with the head of the department.

The recommended caution, in this most common scenario, is **to define well the role of IT as a means-area and not as an end-area**, as in this sector, due to their expertise and proximity with the cabinet, it can really stand out compared to other areas when it comes to technology, including suggesting to the pedagogical sector IT integration projects in schools.

It is important to note that to define the role of IT as a means-area should not necessarily entail moving the sector, in organizational terms, to a level subordinate to that of the pedagogical department. Experiences that sought this model encountered several conflicts as the pedagogical administrator showed no technical knowledge to command subordinates - which caused difficulties in day-to-day activity and fewer benefits than expected.

Therefore, a good collaboration model between the pedagogical and IT areas, with mediation of the education leader, can produce better results than a subordination model.

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Having a technical administration under an administration that only has a pedagogical vision does not work. First, it cannot cope with the depth of the subject. It does not have the expertise to negotiate with an outside company. Those who manage don't have the detailed knowledge required to negotiate with the third party. The vocabulary itself is different. The vocabulary and way of expression in a technical area is completely different from the educational area. (IT, Municipal)

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I don't think the IT guy must make decisions by himself. The guy with that type of career is a technical person and has little experience in the teaching area; he needs to be under a governance committee that will provide him with guidelines, and be himself an area that interacts with the areas of evaluation and basic education... Because if you ask an IT director [to decide] what to put in a school, anything might come out of that. Most of them are nerds, enthusiasts, who will want to put anything inside without any sort of basis. So, alone, I affirm, he cannot stay. I think the model we have here, for example, paralyzes us because everything I have to do is has to be sent to the committee; the committee has to decide. But for a long-term strategic policy, it is good because we will avoid that type of error. Here, however, however wrong the decision may be, it is a collective error. Everyone has ratified [the decision] together. (IT, State)

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According to the rules, I report to the general department, [which is below] the Secretary's office; but in practice, I do not report to the general department but to the secretary, directly attached to it. It was a strategic way he found for us to [remain] attached to him... It improves a lot, and it's much more fluid. Both in terms of communication, and for requests. And that, for me, is excellent. (IT, State)

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That was the idea, they did not want the IT area to be a coordinating body... Because, can you imagine having a coordinating body with the same autonomy that basic education has!? A few strange things would begin to appear in schools. The idea was that we would give support. (IT, State)

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Let's take [the project] to the pedagogical area and we understand that this is a very strong paradigm shift. That issue of meritocracy, the issue of ranking, to see if they understand if they are important or not ... There's a teacher here who has been working with gamification in education; we were talking to her, to see what she thinks of implementing such a project in the city. I think it helps a lot. (IT, Municipal)

3.2

The protagonism of the educational area and promising results

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The pedagogical area wanted to use a software program ... In that case, it is the software and the associated hardware, where you have a digital transcription of what the student says. But this has some cost. It's an ideal world, it's cool, nifty, but this technology was very far from ours, mainly because it didn't exist in Brazil; the software was French. So we decided on a middle ground. We took a classroom management software ... It's a different software, not in real time, but we managed to adapt something. (IT, State)

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This year, we had management consulting and new situations have been implemented related to evaluations - a diagnostic assessment and bimonthly assessments. At first, it was the task of our [IT] area, along with the staff of the educational area, until we could equate a technological solution for them. They are applying it, since yesterday, to the assessment of the second quarter, already with this new solution that we hired. It's working. Now, the assessment and monitoring areas can deal directly with the company. (IT, Municipal)

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We've been working on improving this infrastructure. And we also work together with an area that exists in our pedagogical [department], where the use of technology in the classroom is discussed. Because I, actually, although I am a teacher, my job is not teaching, my role is technical, it is [to find] a better technical solution. (IT, State)

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We have a very good interaction in relation to the [pedagogical] because we have meetings in which we discuss their needs. And then, we search the market to see what could attend [this need] or not, we bring the vendor here and have meetings with them together; because sometimes, for them, it is difficult to understand. So, we try to take this approach. I advise, I help, but the decision is theirs. My position is not to decide about the pedagogical area. (IT, State)

When the pedagogical department and the NTE are proactive in seeking solutions for the integration of ICTs in their projects, dialogue with the IT area increases to quite productive proportions. In such cases, it is even common for the educational sector to manage outsourced companies for the production of software such as management systems and educational portals, for example.

In addition, when IT managers come from the education area, the idea that the role of the IT department is to be at the service of the pedagogical area stands out even more - which facilitates the mediation of both in joint projects.

The involvement of the pedagogical sector in ICT actions also tends to generate closer plans to what may become a mobile learning policy, involving provision of digital content and greater focus on teachers and their training. The pedagogical needs become more relevant in this case.

The experiences studied show that without an educational sector empowered and sensitized to the changes that ICT can promote into the teaching-learning process, into curriculum reform, it is extremely unlikely that mobile learning actions will materialize.

So, it is necessary to shed some light on the profile of pedagogical departments and their administrators, to be able to view the paths necessary to that end.

3.2.1

The pedagogical area, its structure and the place of ICTs

The pedagogical sectors of the education departments are quite heterogeneous in their structures. They can be considered superintendencies, divisions or departments. Usually, they are divided into school levels: kindergarten, elementary/middle school and high school, and have specific work-groups to specific populations, such as indigenous, *riberinho* and *quilombola* communities and race relations. Their functions, however, converge: planning and implementing education policies for the school system.

The teams responsible for continuing education of teachers may be subject to their pedagogical departments, or may, in some cases, be constituted as training schools and report directly to the education department administration.

To address ICT issues in education, the areas of educational technology are the most common structure. Usually subordinated to the pedagogical department, they may have different names such as: department of technology and educational diffusion, directorate of educational technology, educational computing nucleus, and educational technology nucleus, among others. More structured networks, in particular the state ones, may have areas of more robust educational technology, even with divisions, focused on training, on production of digital content, distance learning, etc....² Also in existence are a technology projects administration linked directly to the educational department's central administrative office as well

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Under the current administration, the secretary has implemented a sweet poison for us. Before, no one listened to the pedagogical side; now, everything has to be validated, requested, demanded by it... The heart of the department must be pedagogical. If the mobile computer lab is going to be purchased, we do the research... If some training is being done on... the use of the software, we request for the human resources administration to do it. The secretary's vision is very clear: if we want to get anywhere, we have to know where north is. What is the best sector to say that? The pedagogical sector - he was very clear in this sense... Before, it was not so... It was the infrastructure, everything was infrastructure... Sometimes, something would arrive that was good for nothing. (ET, State)

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I determine what type of equipment schools need during a discussion with the schools themselves. Then we assemble a benchmark of such equipment and send it to the equipment sectors. When they say it's ok, I can immediately send to the purchasing sector. Who determines, exactly, the terms of reference, the necessary equipment in every classroom, it's us. Other departments will deal with the budget part of the tender, that is, the practical part of the purchase; but the initial decision is ours. (ET, Municipal)

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We [area of educational technology] researched [along with a computing company] what would be the minimum equipment required to run educational programs that were used, and a projector that would show a good resolution within a classroom, and then we did the specifications required at the time; and, with those specifications, we opened the tender. (ET, Municipal)

² Among the municipal departments, only the one from Curitiba showed a similar structure.

as secretarial advisors coordinating specific projects, such as the production of digital content.

Training for the use of ICTs has been under the purview of the areas of educational technology, in some cases, in partnership with the continuing education teams, as will be seen later and in greater detail in Chapter 7.

Figure 4.2: Illustration of the most common organizational structure of the education departments

Source: Authors' creation

This study shows a consistent increase in the number of people dedicated to ICTs in the pedagogical sectors of the education departments, even greater in places where the topic has gained relevance due to the portfolio administrators. Demand for new activities is growing and new teachers are shifted to contribute in support functions, training, digital content production, among others. Although this suggests a promising context, many challenges can

be observed, mainly related to organizational arrangements that are established and the consequences for the incorporation of ICTs in various sectors of the departments.

On one side, there is a tendency **to focus new employees in departments responsible for educational technologies without institutionalizing their dialogue with other educational areas such as curriculum, training, etc.** The trend we can see is like a magnification of a specialized nucleus, which, as we have seen with the trajectory of the NTEs, may see their results limited due to lack of impact on other departments.

On the other hand, **the quantitative expansion of ICT-oriented people in general has not been accompanied by an analysis of the positions of this new staff positions.** This raises concerns about instability, since without associated legal guarantees, a change in government may discontinue such functions, sometimes associated with specific projects. The condition of employment insecurity is a factor that is present, even for pedagogical advisory functions – a form of on-site support for teachers on the use of technology, which has been established by some departments.

3.2.2

The profile of pedagogical managers

All interviewed directors, superintendents or advisers from the pedagogical area are also educators. Among nine people, seven are teachers for their school systems in elementary or high school, and two are university professors. They started working between 1970 and 2000 and have wide and diverse management experience in directing schools, high school coordination, central administration departments, and university vice-provost.

In terms of their time in office, they are quite recent in their current roles – between one and two years – and even a case of only three

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I had a team from my under-department; it was a small team; I had 5 people. I started with 5 people and went out with 15 people. It was much reduced. (ET, Municipal)

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We went from a team of 4 people, plus the directors, to a team of 18 people, plus the directors. (ET, State)

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To go to the department means a wage loss of 75%. If I was in a school, I would earn 75% more. No one wants to come and work here. I have tried to change that with the career plan, but the legal office doesn't understand that the guy who thinks about public policy needs to receive as much as a teacher. It's very complicated. There are good people in schools, managers, technology teachers who even want to work here, but it's too great a loss. (ET, Municipal)

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Because it's an election year, many teachers are afraid of a role as a [technology mediator]. They're going to other places. Unfortunately, we have this aversion to public service, which we consider unstable; people are afraid of the change of government and seek another position. Imagine you are doing very well on a project; a person who is going very well there, in that role, but is afraid because there will be a change. (ET, State)

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I think that, today, technology is modernity. We talk a lot about this: “It is not from my time.” But it is my time, because I’m experiencing it! Now, it is much more of the time of those children there. In fact, what is new to us, very often it’s not new for them. And they surprise us all the time with that; and I think the school has to be always modernizing to keep up.
 (EC, Municipal)

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We always think about information and communication technology through the technological tools that enable this process. I think of information technology, the one that opens up the possibility of networked knowledge. And this possibility of large-scale information, for me, so to speak, is the strongest point. (EC, State)

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I understand ICTs as just another opportunity for children and young people to learn. Both with regard to informing oneself, seeking information, and communicating, managing knowledge and everything else. (EC, Municipal)

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In this environment, my profile is the one of an apprentice. For example, I use e-mail ... I have WhatsApp, I have ... But then, with family, with a group, the group of undersecretaries of secretaries ... We have also Face [book] ... Now, I confess to you... Very often, like this... Girls who are administering [for me]. When I post [something], they say, “No, but if continue opening, then I’ll lose control over here.” (EC, Municipal)

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We need to get more involved, because devices become obsolete too quickly. You can see that, simply on the update of WhatsApp: you upgrade it, it seems, once every two months. So we increasingly need to upgrade this technology, for sure. That’s why we are on the secretary’s case; we need to know the tablet. I must have a tablet. It’s not just for personal use, [but] because, by the time [I] get to school, and the teacher says that he has no material, that he cannot access this or cannot access that, I can say to him: “But teacher, you have a wonderful software, you received it, it’s on the tablet”. He may not be knowledgeable, but we need to know what we have and to know how to use it, to be able to show those people in the classroom, why we still have this difficulty, this detachment, this fear – which is common. I also have it sometimes; we all have. (EC, State)

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I have a computer, a mobile. The devices, I have. I use them for work and for whatever is necessary. But I don’t have much aptitude; I didn’t develop that a lot, no. (EC, Municipal)

months in this role. We also interviewed a former pedagogical coordinator, in charge when the deployment of mobile technologies in his school system was implemented.

With regard to their vision of ICTs, they are all very open to the theme, and see them as an important asset.

Concerning **the intimacy** they have with the discussion of ICTs in education, we find two profiles: the first, more common, are those **educators who feel uncomfortable with the subject**, clearly exhibiting a substantive difference from the heads of educational technology nuclei, usually their subordinates.

The second profile is that of **educators with experience**, either because of personal profiles or due to previous functions related to ICTs in their own department or in other organizations.

The profile of educational managers, more accustomed to ICTs or not, does not necessarily determine the investment in digital technologies for the school system. As we have seen, decision-making on this subject takes place mainly within other spheres. However, **depending on the profile of these managers, the reflection on the role of ICT in education can reach other dimensions** – the articulations with the IT sector, for curriculum and training, can be better established and recurring, and more comprehensive plans and the consistent inclusion of technologies tend to be more likely.

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I started in the academic field; then I worked at IBM, in Brazil, for ten years, as a manager for the incorporation of technologies in schools and universities in Latin America. I left the academic area; I was an advisor for the state government for the implementation of some technology-use projects. I was consulting for the processes of incorporating technologies in schools, teacher training. (EC, Municipal)

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Well, I am a passionate person and I cannot imagine how I lived before 1994: it was the first time I was introduced to a computer. When my father died, he left an inheritance for his three daughters; my sister bought a blue Beetle, my older sister spent it on clothes and I bought a computer. It was the first time I signed up for dial-up network ... (EC, Municipal)

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Well, I'm an electrical engineer; so, I have always worked with technology and I love it. I am a staunch user of technology. I love smartphones, computers, modern things. (EC, State)

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I started working here [at the education department] with the department of technology and educational diffusion, and now I started directing the department of elementary school. I have no training in the area of technology, nor any specific knowledge. I have a profile that seems to correspond to that of an articulator, not of a specialization - I think this has to do with the question of technology: to be familiar with various areas so you can link the use of technologies and other functions that you have inside education. (PD, Municipal)

Based on the evidence found, the construction of mobile learning policies can greatly benefit if a formative approach and engagement of pedagogical managers is developed. While the focus of training initiatives for the integration of ICTs in education is based today on teachers working in the classroom, those (also) teachers who occupy the management positions in the offices, have a much more comprehensive action potential and have not been included in these actions.

Collaborative networks and immersion for stronger appropriation of digital technologies by these professionals can contribute to change the dynamics between the pedagogical and IT areas as they tend to help mitigate some poorly rooted short-term projects, currently developed by the sectors of educational technology.

3.2.3

Organizational design and the isolation of education technology coordination

With a more homogeneous profile than that of the pedagogical managers, educators working in the areas of educational technology have many traits in common. They are educators who, because of their personal

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I have all [the technologies]; I'm considered an addict. I have a very large involvement with them. I was there, waiting for you, taking care of my life in the smartphone. I use them all at the same time (ET, Municipal)

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Today, I produce even when I'm driving in the car! There is a tool inside the Samsung, with which you can talk and it types the text. I have used this application very often. So I produce, I use and I share. (ET, State)

profile, ended up getting known in their schools due to their use of ICTs and were therefore recruited to work in the departments. They are quite experienced teachers, who witnessed the arrival of the first computers to schools and the beginning of ProInfo, and have been following the development of their school systems with the integration of digital technologies.

Due to these characteristics, these are the people to whom we were often directed during the course of this research in all departments. Even when we asked to talk to other departments, it was a recurrent to be told: 'If you are already talking to x (educational technology coordinator) you don't need to talk to Y (pedagogical director)'.

So, even today ICTs still have first and last names in school systems - in departments, they are the coordinators of nuclei or the managers of educational technology, or advisors of the secretaries or undersecretaries responsible for implementing technology projects. In schools, however, they are the teachers who use the laboratories, projectors, digital whiteboards, and students' mobiles.

Two thirds of the studied departments have very small areas of educational technology and they are poorly structured, with limited numbers of staff and face many difficulties in executing their projects. As a result, the dissemination of technologies as a language that goes beyond the departmental and disciplinary boundaries of their own departments is still limited

Box 4.2: An experience to expand the integration of ICTs in the Bahia State Department

One of the state departments visited, that of Bahia, chose to strengthen ICT actions by putting them all under the teacher's training superintendency. Under the same structure, we find the coordination of educational technology, with the NTEs, the production of learning objects, and distance education, creating a broader center that is connected with training. This movement aimed to focus and optimize efforts, but without losing sight of the need to interact and influence the training of teachers.

In 2011, during a restructuring process, mapping was conducted to identify which sectors were developing educational technology. Three sectors were identified: one that was connected to the pedagogical department (Superintendence for Basic Education), one coordination of technologies and also a production team of the Anísio Teixeira TV. A proposal for unifying these areas was drawn up, which, together with a training center for teachers, came to form the Anísio Teixeira Institute – which has also become a center for the production of educational media.

Source: Authors' creation

It is imperative to reshape the organizational structures for the educational technology areas of departments, which have become like "islands" of specialized educators in ICTs but without proper integration with other departments responsible for structuring the curriculum and teachers training, and without the necessary empowerment to convert ICTs from isolated tools into a language.

For intersectoriality to become, truly effective, integrating complementary sectors into mobile learning policies, it is essential to conduct reforms in the organizational designs of departments in order to achieve:

- » Mediation to decisive action into the IT area and its establishment as a means-area

- » The appropriation of digital technologies by representatives of different sectors of the educational departments to transform them into protagonists in the development of mobile learning policies
- » The construction of mechanisms to ensure an environment that is beneficial to both sectors, IT and pedagogical, to share their ideas and knowledge.

CHAPTER 5

INFRASTRUCTURE

1

WHY IS IT SO DIFFICULT TO MOVE FORWARD?

"The real administrator, as a driving force of situations, lies between the two extremes. The balance between the controlled and uncontrolled variables defines the governability of the object of the plan."
(MATUS, 2006)

Figure 5.1: Laboratory with an electrical grid adapted to receive computers

Source: State and municipal public schools

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We have difficulty with the Internet. Today we have internet in most schools, but it is not fast enough. Here at the department itself, there are times when I try to access here and I cannot, it takes too long. I think the biggest problem we have with the mobile equipment is slow access.

(Administration, Municipal)

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We have states, municipalities, which still have difficulty just talking on a regular telephone; imagine cell phones, Internet and stuff like that.

(IT, State)

One of the pillars of mobile learning policies, the infrastructure of schools, presents many challenges, either in the decision-making processes, or the difficulty of obtaining sufficient resources to implement medium-term plans, or even the limited governance the departments of education have when it comes to the topics of connectivity that go beyond their purview, that of the level of government and the public sector as a whole. There is no doubt about **the need to focus specifically on this area, since it serves as the foundation, which enables the development of the other pillars of action, and imposes significant limits on the possible scope of initiatives.**

What sets this pillar apart from the others – digital content and training of human resources – is its **complexity in terms of the different layers of decision-making**. This includes **the more visible devices for access** such as computers, laptops, tablets, 3G modem, Wi-Fi access points; but it also includes some **elements of less visible layers** to ensure connectivity, such as cabling in schools, renewal of the power grid and wiring of cities and neighborhoods to receive high-speed Internet – typically third party investments, such as telecommunications operators, who are currently focused on fiber optics. As a result, infrastructure is the pillar, which entails **less governance by the education departments** in general, because it includes layers not administered by education administrators.

As we will subsequently see, the most visible layers of infrastructure have been developing by leaps and bounds in schools. In fact, we found a lot of equipment distributed by governments to teachers, students and also to schools, a result of computerization initiatives of ProInfo schools since the 1990s and also local government initiatives.

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If you go to a private school, you may not find all the equipment you find in public schools today. (ET, State)

On the other hand, especially at municipal levels, but also at state levels, advances related to Internet connectivity are slower and need to be negotiated with other departments, data processing companies, and others, depending on the institutional arrangement established by the city hall or government. In addition, there is a dependence on cooperation with third parties in all cases, which includes aspects related to the investment capacity of telecommunications companies.

In addition to less governability, **the less visible layers of technology infrastructure are also less familiar to education administrators** and require specialized knowledge, which the Information Technology (IT) and infrastructure administrators of education networks are responsible for mediating.

Another important aspect is that this type of investment is not the focus of the school's most urgent needs, as in the case of leaks, roof problems, and other aspects of infrastructure, where the effects of the problems generate the need for a solution to keep the classes functioning, and they are elevated to **essential actions**. For various reasons, as we will see in Chapter 8, ICTs do not advance quickly in terms of the demand of educators. **If it is not structured as a public policy of the Departments, digital technologies may take a long time to come into demand as essential at schools.**

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There is a law that the municipality's processing company must provide our communication. There is legislation. I cannot go and say: 'Today I'll contract my connection for the schools from whomever I want and set up at my school'. I do not have that autonomy.
(IT, Municipal)

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I have a universe of schools where, in some of them, I can't manage to bring the Internet. It has to be via satellite, because of its location. So there is a whole problem with infrastructure that is not only of the Department, but of the whole structure; it hinders scaled actions very quickly. It has to be built up.
(Administration, State)

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There is a side of technology that is difficult to see - the infrastructure. So then, it's not just this Department, but all the others, they have trouble visualizing this. That is, there is a side of technology that is: 'Oh, I need a base', but it is difficult to be tangible for anyone who does not work in this field. (IT, State)

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There was no investment in technology and especially in infrastructure ... The school continued to have a 128Kb link a year. It is very difficult to grow and meet the expectations of it, because the infrastructure does not grow, but the work grows.... The school census and registration are online; the human resources system and the systems that the MEC makes available to the school are online. So everything is online ... and because of the infrastructure and the lack of investment, [it] ends up being weakened
(IT, Municipal)

2

THE CHALLENGES OF
INFRASTRUCTURE FOR
DECISION-MAKING

[There is] even political interest. I think this does not only happen in municipal networks, but in other networks too. The political interest of administrators, the mayor [to invest] ...

(ET, Municipal)

The problem is not the purchase of equipment. The problem lies in the connectivity infrastructure, in having Internet or Wi-Fi point in all units, so that the equipment has access.

(IT, Municipal)

For every real of our money received, we have to invest again 2.5 more. This is the calculation we do today. We are speaking of bidding, Wi-Fi, infrastructure, plus the installation, plus maintenance; this bill cannot be paid all at once. We estimate about 40 million to 50 million [reals]. So it is considerable [amount of] money if we look at how much we spend on tablets, for example ...

(IT, State)

The issue of Internet is the responsibility of MEC and of the Ministry of Communications. If we were to take a very good connectivity model to the schools, it would cost billions of reals to make it universal. We have done this survey already. And this amount has to come from some budget. It is the policy of the state to establish whether it is a priority or not to invest more and more and bring in broadband, the connectivity we want. This costs billions.

We need to think about the budget. The National Education Plan already provides some paths. We are not left out; we are being prioritized. But we have to see the budget issue.

(Federal Government)

The arrival of the infrastructure issues at the decision-making table of administrators at the local level usually follows relatively general demands for expansion of access to technology in schools from higher levels, including the **mayor**, in the case of municipalities. Such demands open up the discussion of technical needs that are rarely addressed on a day-to-day basis, although they are basic elements for expansion of technology in schools.

At the decision-making table, costs are a key variable for establishing priorities of the departments, and also the federal government; and infrastructure requires high investment, which prevents certain courses of action and prioritizes others.

The purchase of hardware, in any case, has occurred despite this discussion, and before any necessary restructuring in schools, something that is due to the following factors, among others:

- » the ease of processes for and availability of financing for the purchase of devices, either directly or via the federal government;
- » the fact that many of the purchases are being made regardless of structured plans, such as awarding student and teachers with tablets and laptops, and unrelated to educational projects;
- » the high investment necessary to improve the less visible layers of infrastructure, and medium and long-term aspects involved in these actions, which limit investment, because the results are likely far removed;

- » the fact that the issue of technological infrastructure is not yet considered an essential action in education.

Given this challenging scenario, school systems have developed heterogeneously when it comes to infrastructure, positioning themselves still between urgency and application (SEVERÍN, 2010) in the field of mobile learning policies. The investment into the distribution of tablets from the federal government to high school teachers, starting in 2012, in addition to local investments that have sought to increase access to mobile technologies in schools, are examples of the focus on providing hardware - the visible infrastructure dimension of ICT policy in education.

It is evident that while the issue of ICTs in education has gained space and has become an aspiration among administrators, the issue of the less visible infrastructure to make the technologies function properly still lacks prioritization and room in the budget. The hardware, thus, has arrived prematurely to schools before the necessary infrastructure.

3

THE SCENARIO OF DIGITAL TECHNOLOGIES IN EDUCATION NETWORKS

The scenario of **digital technology availability in education networks** is highly heterogeneous. The availability of devices, as well as connectivity and other infrastructure aspects can vary greatly

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I think the biggest difficulty is that we had no equal distribution: you won this laptop, but I won the tablet, she won nothing ... This school has a computer lab, [the other] only has a board...

We did not think purposively about anything with a strong integration. Of course, there is a way of using your tablet aligned with the board, this exists, but we were unable to think in a standardized way of the resources that we have. They were not distributed in a standardized way, because it is too expensive; did not reach the whole network. (ET, State)

from school to school, whether due to the existence of various pilot projects or the partial purchase of resources for some units based on varied criteria.

On one hand, it is understood that the **technologies are complementary** to each other, with the tendency being to have different resources available. On the other hand, as **different equipment gets to school without being properly integrated into the teaching process**, there appears to be an overlap of technologies and a lack of a plan that integrates them, which makes the administration of the departments of education rather complex.

Below, we will describe the infrastructure resources available in the public school systems for elementary and high school education.

3.1 Electrical network

The grid is part of the less visible infrastructure that requires much attention from technology directors and sometimes causes problems in the use of equipment in schools. **Many schools must undergo intensive electrical renovations** to provide capability of charging multiple devices at the same time in a classroom. Alongside the arrival of equipment via the departments of education, there are more and more personal devices at schools, which constantly use the network.

The interviewed technicians are optimistic in pointing out that the **devices are becoming lighter** and increasingly require less energy, which suggests a more promising future; however, there are major difficulties resulting from an aging infrastructure in municipal and state networks.

Figures 5.2 and 5.3: Renovated electrical network in a school and cell phones of students charging at another school

Source: State and municipal public schools

Improvement actions

Renovation of electrical networks based on prior planning of digital technologies intended for schools.

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Sometimes you have a machine that is under warranty and it is subjected to the precarious infrastructure of the school. No supplier will provide a warranty for equipment that broke because of the school's electrical issues. (IT, Municipal)

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The question of infrastructure, primarily electrical and construction really affects our work. It has a direct impact on our operations. We receive work projects sometimes, and we see our part of the service, and it is incomplete. Then, you have to fight with the company to ensure minimum infrastructure quality standards needed to set up the technology afterwards. (IT, Municipal)

3.2

Internet and connectivity

The main challenge of the IT field in education is connectivity. Including at the federal level as well as in states and municipalities, one of the major constraints to the expansion of Internet access at schools is to prioritize the issue of infrastructure, with so many other demands, and to invest substantively in the less visible elements of the chain that are more expensive than the equipment, such as tablets and notebooks.

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We, technology administrators, we know that there are things that cannot wait, they need to be done. It's the basics. If the basics are not done, everything becomes chaos. And since the technology is not palpable, when you do not have the service, the availability, then yes, you feel the lack of technology. (IT, Municipal)

The investment is made when it reaches a priority status for the leaders; although, even in these conditions, spending cuts can affect continuity. According to the information provided by the studied education departments, the total budget for technology (equipment, Internet services, infrastructure) tends to correspond to less than 2% of the total budget of the departments. Among the available data, the exception is Curitiba, whose budget exceeds 10%.

Table 5.1. IT budgets of the departments of education

Level of government	State/ Municipality	Budget of the Department - 2014	IT budget* (equipment, Internet and infrastructure)	% IT
Municipal	Curitiba	BRL 1,208,535,690.31	BRL 143,607,981.40	11.88%
State	Goiás	BRL 2,753,557,000.00	BRL 40,188,000.00	1.46%
Municipal	Manaus	BRL 1,156,452,000.00	BRL 16,000,000.00	1.38%
Municipal	Goiânia	BRL 432,121,000.00	BRL 5,364,168.10	1.24%
Municipal	Rio de Janeiro	R \$ 5,104,630,816.47	R \$ 17,936,863.95	0.35%
State	Paraná	R \$ 5,812,232,500.00	R \$ 8,711,033.82	0.15%

Source: based on data provided by the departments

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It could be better planned, but unfortunately ... At least the years that I have been at the department, I always try to plan. My planning is based on the department's strategic plan. We keep minimum resources in operation, but it is never ideal; we need a political and budgetary decision to invest in technology a certain percent a year. (IT, Municipal)

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We have budget planning; we program a number of things; but this planning, in these last three years, at no time, was it considered 100%. So in all the years of financial difficulties, there is a cut of expenses. This year I had to cut 20%. An example of this is the 40 million that we asked of to set up Wi-Fi access. At first there was money, and then no more. In the end we managed; scrapping for pennies, we put together 10 million, which were intended for other things, and we thought we could use that money, but we did not manage that either. Now, we are asking for three and a half million to start [Wi-Fi] at over 200 schools in 2015. (IT, State)

Improvement actions

The creation of a network of IT professionals from departments of education could play a role in several dimensions of standardization, including cost estimation and minimum investment parameters for the establishment of solid mobile learning policies.

3.2.1

Types of internet connectivity

There is much heterogeneity between the municipal and state departments with respect to the Internet. While there are

networks with 10Mb broadband Internet available in all the schools, there are also educational networks with a 128Kb signal available at most schools. Thus, there is wide variation in terms of connectivity and speed when considering medium and long-term plans established for improving connection services.

The **type of Internet** used and the distribution of broadband by **fiber optics** are important to consider. Among the surveyed states, Paraná and São Paulo are best served by fiber optic cables: according to the online research conducted, the cities of Curitiba and São Paulo were the only ones to report that 100% of their elementary schools have fiber optic Internet, which is equivalent to 180 and 555 units, respectively. Goiás and Rio de Janeiro indicated the lowest concentration of fiber optic cable, with almost 100% of their schools are served via twisted pair cabling (ADSL).¹

Other types of connections that provide fixed and wired Internet in the context of schools today include mobile Internet, satellite Internet and a radio connection.

I. 3G Internet

3G Internet, or mobile Internet, as it is also known, has been used as an alternative to conventional wired Internet, which does not yet adequately reach certain regions, whether due to barriers and difficulties of access or due to limited public and private investment relative to demand. Given the increasing coverage of this technology, devices with 3G Internet are preferred by some IT technicians to ensure connection complementarity to users. Mobility of the equipment is also an aspect considered to be important justification for investment in 3G Internet.²

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We are going to give the tablet, 7 or 10 [inches], from the MEC bulk purchasing, [because] this tablet is better. And we opted for a tablet that has 3G for the student. (IT, State)

¹ Optical fiber is the physical medium that allows for the highest data transfer rate today. Over a billion times more data can be transmitted via optical fiber than via copper lines – the latter most widespread in Brazil, being part of the telephone infrastructure (ESTADAO newspaper, 2013). The transmission standard available via optical fiber in the Brazilian market currently has reached download speeds of up to 500Mbps (megabits per second), but it is still restricted to some regions in Brazil where such wiring has been installed and with prices still a limiting factor.

² 3G is the name given to 3rd generation mobile technology. Its signal is picked up normally by chips installed in mini modems that connect to USB devices. Models that do not use modems were also seen in some local cases. In January 2015, 3G Internet was present in 3,929 municipalities, or the equivalent to coverage of 91.9% of the Brazilian population according to Teleco (http://www.teleco.com.br/3g_cobertura.asp). Last access on 03/09/2015.

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[A percentage of schools] have 3G, and it is not a 3G mini modem, it is a corporate 3G... These schools have the 3G, because they are schools outside of Embratel's coverage area, via cable. And they implemented this 3G, which was one of their pioneering projects. It is an unstable Internet; at least the experience here at the department was not very good ... The 3G comes with a small antenna, [but there is no] 3G in some areas of the capital. So there was difficulty with communication. Embratel put external antennas on schools to aim to its main antenna, some solved the problem and some did not.
 (IT, Municipal)

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There was an error of distribution in these mini modems. The concessionaire sent to the schools to deliver them directly to the teachers. And then, when I arrived, the concessionaire [said]: 'I delivered more than 5000 modems and I want to charge for them.' [And we said]: 'Look, you will only charge once the teacher is using them.' And then, there are directors who lost, misplaced, did not give to the teachers... We demand accounting, we demand accounting from the regionals, but nothing... Because IT does not have this representation; our team is small, it is more administrative. (IT, State)

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The federal government also tried, distributing 3G modems to each rural school. There was a bidding process and Claro was chosen to distribute these modems. But there's one problem: there is no 3G reception there in the rural community. The administrator receives a 3G modem that he will only use when he's in the city. Or, in some rare cases where you get a 3G signal. (IT, Municipal)

In Salvador, according to IT staff, in early 2015, approximately 12% of the schools used a 3G connection. In Manaus, 2% of the municipal schools also use this type of connection.

On the other hand, following the strategy of enhancing teacher access to computing, the state of Rio de Janeiro, in late 2014, distributed over 25,550 modems, most of them – more than 21,000 – given to high school teachers, and the payment for the service is made by the department itself.

In addition to the 3G Internet connection via mini modems, there is also a corporate 3G model, less common in schools and that does not involve the use of a modem.

The departments also report **administrative problems** during 3G Internet implementation, which causes another set of challenges unrelated to the actual service of the operators.

Administrative problems are also reported at the level of the MEC. To service remote areas and rural schools, in addition to providing satellites (see below), the federal government has also prioritized the distribution of 3G; however, after the bidding held and modems delivered, it became apparent that there are many areas that are not covered or have no signal.

Although 3G Internet is a great option from the viewpoint of governance, as it allows the IT sectors of departments to acquire modems and services directly through bidding, without relying on other levels of government to ensure the connectivity of schools, **this type of connection is not considered the first choice in school systems, because it is considered more unstable and provides slower speed than fixed broadband**. It is, in any case, an alternative viewed as important in situations

where there is no available wired Internet, or good Internet speed – a constant condition in all regions of the country.³

In the short and medium term, mobile internet options can be a good solution for education systems if the quality of connectivity matches the objectives and expectations of use of digital resources in schools contained in the mobile learning plans of future policies. They can also allow access to the Internet anytime and anywhere, bringing important benefits to parents and students in and out of school, strengthening engagement with expanding mobile learning initiatives, including access to school administrative and monitoring tools.

Improvement actions

The mobility of 3G Internet and even less common 4G Internet is highly valued. The quality of services, in any case, in terms of coverage and speed is critical to provide the basis for mobile learning policies.

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It was the first [Internet] we had. So we were grateful for having any speed whatsoever. We could connect only 10 tablets. Then, [routed] 3G does not allow you to connect additional devices; but, then, we took turns: half an hour 10 [tablets], after another half an hour, 10 more... We were able to come up with some very cool arrangements. Everyone loved it. Just the fact of having Internet on the tablet was great. (ET, Municipal)

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When we got Internet for two years, we won because a partner bought the 3G modems. The teacher would add credit on the card and use 3G Internet at school. It was very nice. He was a partner in an IT company. He worked in schools with the information system. We coordinated the work that they did... Everyone contributed and added [credit]. It really worked beautifully! (ET, Municipal)

II. Satellite Internet

Internet via satellite is a connectivity alternative in areas of difficult access, and it was more common in our research sample in the states of Amazonas, Bahia and Paraná. In Paraná, according to data provided by the IT industry through online research, almost ¼ of the schools also have access to the Internet via satellite. In Manaus, this access reaches 15%, and in the state of Bahia, it corresponds to approximately 11%. Other schools with this type of connectivity are also mentioned in the state of Goiás (6%) and, residually, in the state and in the city of Rio de Janeiro and the city of Goiânia (1%).

Companies provide the satellite connection commercially, with higher prices than conventional Internet. In addition, programs in the public sector use satellite technology to serve people in rural areas, indigenous populations, residents of *quilombos* and *ribeirinho*

³ As a parameter, according to data from Teleco, the average speed in the third quarter of 2014 of fixed broadband connections in Brazil was 2.9 Mbps, almost twice as fast as mobile broadband connections, with an average of 1.5 Mbps. Available in: <<http://www.teleco.com.br/blarga1.asp>> and <<http://www.teleco.com.br/3g-brasil.asp>>. Last access on: 03/11/2015.

communities. Examples of such programs are the GESAC, the telecentres of the Ministry of Communications, and education programs at the state level, such as the Teaching Through Technology Mediation (*Ensino com Mediação Tecnológica*).

The GESAC (Electronic Government - Citizen Support Service) is a Ministry of Culture program, which offers connection to broadband Internet with commonly up to 512Kb connections, according to the reports of respondents. The available speed, in any case, sets limits on their pedagogical utility.⁴

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With the GESAC, sometimes you cannot open Google (IT, State)

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In rural school in a very dense forest, you can install very good radio connections; but they are very expensive. On the other hand, if you want something with a little higher cost, you use satellite technologies. But then you have connections that are very susceptible to climate variations: if it rains and it gets cloudy, then, the satellite stops working at the school; in addition to logistical difficulties, both for us and for the operators to get to these schools. (IT, Municipal)

Improvement actions

The improvement in the speed of satellite connections provided by the federal government is one of the existing demands.

Box 5.1: High school classroom mediated by technology

A pioneering experience and winner of more than a dozen awards is the On-Site High School Mediated Through Technology program, initiated by the government of Amazonas in 2007, and since 2008, also implemented by the government of Bahia and other states in the north and northeast regions. One of the reasons for its emergence was the limited ability to keep students who completed elementary education in high schools in the Amazonian rural region, due to the lack of schools and especially the lack of teachers.

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“Every year, eight thousand students finished elementary school, and they did not enter the network. Every year, these students had to make a decision, that is, to move to the urban center, where they had high schools, or to stop studying. This resulted in the formation of what we called ‘unmet demand: adults who spent ten years without studying because they did not want to move from where they were living.’ (Administration, State)

⁴ According the GESAC website, in 2013, 70% of the connections reached 1Mb and some reached 8Mb. Available on: <<http://www.mc.gov.br/inclusao-digital-noticias/27714-em-nova-fase-gesac-teravelocidade-ampliada-eo-dobro-de-pontos-de-conexao>>. Last access on: 03/10/2015.

Each state has developed its own structure, usually made up of a professional studio - which can be a subcontracted company - with a recording team, audio and video, and a selected network of teachers produce and explain the content of lessons transmitted live at scheduled hours to thousands of students. Through a satellite dish, a TV, a laptop, and communication accessories such as cameras and microphones, mediator teachers and their classes of students follow the lesson from their communities, and can interact via text or voice chat, by doing the proposed activities and asking questions to the expert teacher in the studio. The curriculum followed is the same as for regular education and the completion diploma is valid nationwide.

Figure 5.4: A studio of the Education Mediated Through Technology program

(continue)

You have the best teachers within the network, imparting knowledge to very remote locations. It's the big gain we have from teaching through technology mediation. Today, we have over 700 schools covered. (IT, State)

(Figure 5.4 – conclusion)

Source: State Department of Education of Bahia

Figure 5.5: State School, in the Environmental Protection Area of Rio Negro in Amazonas, served by technological mediation

Source: Amazonas State Department of Education

The arrival of this type of education is accompanied by criticism and fears, recurrent in projects involving technology, such as the fear of teacher replacement, but the results have been positive and allowed us to expand education in the Amazon region:

Another important point concerns the relationship with the private sector, considered key by administrators for shaping the program.

These are pioneering and very rich experiences that deserve studies on the relationship established between teachers and students and learning developed in this environment.

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“People said, ‘Oh, this program is to replace teachers, to replace the traditional school’, but actually it was not that. The enrollment has increased; because there were people who were not studying and the program was made solely in order to go where conventional schools could not reach.”

(Administration, State)

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Had there not been so many outsourced things ... The State, unfortunately, is not that fast, that robust, does not have the structure to offer certain things; so it really needs to outsource. How do you install an antenna, for example, there in the region of São Gabriel da Cachoeira, “on the dog’s head”, as we say? You have to go through 200 waterfalls to get to an indigenous community ... Does the state have resources to do this? It does not, but it has financial resources, a budget; so it contracts others.

(IT, State)

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We used a 512Kbps connection per school. In a school where you have the secretary’s office, the director’s office, the library, sometimes you have a library with seven to ten computers; you have a computer lab and often you have netbooks, tablets. All this and the will to serve the community at a time when the school is not using the connection. It is very precarious. There’s no way to do this with a 512Kbps connection satisfactorily. In practice, it becomes impractical. Today, we are putting this 5 Mb to 10 Mb bandwidth link.

(IT, Municipal)

III. Internet via radio

The increase in Internet access via radio in the market makes this a viable alternative to low speeds offered by ADSL Internet operators or to their absence in some regions. In the city of Manaus, according to the IT sector, approximately 76% of schools have Internet via radio. Its proper functioning is conditional on direct communication between towers that emit signals and receiving antennas in schools. Obstacles such as trees or buildings between the emitting source and the receiver can impair access.⁵

Improvement actions

The Internet via radio remains a valid option for departments with areas not fully served by the most common and cheapest types of connections, providing speeds that are even higher than these connections. But the costs of service are still prohibitive.

⁵ ADSL (Asymmetric Digital Subscriber Line) is the Internet connection method most common in Brazil, which uses the telephone wiring infrastructure for data transmission (twisted-pair). It refers to the asymmetry of download speed, which is always greater than the upload speed in this model. That’s one of the differences of this type of connection and the cable connection provided by cable TV companies, in which the download and upload speeds are equal.

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I would say 80% [of our schools] have this connection of 128Kbps... Many directors, for example, use [the Internet] at home, take work home, because the connection is better. The residential connection is certainly not comparable to the corporate connection at school ... There is no comparison between 128Kbps and 10Mbps, from any operator out there.

(IT, Municipal)

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Most are twisted-pair. 70% of our schools have a 512kb connection. It is very little. But we are evolving many of these from 512Mbps to 1Mbps, 2Mbps or 10Mbps. The idea is to bring 10Mb to 300 of our schools by the end of the year.

(IT, State)

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The contract [with the operator] was planned to bring 2 mega to all schools in 5 years. In the capital, we are entering the third year, in the other areas, the second year. We are making progress.

(IT, State)

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They managed to launch a fiber optic line beneath the Amazon River; [they] brought some Canadian divers, and this fiber optic line now effectively reaches Manaus. After that, with the mandatory investments that have been made by the Telecom operators, with the World Cup and all these situations, a fiber optic line was brought from Venezuela by Oi. The one from the Amazon River via Porto Velho is from Embratel ... And now there is one coming by Tim from Pará. So it's very difficult and very expensive to get an Internet connection here to serve the schools.

(IT, Municipal)

3.2.2 Speed

The heterogeneity of the departments is even more acute in relation to speeds, which vary widely, not only among states and municipalities, **but within their own school systems**. This is mainly due to the unavailability of telecommunications service providers in certain regions and the limitations of governability of the education departments when it comes to the infrastructure needed to improve connectivity.

The nominal speeds at schools of education networks reported by the IT teams of the surveyed departments are provided below. One of the pieces of information relevant for this research was the difficult access of most departments to this information, taking up to several months to obtain the data; in some cases, after long consultations with operators.

Such data should serve only as ballpark figures, since there is a lack of established processes to monitor and control the connectivity framework of schools in most departments and there may even be a lack of information about the existing multiplicity of connections, such as those provided by federal programs.

As shown below, in most cases the speeds are up to 2Mbps. Curitiba is the network with the best connectivity, where 100% of the schools have 10Mbps or more. It is followed by the cities of Manaus and São Paulo, where higher connection speed is reported for most schools.

Table 5.2: Internet speeds reported by the departments of education

Level of government	City/State	128 Kbps	256 Kbps	512-712 Kbps	1 Mbps	2 Mbps	4 Mbps	8 Mbps	10 Mbps or more	Total reported connections
State	Bahia*	0%	7%	40%	22%	30%	0%	0%	0%	2697
State	Goiás*	0%	0%	0%	9%	68%	8%	0%	14%	2040
State	Paraná*	49%	11%	1%	2%	0%	18%	10%	9%	4342
State	Rio de Janeiro	0%	0%	50%	26%	5%	0%	0%	19%	1265
Municipal	Curitiba	0%	0%	0%	0%	0%	0%	0%	100%	184
Municipal	Goiânia	0%	0%	0%	30%	48%	5%	12%	6%	168
Municipal	Manaus*	0%	0%	16%	8%	0%	0%	0%	76%	501
Municipal	Rio de Janeiro	0%	0%	0%	5%	61%	0%	31%	3%	1008
Municipal	Salvador	45%	0%	0%	0%	39%	0%	0%	16%	445
Municipal	São Paulo	0%	0%	0%	0%	0%	0%	92%	8%	555

Source: Based on data provided by the departments

* Departments that reported more connections than the number of schools with broadband, indicating a multiplicity of available connections.

IT directors and organizations working in partnership with educational networks recognize the challenges and report many difficulties with the speed available in the networks when starting to do work that actually assumes there are functioning connections.

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There are days here that even praying does not get the Internet started. Since we work with the book, and it is associated with the portal, so, depending on the content you have there, you already connect directly to the network to use the portal, where some students who are better able to use the portal [could] make progress with that content... **(Organizations)**

”

The speeds vary. Our goal is that, by August 2015, all schools have at least 8Mb. We even have schools with 34 Mbps; and we still have six schools that have less than 2Mbps. The rest have migrated to at least 4Mbps at the end of the year. (IT, State)

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Today, schools have a 128Kbps connection in the secretary's office and administration office, and an ADSL connection of 1Mbps to 5Mbps from this Broadband at Schools Project... And from Net, we already have 67 [schools] with this Internet installed; there are two connections of 10Mbps - one administrative and one in the computer lab. (IT, Municipal)

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We also have schools that do not have Internet because in that region this operator does not offer Internet yet... You can only ask that company, because it has a contract with city hall. (IT, Municipal)

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There are no schools, even within the netbook proposal, working with various classrooms connecting at the same time. It is usually one or two rooms. Therefore, the bandwidth is more than sufficient; more than the schools need. 99% of the Wi-Fi complaints we receive from schools are equipment configuration problems. (IT, Municipal)

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Even in places that have 5Mb, 10Mb, 8Mb, it does not help. When you use it, you know it does not support such use. (Administration, State)

The research confirms the inadequacy of data on Internet availability in schools to support the initiations of new projects that depend on connectivity. Establishing procedures to understand, among other things, **its speed and distribution in schools, whether or not there is wireless (Wi-Fi), its scope, its frequency, and the uses of Internet**, is essential for a good evaluation of existing connectivity.

Besides the low speed, even in capital cities studied, **there are still schools without a connection**, either due to the lack of local infrastructure or because of legal issues associated with a single operator's exclusive rights to provide Internet provision.

In educational networks that have the best connectivity there are administrators closely monitoring the issue of infrastructure. These are networks that have developed plans for the use of ICTs and where the infrastructure is perceived as a bottleneck for the development of existing plans.

In any case, the best performance is currently seen in educational networks where schools reach connection speeds of 10 Mbps, which is 10 times less than the standards set internationally (FOX, WATERS, FLETCHER, & LEVIN, 2012). **The fact that there are no complaints about the Internet speed in some educational systems, even from those most well positioned within the Brazilian context, indicates the persistence of the low use of ICTs, rather than the attainment of ideal service for the smooth progress of mobile learning policies**

I. Low connectivity: distribution difficulties and the development of alternatives

Many departments divide the existing bandwidth between administrative and teaching networks: the first network is available, usually, in the director's office, secretary's office, and sometimes the faculty room, with a computer connected to the network; while the teaching sector network is accessible in the labs. When there is Wi-Fi, the teaching network is available in other areas of the school and sometimes in the surroundings for community access.

The challenge in expanding the access points in schools is the **need for a signal speed compatible with the desired coverage**. The wider the coverage area at a school, the higher the need for bandwidth. A bandwidth of 2Mb, shared in a disorderly manner, can have the same unsatisfactory quality of a connection as a lower bandwidth, available only in the administrative area. **In the current framework of connectivity, the priority of school systems is to meet the administrative demands.**

Due to the lack of established standards in Brazil, the views of the IT technicians at the departments vary. Some consider the minimum to be a total of **8Mbps to 10Mbps in schools with 1,000 students, while always considering that not the whole school will be using it at the same time**. Smaller schools, according to other technicians, **may have basic teaching access to 4Mbps, but with some important restrictions**, such as downloading videos simultaneously on multiple computers.

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[The Internet signal] comes, and we divide it between the teaching and administrative areas [at the school]. But we started having a lot of problems, because when it was accessed for teaching the administrative one would stop working. The school's priority is the administrative area, because it takes care of payments to teachers, the attendance tracking system, a number of things. Then, the labs were not used because of this problem. Today, it is a challenge, we still have to install at least 8Mb at all these schools, which is the minimum the schools should have. (IT, State)

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An administrative machine of a school is much more important than one of the machines of a call center that is not in use, not because it is not important, but sometimes the procedures that we use can shutdown access to all the grades of the entire school system, and this is delayed because a computer is down. So you have these issues of relevance and complexity that we try to work out. (IT, Municipal)

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The vast majority of schools have Internet that is the Broadband from the MEC. This Internet has a big problem, it is very slow. Today, we have some schools reaching 5Mb, but most schools do not reach 2Mb. It has to serve both the administration and the computer lab. With mobile technology, many teachers are using laptops, bring theirs, they also want access to this network. Then imagine what this Internet performance is like, with all these machines accessing 2Mb or even less ... (IT, Municipal)

We ran a test: when you turn on 20 computers in a room, they take up 4Mb to 5Mb only to load the software. (IT, State)

We held several bids, company x and company y won one and company z won another, but none of them managed to provide a service that was worthwhile. There was a time we did one thing: we told schools that we would send the money, and they would contract the Internet themselves; and, then, we received a subpoena from the Municipal Court, saying that we were apportioning the expense, and that we could be arrested for it. These bodies, such as the Ministério Público or the Audit Court, get in our way a lot. (ET, Municipal)

We began offering offline lessons, which the teachers downloaded and then passed on to the students. It is a quote unquote palliative solution, but it is there so that we don't leave out those schools where the Internet is not efficiently reached; which is not a problem only of schools but of the entire city. (ET, Municipal)

There is an infrastructure project to increase to 1 Mbps. Initially, we invested in a program that could be run offline. The idea of providing digital objects, teaching guidelines, and everything else on the site, was this: the teacher downloads and does not depend on the Internet. But, of course, our dream is to reach the most advanced levels of technology use. (ET, State)

Faced with these obstacles and with little control over the operators and other sectors of government responsible for the connection infrastructure, some school systems are seeking **alternatives**.

One of them is **the decentralization of Internet contracting by schools**, but out of legal considerations, regulatory bodies have found such action to be illegal.

On another path, **offline work** has been an option. In a school system that acquires educational content from companies, for example, there was a negotiation with the service provider company for the contracted content portal to be stored internally in order to allow access for teachers and students in a virtual environment, but without access to the Internet.

Researching and developing local solutions, which necessitate negotiation with other bodies and enhance governability of the education departments when it comes to connectivity, stood out in some school systems.

Box 5.2: Local solutions for the difficulties of Internet access in schools

Highlighting the production of educational content online via the Anísio Teixeira Institute, but with similar difficulties to other Brazilian states with the issue of infrastructure, the administrative team of the Bahia State Department conducted research with the MEC and the private sector to find a solution for the bottleneck of Internet access in schools. Since no structured solution to the problem was found, a project was launched with the help of a consulting team and internal working groups to think of a model that could meet connectivity needs in a timely manner.

The model idealized is to have a robust server per school, with offline educational content for virtual access on the equipment available at schools such as computers and tablets, via Wi-Fi, creating a sort of local cloud, including Internet page storage offline or cached to increase subsequent access to the page. Every day, at night, the server connects to the Internet and synchronizes all the information entered in the systems used with the central server of the department.

The Intranet will also be used for the administrative system recently deployed in offline mode. The idea is that teachers can record student attendance, incidents in the classroom and evaluations directly from their tablets, independently of the school administrative office.

During this study, the project was in the equipment implementation stage in selected high schools and the bidding process was initiated to obtain the software to interconnect it. The federal government is funding part of the project with the expectation that it can be a possible solution in other local contexts. A similar model has already been used by educational technology companies such as Positivo.

In the Amazon region, a mobile local network model is also being tested now to serve rural schools. With difficulty using the online class attendance system with Internet connections provided by the federal government, whether via satellite or via PBLE, and the deficient support from operators, the department of education, along with the data processing company of the state is conducting tests of mobile data stations in equipped containers that provide Internet signal adequate for the daily operation of the class attendance system.

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The tablets arrived and ran into a problem with the connection. 'What are we going to do?' Because we had to use the tablet. We have people who produce digital content; so we have wonderful material ... And what is our main goal? 'How will you bring that content into a school?' The network is too weak for the optimum amount. That was our challenge. So, then, we began to analyze and we saw that the best way would be to forget the Internet! It would be to set up an Intranet within the schools.
(IT, State)

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We set up a wireless network structure, but to access the server that is within the school, as we have schools that have 8,000 equipment units, and does not have Internet bandwidth with capacity for simultaneous access by 8,000 equipment units. So we put our content on a server within the schools, and the rooms connect to that server via two access points in each room. This is a digital ecosystem, because the equipment goes inside the classroom and accesses the content, which is on the school server. The part of the portal, no; for the portal you cannot do without the Internet, because [it includes] collaboration, communication. But the content, evaluation, reports for teachers, yes.
(Organizations)

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As everything is becoming mobile, you buy the data from the mobile center. A container [is] equipped with all the possible security; power grid security, security against theft ... And inside, you put a data center, place it somewhere and, from there, you distribute your network ... What is our intention, ours and that of the department? It is to show that it is feasible for the state government, which is collaborating as well. The state ends up having to assume the role of the operators.
(IT, State)

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We wanted to end this year with all schools at 10Mbps. In August next year we'll have 8Mbps. The process works, but, in our experience, it is a very, really very, very slow process. (IT, State)

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The operators with which we have contracts today are a few years behind in trying to set up connections in all the rural schools. (IT, Municipal)

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According to the 4G goals of communication in Brazil, in 2015, there should be at least functional 3G in rural areas; but in practice, we are still very far from this. We're not even managing to get a satellite to work with the operator. And satellite is a basic thing that everyone has mastered many years ago. (IT, Municipal)

Solutions to low Internet speed are also being studied in the state of Rio de Janeiro, based on, for example, shared download strategies. In a lab, when all the equipment downloads the same content, one machine can become a server for another in a peer-to-peer model. In this case, while a device is downloading content from the Internet, others are downloading from this equipment, via the Intranet.

In Manaus, the use of Intranet is also being planned for the use of digital content made available by Positivo. An arrangement that includes a mobile kit with a laptop for the teacher, tablets for students, and a projector, the laptop will work as a server in the classroom and tablets will be offline clients, using a router to avoid overloading the tablet storage capacity.

II. Relationship with connectivity service providers

Beyond the challenge of having a connectivity plan for the educational network, the relationship with telecom operators is another important difficulty, because it **requires constant long-term negotiation, against the backdrop, in some cases, of a regional monopoly of service provision.**

There are legal mechanisms that some departments resort to in trying to ensure performance of the services, which usually result in fines to operators that have direct contracts with the departments, or in the scope of the Broadband at Schools Program (PBLE). But

the lack of results, including in relation to fines, generates other agreements in an attempt to surmount the challenges.

In the absence of fixed broadband, which would provide a robust Wi-Fi network in schools, some educational networks, as we have seen, have opted for mobile broadband, often from the same operators. In other situations, internal projects are adapted.

The lack of availability of the contracted services and the instability that exists are also reason for complaint.

The relationship of education departments with operators is marked by demand for better services and connection speeds in the face of a limited response to requests and in the context of poor connectivity infrastructure.

3.2.3 Wireless network (Wi-Fi)

It is increasingly common to have Wi-Fi in schools, primarily a result of the **installation by the directors of the schools, in response to requests from educators**. However, few IT sectors of education departments built Wi-Fi plans.

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The only instrument we have is a fine. We fine them so much that, just to give you an idea, we have reached a point when we said: “We do not want more fines, because we see that it brings no results. So, just submit a project to do this in a feasible timeframe.” There are two phases: 2015 and then we will wait two more years for them to deliver the rest. (IT, State)

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Our main challenge is the communication network. The carriers are not interested in bringing communication [to the rural areas]. This is a factor including of the Parliamentary Inquiry Commissions (CPI) of our [legislative] Assembly here. There is a CPI to take care of the relationship of the operators and state telecommunications; this is a fact. (IT, State)

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When the Secretary took over, he went to all the schools, directors, and noted a number of things that the schools would like to have. One of the priorities was increased Internet bandwidth. So we called the company and said: “We want to have broadband in all schools. We want all schools to have 10Mbps.” I had a reason to [ask for this speed]. We want all schools to work on fiber optics. Technically, if you have fiber, converting from 10Mbps to 100Mb is just a matter of configuration for the fiber to support it. But the company needed to make a very big investment, especially in the rural area... We agreed with them as follows: “We will upgrade; in time we will improve the Internet; but you will improve the structure so that, at a certain point in time, we have fiber in schools.” So, we will be able to get 8Mbps by 2015 and we want then to expand the fiber network by 2017. (IT, State)

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At the beginning of the year, we had a very serious connection problem. So the connection was not stable; we had no service; and the company taking 10, 15, 20 days sometimes to restore it. (IT, Municipal)

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Today, we will not have a very consolidated number, because schools buy a router and set it up. We installed [Wi-Fi in schools] in some cases, but there is not such detailed control... It is largely the school's initiative to acquire it. Then they come here and bring it and we configure it and set it up there. (IT, Municipal)

Among the few cases of mobility expansion plans, we can mention a large state network that is developing a pilot project to install Wi-Fi in 10% of the schools, and a large municipal network that has a contract with third parties to install Wi-Fi in the schools. When the initiative comes from the school itself, monitoring by the IT area is compromised, since the installations may be carried out without it.

Another important aspect to understanding the potential of a wireless network in a school is that the presence of Wi-Fi does not necessarily mean access for students and access in the classroom. Whether installed autonomously by the school or through structured actions of the departments, **it is very rare to find a wireless network available for the whole school, and in schools where this was observed, the connection was constantly out of order**. In the municipal network in Salvador, for example, 39% of the schools have Wi-Fi, according to IT staff, but it is restricted to the computer lab.

I. The challenges of expansion

In addition to the Internet speed available to transmit the wireless signal, there are three main barriers that contribute to limiting the Wi-Fi network in schools:

- » fear of the educators of the potential lack of control if access is available to students
- » costs in the face of other infrastructure and connectivity priorities that take precedence over mobility and open access to Wi-Fi

According to IT directors interviewed, to be able to offer Wi-Fi at a school with about a thousand students, so that students and teachers can use their mobile devices, **the necessary bandwidth is at least 34Mb, a speed reported by less than 2% of the schools** sampled in the 2013 ICT Education survey (CETIC, 2014).

The data that 75% of the schools have Wi-Fi in the country (CETIC, 2014) should be used with caution for the purposes of planning new programs, because this likely does not mean open Internet access or quality access in the classroom, but only mobility restricted to a few areas and actors in the school environment.

Departments that provide a Wi-Fi connection without the necessary planning are faced with other kinds of problems, hindering the flow of administrative activities of the educational units. The availability of open Internet for everyone, including the community around the schools, is rather compromised.

On the other hand, the ability to have Wi-Fi throughout the school leaves teachers and directors with a limited ability to control access by the students, given that many have smartphones. Password control is not effective in most cases, since students end up having access to security passwords, even if limited to teachers. Thus, **among the educational systems that are releasing Wi-Fi for students, there is talk of a centralized**

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The science teacher wanted to work on a video. By the time the class ended, only four [computers] had accessed it. So it was a class where they kept trying, trying, and failed.

(ET, Municipal)

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We do not have Wi-Fi in schools. We have a few schools with Wi-Fi infrastructure, because I do not have [enough] bandwidth for Wi-Fi; they could not use it.

(IT, State)

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Wi-Fi is the future I think... I think you have to be very careful with this kind of thing, so that the solution does not distort the concept's virtues.. I cannot simply install Internet, for the sake of installing it; it is a vision of mine. Because you install the Internet, clear access to everything... I think you lose some focus... That part of the infrastructure, I am responsible for, but of course we talked a lot about this. But currently, is not a priority of the department to install Wi-Fi in schools.

(IT, Municipal)

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Let's say we had four communication channels: one, we would release to the students, and three to the teachers. We are not very concerned about the student channel competing directly with the community network... That is not what we are concerned about; we cannot afford to give the student the same power of communication that the teacher has, it does not work. So, unfortunately, who have to choose to give more or less. This is where the department understands that the teachers need more because they have the [online] attendance sheet, need to give their lessons, to do research.

(IT, State)

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Today, we just do not encourage much because of the Internet. We have already had several problems. We opened access, a few days passed, and the Department staff, the secretary in charge of school data who needs access to the system, starts complaining that they cannot work because speed dropped a lot and they cannot access the site, which is our school administration system.

(IT, Municipal)

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It was password protected, but one of the devices, which is the interactive projector, reveals the password. So then, the password began to be used by all the students, by everyone ... [But] nothing is configured for such heavy traffic. So there were schools that turned off the Wi-Fi network, because otherwise they were unable to work.

(IT, Municipal)

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We control access to these environments that consume a lot of bandwidth, such as YouTube, video players in general, social networks... from seven in the morning until midday ... Then, between noon and one, they can do whatever they want; it is fully released without any blocking. But when school starts again at 1 p.m., [it is blocked] until 8 p.m... But it was the schools themselves that requested [the control]... We opened access and they realized how the network is more attractive than the classes; the kids were on social networks all the time. (IT, State)

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Now, we registered all the equipment authorized to access [the Wi-Fi network]. It is controlled, registered with the controlling company. So the department's devices can access the school's 'Wi-Fi' network and the teaching network. (IT, Municipal)

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[To install Wi-Fi] you have to renovate ... renovate the switching cabinet ... Each school costs on average between 300,000 to 400,000 reals. This has to be done in several thousand [schools]; that's a few billion. There needs to be a policy, a priority. If you establish that this is a priority, you allocate money for it. Today this is not the case. The policy, in principle, is not this. Schools that we can serve, alright, we do it. Full-time schools, why do they have it? Because there is a policy there, they have to have it. Now, in a school different from these, there is no policy; so, in theory, I cannot provide this infrastructure to them. (IT, State)

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It is not a rule of ours for infrastructure, today, to have Wi-Fi at schools. First, because we do not have a standardized architectural design for schools. Each school would have to have a very personalized structure. This building has three pavilions, yours has two; there are two floors, the structure is totally different. You cannot create a standard project. (IT, Municipal)

control by the IT sector of certain software, including for teachers

Nevertheless, many schools, recognizing the importance of mobility that the Wi-Fi network brings to the school environment, have purchased access points and contracted installation on their own, mainly for the teacher's room. In many cases, when, in addition to the Internet network made available by the department, there is also the Broadband at School Plan (PBLE) connection from the federal government, the departments or the schools themselves took advantage to convert this second connection into a Wi-Fi. This is one of the reasons why education departments may be unaware of the Wi-Fi availability in schools.

This does not necessarily to duplicate the school access capability; but you can have more areas with Internet from the connection installed by the federal government and have backup, if one of the connections fails.

Flow containment measures have also been taken by networks that have structured Wi-Fi plans targeting the mobility of educators, aimed at ensuring the delivery of service and preventing open Internet availability to everyone without the necessary structure.

Another important aspect is **the cost to design and implement the Wi-Fi signal in the face of other priorities**, within a landscape of different school projects.

Within a context of many infrastructure challenges, the possibility of Wi-Fi use in the classroom of a public school is still a reality restricted to some schools, which benefit from the availability of better quality Internet. The spread of mobile devices increases the demand for a wireless network in the context of the classroom; but currently its pedagogical use with students is still sparse.

3.3

Fixed computer laboratories

"When we started this project to set up one laptop per student, it is because computer labs had been in use for about 20 years at schools and nothing had changed at all. Student learning did not improve. All the research shows: the labs were a considerable effort, because the machines were expensive, and nothing changed in the schools"(LÉA FAGUNDES)⁶

Figures 5.6 and 5.7: Examples of computer labs

(continue)

⁶ Available in: <https://www.youtube.com/watch?v=8XCX92NNaYU> .Last access on 03/25/2015.

(Figure 5.6 e 5.7 – conclusion)

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Our challenge is the infrastructure. Both of the Internet and of the space itself. Today, of these 168 elementary schools, we have 124 schools with a computer lab, because the others do not have the physical space to set up a lab... Our demand for school is very big. We've already had to disassemble computer labs to add students. (IT, Municipal)

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Every school has its computer lab with 21 computers. There are schools where these computers are all broken. Much depends on the administrator. There are administrators who care, who use, schools that use; and there are schools that do not even use. But all have access to it. (EC, State)

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These labs have certain shortcomings. The equipment is outdated, we have a lot of equipment from the ProInfo project. Equipment has been delivered as part of this project since 2005, and the last batch was in 2010. It's 2014. All are out of warranty, and maintenance work is very extensive. To keep this lab in operation is very difficult... The technical team comes, but sometimes the equipment stops working the following week. (IT, Municipal)

Source: State and municipal public schools

Computer labs are the most prominent technological resources in the surveyed educational networks, either through the distribution of computers via ProInfo or the acquisition by the departments themselves, following the lab model disseminated through the MEC program. There is still, however, unequal access due to various constraints, especially space constraints.

The equipment is distributed by ProInfo after the departments choose the schools that will receive the computers. The MEC then distributes the equipment directly to the school units and performs the installation. Maintenance is covered by the warranty and after this period, it is the responsibility of the department itself. This is when the main difficulties of the IT sectors begin with respect to the labs.

In some school systems, labs are run by the NTE, since it is a policy of the federal government, something that generates a certain distancing from the IT area, which is sought out only after the computer warranty expires.

The challenge of using labs is added to those mentioned above, related to infrastructure as a whole: **even when available and running, it may end up not being part of the class dynamics. But that's where the best infrastructure of the schools is, because of the length of time this policy has existed**

Currently, computer labs are defended as a space for the use of technology only by those who already have a proposal to use ICTs in their educational network and see the lab as a **collective space for dissemination of knowledge** related to ICTs. **The vast majority rejects this space, associating it with the past.**

Improvement actions

The pedagogical use of technology tools requires, in addition to easy access to infrastructure, the planning of goals, available content and training of teachers - topics that have not been addressed in parallel.

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There are schools where the labs are well-functioning; sometimes, there are professionals dedicated to it; so the teacher is more at ease, uses more, enjoys more... There will always be schools that use them a lot. Sometimes they are busy during the five lesson times every day of the week. In other schools, they are used less. (EC, Municipal)

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The possibilities are greater with mobile devices, but if we offer working conditions with a fixed device, we can effectively organize better, because of the structure. (ET, Municipal)

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There is a growing disqualification of the proposition of laboratories. This affects the education offered. The lab is a collective technology; people are gathered there in groups to use the technology, while mobile is an individualist technology; each one goes his or her own way and browses what he or she wants on their own. I believe this should be complementary, one thing does not replace the other. I think a public access space is needed. I do not like to call it a lab, but the space is important, as it would complement mobile technology that people can use at any time for a more personal reason. (ET, State)

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We know that in many municipalities, the only computerization process is the ProInfo laboratory. We no longer think about this lab model, which failed, and we see the model where the teacher handles [the equipment] on his or her own in the classroom to be future leaning. (ET, State)

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Nobody wants this space anymore. We are proposing to replace the fixed [labs] with mobile ones. This process is being addressed at the department, because moving towards a fixed [lab] is no longer a reality that we consider. (ET, Municipal)

3.4 Tablets

Figure 5.8: Example of a tablet distributed by the departments of education

Source: Amazonas State Department of Education

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[Other departments] had already bought netbooks, [cities in the southeast]. They recommended [tablets] from personal experience. According to the technology team that used the tablet in the project on mobile technologies, the tablets had better performance ... They are not just cheaper. Netbooks stopped being commercialized. At the time, they were still commercialized; now, because of the ultrabooks and tablets, production has been discontinued. But even if they were still producing them, I would have bought the tablets. (IT, Municipal)

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I believe that [the motivation] is more to get new technology to the teachers, which would be the tablets, to include them technologically. They received laptops last year; now, tablets. (IT, State)

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We do not care for laptops anymore because they were from 2010. We believe the tablet will retire the notebook. (IT, State)

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The teachers received the laptop [in the previous campaign]; and now the teachers started to receive tablets. For me, laptops and tablets do not overlap. For me, they have [distinct functions]. For pedagogical use of schools, it should be defined in a project. The overlap is only if you have no equipment use proposal. (Administration, State).

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If the computers [laptops] they [teachers] had received [years ago] had had this function of the interaction by touch [that tablets have], there would be an overlap. In my opinion, [with the laptops received earlier] you limit the use of some educational software [3D] that requires interactivity. (Administration, State).

As seen in the first chapter, the tablets are the latest devices and the buzzword in public education today, given their competitive cost, compactness, comparable to the old netbooks, and the mobility they provide. Through the federal government, the acquisitions amounted to more than 400,000 (four hundred thousand) tablets in July 2014, with more than 250,000 active ones at the time. In extreme cases, there are networks that have already recently equipped their teachers with laptops and are again equipping them with tablets.⁷

All networks that have distributed equipment a few years ago, and are now doing it again, have actions that are similar in their focus on the distribution of devices without presenting an educational proposal, with largely, an overlap in equipment.

Other justifications for a new investment in tablets focus on the hardware that does not respond to the current needs of content.

The hardware upgrade, necessary and required periodically, cannot be done without plans that guide the use of new technologies acquired; otherwise, the results may not be as expected, despite the availability of attractive educational software.

Since the first price registry purchases of the federal government were restricted to high school teachers, **some departments opted to purchase the equipment on their own in order to create mobile labs or to give them as prizes.**

⁷ A procedure for first access of tablets, linked to the taxpayer ID of teachers equipped with the devices was established. After receiving them, the teachers need to go through an online activation and this allows the FNDE to know how many were activated and how many have not yet been used for the first time.

On the other hand, **there is nearly no discussion and problematization of the educational use of tablets in schools in day-to-day activities of the departments**, which would help assess their suitability, advantages and disadvantages compared to other devices. **The longevity of the tablets, the constant technological change, also has not been the object of scrutiny**.⁸

In the interviews conducted, tablets are associated with:

- » Quick tasks
- » Consultation (e-mail, calendars, audiovisual content)
- » Use of school management systems
- » Classroom administration
- » Use of e-books and educational software
- » Making presentations in classrooms
- » Most respondents, however, believe that tablets are not suitable for:
- » Extensive typing
- » Creating presentations, spreadsheets, etc.
- » Programming

The infrastructure available for the use of tablets is also a decisive factor regarding their suitability in schools.

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We will replace many fixed labs with mobile ones. This will have an impact on cost; let's try to take a closer look ... Because there are schools where it costs 70,000-140,000 reais to restructure the power grid, and none of this will be needed, only an outlet for the charger will be [needed], and the cost of that is lower than that of an air conditioner for the computer lab. So I subtract the cost of energy. If I turn off the air conditioning, I transform a room, which is a computer lab, into a possible classroom, which, financially speaking, if I put 30 students in it, I get almost 70,000 reais of funding from FUNDEB. (IT, Municipal)

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We have a problem: the physical space of schools competing for projects and projects competing for the same rooms, for the same environments. So, sometimes you have a science lab; you have a playground, a library and all that, and you sometimes do not have space for a [computer] lab in all areas of the city or in all schools. (IT, Municipal)

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Technically, the solution is very cool: you have a lab and you can take it anywhere, bring the energy of your equipment, which is a big problem; because you get to a classroom and there is only one outlet, and the mobile lab solves this technical problem, but what is the educational proposition of it? (ET, State)

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One of the main things that can be improved with the use of tablets, which we have wanted to do for some time, are the digital attendance sheets. Without a tablet, it is unfeasible, because I would have to have a network point of each school, in each classroom, and I will not have that infrastructure. (IT, Municipal)

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Teachers, to create and put together their lessons, need something that the tablets do not have. But I am in favor of the department having a lesson production unit or even a group of teachers who have more advanced knowledge, who are able to produce this content and these lessons, to help the teachers. Then yes, teachers with tablets and ready material will be able to use the tablet to present their lessons. (IT, State)

⁸ For example, common (non-educational) netbooks that emerged on the market in 2007 and sparked high demand in 2009 and 2010 were discontinued by major manufacturers already in 2013, six years after their emergence, given the growing shift of interest to tablets. Available on: <<http://www.elmundo.es/blogs/elmundo/el-gadgets-blog/2013/01/02/hasta-siempre-netbook.html>>. Last access on: 03/12/2015.

”

The schools that have an effectively set up laboratory, we can provide Internet, a printer; the machines are more powerful. In the space where we only have the tablet, we do not even provide Internet for the teacher to download applications. The teacher takes the device and does everything at home. We can only give the device; not the Internet, not the rest, even if everyone prefers the mobile devices. (ET, Municipal)

”

I analyzed [the MEC tablet] and found it horrible! Because on the tablet, you click here, but in reality, it's a bit higher. Its sensor point definition is very low. So I think, like, that the quality of the tablet was very... it was much poorer. Its touch is not good. And it's slow, it's not such a fast tablet.

(IT, State)

”

If you do not have embedded content, if you do not have quality web, what else can you use the equipment for? It is doomed to fail... And there is much talk of getting more content from the start. Because the last situation [the federal acquisition] was a bit forced because of the deadline; it came out with very little content, the tablet memory was very small. (IT, Municipal)

”

We simply bought it because the money came and “Oh, we’ll give it away. We’ll give this to the teachers, it is coming subsidized by the Federal Government.” Is it good? It’s good. I have no doubt that it’s fine, but it turned out to be merely the teacher’s instrument; it did not come accompanied by some specific thing for use [in school]. (IT, State)

”

The tablets were arriving; the professor received one, but had nowhere to use them. We had no learning purpose for the tablet; we had no system running on the tablet. So what started to happen? We started using them for personal use.

It ended up not having the educational use that was the proposition that it had. It became a problem for us because we needed to develop content for it. [The teachers] were complaining. We monitor all the social networks; so, they were complaining, posting. (IT, State)

Only with effective planning that considers the future use of the equipment and the infrastructure and digital content necessary for such use is it possible to assess the pertinence of any new device.

3.4.1

The tablets purchased through the federal government (2012/2013)

In the appraisal of IT technicians of the departments, the quality of tablets acquired in the first bulk purchasing of the federal government left a lot to be desired in terms of memory, storage, processing, and also operation of the touch screen. IT areas of the surveyed departments did not actively participate in the definition of the equipment models, conducted by the MEC and the FNDE; however, there was little motivation to refuse the purchase using federal funds.

IT administrators involved in the monitoring of tablet implementation also resent the lack of coordination with the educational sector, and, in such cases, actions focused on the content and use of tablets end up being postponed. The educational technology areas also face problems with the tablets and express criticism..

Some IT administrators also criticize the lack of monitoring of actions implemented by the federal government – the responsibilities and roles are not clear to them. On the other hand, some approve the situation in a resigned manner: there is the desire to introduce ICTs in their school systems, even if not with the ideal design, while others are more skeptical about the potential of tablets in the classroom.

The infrastructure scenario that surrounds the tablet acquisition campaign, via the federal government, is rather deficient in general terms, both in terms of connectivity and in terms of the characteristics of the acquired devices. This fact, coupled with the lack of content and guidance for use of the devices, suggests the need for education departments, along with the federal government, to plan future implementation strategies without disregarding current results.

”

We are planning a campaign at the end of the year to make a survey to determine what we use the tablets for. I do not know if it comes embedded with content, because the MEC says it does, but from what I saw, it does not; what is there are links. (ET, State)

”

We received 5 tablets to for the people from the nucleus. All were blocked. [We have been] trying to unblock them for six months. I did not manage to get directly in touch with a group from there. Contact, e-mail, photos, everything you think could be done, that was requested, I did, but I could not unlock. We decided to keep the little yellow ones that we received. (ET, Municipal)

”

We will get the configurations of a tablet being delivered; it is four years behind. It's always like that. It seems that everything that comes for education, first comes the question of money; nobody listens to the experts. (ET, State)

”

I think the federal government goes, decides on a specific action, thinking it will be great, it'll be amazing, but does not care about how the states or even cities will operate this technology. So this is a point that is complicated, really ... We bought 31,000 tablets, delivered them to teachers, but I do not know if these tablets were actually useful for teachers. It's doubtful that they really became useful. We see that the quantities that were activated are not that great. (IT, State)

”

The [tablet] we receive [from the federal government] was a small one. I found that it is very limited, the resources ... But it's interesting ... It's better than not having it. (IT, Municipal)

”

Each teacher received a tablet and pedagogically I do not see much use for a teacher in the classroom with a tablet, but that's my opinion. I think the teachers should use it to access e-mail, to use it for themselves. More this than, effectively, having an impact in the classroom. (ET, State)

3.5 Laptops

Figure 5.9. Examples of laptops distributed by school systems

Source: State Department of Education of Amazonas and City Department of Education of Manaus

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A notebook is good for spreadsheets, presentations and text. The keyboard, not being virtual, helps, but the cost is higher. The tablet is the most effective in terms of apps, touch mobility ...

(IT, Municipal)

”

We delivered the notebooks now in 2014. Some teachers bring them to school and others do not, it is not mandatory. The department does not require bringing the device to school; some take them on their own account, it depends. And you know that it is hard for him to go home and come to school with this equipment, and there is a question of safety too.

(IT, Municipal)

”

Some schools have what we call a mobile kit, which is a cabinet with wheels that is transportation means as well as a charger for laptops. Each cabinet can fit, if I'm not mistaken, thirty-four laptops. If the teacher needs to use it at a given time, he or she rolls it to the classroom and distributes a laptop for each student.

(ET, Municipal)

In a similar manner to tablets, laptops have been made available in classrooms, through mobile labs, or have been distributed as a kind of reward to students and teachers. The expected use associated with the equipment, however, is broader than that of the tablet, and involves a more extensive focus on diverse content production, in addition to the consumption of online materials.

It is important to underscore that these expectations are not associated with more targeted educational programs, given that no difference was observed in the implementation of actions in relation to the specific types of hardware distributed, whether tablet or laptop. The higher expectations of notebooks are the result of the characteristics of the device itself and its greater storage capacity and processing.

Beyond the greater processing capacity, the laptops are considered by teachers as easier to manage. In fact, as we will see in Chapter 8, most interviewed teachers feel more comfortable with laptops than tablets.

”

There are educational networks in which, in informal consultations with their educators, laptops were viewed as the best tool for distribution to teachers, but, due to the difficulties of purchasing processes at the department, they ended up sticking with the federal government's price registry for tablets. In this case, the goal is to give the teacher some equipment that allows him or her access to the world of ICTs. Despite the preference for laptops, the slogan ends up being: "what we get our hands on first the teachers will receive" (IT, Municipal).

In any event, the positive effects on the self-esteem of teachers and the facilitation of access to ICTs should be the main expected results of the distribution of equipment to teachers. For use in the classroom, and a robust mobile learning policy, other integrated actions are expected.

3.6

Smart boards and projectors

Figure 5.10: Different models of digital projectors and boards in Paraná and Bahia

Source: State Department of Education of Paraná and State Department of Education of Bahia

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What we have is this: we want it to work, because we believe in it. I really believe that technology can change, at least to make the classroom more attractive for this student that is digital. I'm not talking about the computer lab, no, and not the tablet. No. It's actually about using the technology. A projector you use, work with the students, you already change the classroom, leave that board and chalk and the lessons become more attractive. (IT, State)

”

The MEC held two bids. The board is a device that attaches to the projector. Then, the board came, the sensor that transforms an image onto a board, but the projector did not come; or the projector came but not the board. Then, we lost patience here: 'Let's do an experiment of ours.' Then we leased these 500 [digital] boards. (IT, State)

”

I managed to get 500 boards from Hitachi to be distributed to the school. For free. That means, the department has not invested in the purchase of boards. (IT, State)

”

There is no use in you moving forward, saying that you are using the board, but only to keep the same teaching method; that is not what we want... I think we have a lot of innovative things. The big challenge is how to make people notice. All teachers find the board wonderful, but the big challenge is to make them rethink how they teach. Leave their comfort zone. (ET, State)

The acquisition of Proinfo smart boards and projectors for states and municipalities occurred through bidding processes of the federal government and, in the case of smart boards, also independently, in all regions of the country. Most commonly, all the classrooms are equipped or there is at least one exclusive multimedia room with the devices.⁹

These devices come accompanied by the desire to accelerate innovation in the classroom, offering the teacher more dynamic features than traditional boards. When converting common surfaces to surfaces sensitive to touch, the hope is that lessons become more dynamic and the interest and engagement of students increases. One important characteristic of managing the purchase of this equipment is that they end up being a bet mainly of those working in the IT areas of the departments, with less involvement of the pedagogical areas.

Perhaps as a result of this scenario, we find this equipment in some schools in various states and some municipalities; however, use at schools is still very limited, with little interaction with pedagogical planning.

Coordination teams express their expectations, but these are not realities in most of the surveyed schools.

⁹ The spread of Proinfo projectors has been slower due to problems in the bid and delay in the delivery of equipment.

3.7 Netbooks – One Laptop per Child (UCA)

Figures 5:11 and 5:12: Netbooks of the One Laptop per Child program, “little UCAs”.

Source: Manaus Municipal Department of Education

UCA is a pilot project implemented by the federal government. In its first phase, in 2007, the One Laptop per Child Project was brought to six municipalities in Brazil. In 2010, the second stage of the program, named PROUCA-One Laptop per Child program, expanded the initiative to more than 300 cities. In the third stage, called UCA-TOTAL, there was a new experiment, in which all the pupils in seven municipalities received the educational netbook, or as popularly known, the “UCA” or “little UCA” (“uquinha”) (LAVINAS & VEIGA, 2012).

According to reports, the federal government took responsibility for the entire installation, including equipment, infrastructure for Wi-Fi, and training in schools, in partnership with federal universities, but reference to the program’s administrative problems is frequent.

”

The UCA School had a serious problem, because the equipment arrived but not the Internet. So we tried to communicate with the federal government and the MEC, saying that the Internet [had] not been installed. We called the operator and they said it [had been] installed, and we would say no, because we were at the school! [But] the operator said it was... This is still going on today. The equipment arrived three years ago and the school still has no Internet. They use the UCAs offline. (IT, Municipal)

”

These ProUCAs stayed in storage for almost two years. The purchase was of 8,000, but today, if we still have 6500, 6700, it is a lot; and that is because we formatted these ProUCAs. Some were oxidized, no longer worked, and we tried, at least by formatting, to revive them. Most of them we managed... They are popular with the kids, although small. (ET, Municipal)

”

With the UCA, but with other projects [also], the thing just comes, without asking if you are able to receive it. The director put everything in the car trunk and took them home because she did not know what to do [with the netbooks]. There was not even a closet for storage; she was not going to leave them in boxes outside. So I think there needs to be more dialogue. (ET, Municipal)

”

Let's think of the "UCA": the basis of such a project was the network, and the MEC comes with a broadband program to school with 1 Mbps for a school, when it was discussing 60 Mbps. Sure, Brazil has a number of problems with the network, but you cannot start a project like this without thinking of an adequate infrastructure... And the poor teachers have to find a way to use it without infrastructure, with outdated equipment, often without the equipment for use with all... So they decide to close it and store it so it does not get destroyed, something that already came broken.

(ET, State)

”

The only [school] with electric Internet, via the power grid, never worked. So, we had to implement another measure, which was to install routers in the corridors for the school to have access. Still, there were various projects done, various initiatives [of the teachers]. Today, because of the Internet problem, we do not have either, that's how it is... Some teachers who stuck with it, liked it, thought it interesting, but other teachers are not using it.

(IT, Municipal)

Specific problems with connectivity and the experience of the Internet over power lines were also mentioned.¹⁰

These reports confirm the results of previous research on the ProUCA program in Brazil:

"There is no doubt that there has been a learning process about what ICTs are and how digital inclusion is processed via schools; however, it has also been determined that the cost is high and the effects are below expectations. The infrastructure network installed in schools and cities does not meet the design goals and, although this fact was immediately obvious, there were no arrangements made by the general coordinators in order to promote greater efficiency and coverage of connectivity." (LAVINAS & VEIGA, 2012, p. 28)

And there is no doubt about the need for research that focuses on evaluation of projects such as ProUCA in terms of the increase in learning.

"...despite the growing popularity of the one-to-one initiatives, many of these programs were implemented when little was known about their impact on learning and there was little evidence on how to structure the programs for increased impact. This would explain why some projects have had disappointing implementation or impact. The experience of the region in this area highlights the need to produce strong evidence to identify models of effective uses of technology, which can improve students' learning." (ORTIZ & CRISTIA, 2014, p. 22)

¹⁰ The Internet via the electricity network gained attention in Brazil in the 2000s, and its main attraction is the use of the electricity infrastructure for data traffic. Despite research conducted, including by the energy companies, this service is not yet commercially available.

3.7.1

The reinvention of ProUCA by some local governments

In all states surveyed in this study, there was at least one school with UCA implemented; but, in the vast majority, without coordinated actions of departments or even schools, which makes the equipment have no standardized usage and dependent on the attitude of individual teachers. This scenario greatly decreases the chances of integration of devices in educational plans and is seen as a process of discontinuity for educators who are at schools, as well for the administrators of departments, who presume that the plans have changed.

From the MEC's point of view, however, it is not discontinuity, but different experiences, which are being used to test new technologies and keep pace with technological development.

After the pilot project, which revealed problems of implementation and limited results, the federal government provided equipment to states and municipalities via the price registration agreements, to buy equipment using their own resources and to develop their own projects. Two of the municipal networks surveyed here acquired the devices; but after unsatisfactory results and a change of administration, they redesigned their distribution: instead of keeping the approach of one computer per student, they decided to develop mobile laboratories to serve more schools, optimizing investments and solving part of the infrastructure problems. In this model, there is still a one-to-one approach, but for the classroom served by the mobile cart, not for the whole school (LAVINAS & VEIGA, 2012).

Even recreating the distribution model to increase access of the devices for students, **maintenance poses a challenge, since the equipment made available for purchase by the federal government can only be handled by its manufacturer, who designed the device, to be replaced completely** in case problems.

”

In our state, if I remember correctly, there were 5 UCA. No more than that, because, right after, the whole tablet story happened. (IT, State)

”

Ten years ago, the technology was the computer. It was what was available and it was necessary for the schools. The technological progress allows you to have other devices. Then came the MEC, with a Brazilian patent, and created the ProInfo projector that gives you mobility; you take it to the classroom, it has Internet, Wi-Fi, it has USB, a keyboard. Then, smartphones and tablets emerged. The tablets that allow you mobility, allow you to do research, but also have limitations. Just before, the UCA, One Laptop per Child, came as a pilot project. The MEC incentivized this research in some states. We walk along with the technological developments. We do not defend any particular technology. (Federal Government)

”

If I were to give 8000 netbooks, I would give just to eight schools ... And the others would not have. So with these 8,000 netbooks, we made 166 kits for those schools that are mainly in rented buildings that will never have a lab because the physical structure does not permit... So, the lab would have to go into the classroom. Sometimes there is a [federal] government project but we have to adapt to their reality. (IT, Municipal)

”

We are planning a redistribution of UCA equipment to equip mobile labs of some schools that are making acquisitions of carts... There is more distribution. From 8 schools, we go to 34, with several mobile labs to be used by the teachers. In total, [there will be] 81 labs. (IT, Municipal)

”

The idea of the project [ProUCA] is: “Broke?” “Throw it out and buy a new one.” We became dependent on a project, with no options, where we cannot even buy parts somewhere else, because it is a project from the federal government. So our outsourced [support] is unable to do maintenance of this hardware for this reason. Software maintenance is simpler, because the system is Educational Linux. (IT, Municipal)

Aspects related to equipment must be thoroughly studied to maximize their useful lifespan, diminish logistical challenges and also to avoid immobilization of local teams responsible for keeping the equipment in proper working order.

Box 5.3: Cases of ProUCA continuity

Figures 5.13, 5.14, 5.15 and 5.16: Lessons using ProUCA of-line for typing and with student-monitors

Source: Municipal Department of Education of Goiânia

Despite the lack of projects to create structure from the departments, we discovered two very interesting cases of teachers who took on ProUCA and followed through with the project.

Both experiments have some points in common. These are **small schools**, with 164 and 522 students, according to the 2013 School Census. Both have the **IDEB index above the target and the average of the municipalities**. The Municipal School of Maria Antonieta Alfarano, located on the outskirts of Salvador, reached the IDEB of 4.5 in 2013 while its goal was 3.3. The IDEB of Salvador was 4.0. The Municipal School of Jaime Câmara, in Goiânia, reached an IDEB of 6.5 in 2013, above the target expected in 2021.

The two teachers also use some **strategies in common: they selected students from the upper grades to be monitors** and to provide support in the classroom. This helps a lot on a day-to-day basis, because the environment of UCA classes is relatively intense, with many students asking questions and many details to enable everyone to follow the activities. In this case, one student ends up helping another and also the teacher.

Figures 5.17, 5.18 and 5.19: Offline ProUCA use strategies and with student-monitors

Source: Municipal School of Maria Antonieta Alfarano in Salvador. Professor Iza Lopes also has team of student monitors.

”

When I came here, I had never heard of the UCA. I worked in the nucleus [NTE] with teacher training on Linux, but did not know of the existence of UCA. When I arrived, there was a locked cabinet. I asked what it was, and they said these were little UCAs, and I became interested. The ladies from the NTE told me that there was this project to put in motion and that the UFBA would provide training. Then I started studying. I started thinking about how I could train teachers and students. Then came the idea of [student] monitors.
(Teacher, Municipal)

”

On Monday, I sit with the monitors to decide what we will do. And they give ideas. We are working with the environment. “In the 1st year, what could we work on?” Then, we start preparing; I put everything together and we teach.
(Teacher, Municipal)

”

There are 2 or 3 [monitors] helping at the desks, and one in front explaining. And the teacher is also helping, watching the kids... But they are so developed that sometimes the teacher just takes attendance. If a student has difficulty writing a word, the teacher goes and helps...
(Teacher, Municipal)

”

I found myself. The students discovered many things. We learn a lot from the students.
(Teacher, Municipal)

”

I work once every two weeks or once a week. They love it. On this day, everyone comes. They wait for this day. The reception is good.
(Teacher, Municipal)

”

We do not have Internet. A maximum of five computers have access. In early 2012, up to thirty [computers] could access. Then there was a capacity problem. Then, it was no longer possible to use it.
(Teacher, Municipal)

”

Since 2010, we had problems with just 5 computers. But it's like I said: a battery that does not work, does not turn on. None were lost.
(Teacher, Municipal)

”

Our greatest fear is that they would all be broken. And, to our surprise, they are all very careful.
(Coordinator, Municipal).

ProUCA are operated, in these two cases, **without the Internet**, because connectivity problems are common and the activities are offline and focus on the programs that exist on the equipment.

The **care with, and the lifespan of, the equipment also are repeated in both contexts**. In Salvador, the students take the little UCAs home on days of activities and homework. Even though the school is located in a violent area, they were never robbed.

In Goiânia, there is also **a hired assistant to take care of more than five hundred units of equipment**. Besides being designated to the students, the devices are kept in special rooms, with outlets to charge them. When teachers request their use, the assistant helps with the logistics and also provides some support in the classroom

The teachers' perception of the greater engagement of the students in activities, the educational planning associated with the use of the equipment, and the logistics solutions to assist the teachers are very important factors in motivating the use of equipment by educators in these two cases of success.

3.8

Devices of the students and teachers

The increase in students who have smartphones is noted by all respondents. The use of these devices in the classroom is been reported as increasingly frequent.

In any event, **there were no structuring projects of the departments, which take the devices of students into account in their planning.** The lack of Wi-Fi in the classroom, the lack of plans and content for use, and the fear that teachers will lose control of the classrooms are some of the reasons. It is up to the teachers to devise and lead projects, which can range from sending messages about activities in WhatsApp groups to creating school community projects using cell phones.

On the level of education departments, the issue is complex. While there are administrators open to cell phone use for educational purposes, there are those that strongly defend keeping or creating legislation that prohibits the use of devices in order to reinforce the legitimacy of educators at schools in the face of cases of bad discipline, promoting adverse situations in schools, with students distracted and not paying attention due to the use of the devices.

”

The student no longer wants just the whiteboard. The student is very anxious. While the teacher is writing something on the board, the student Googles it on their cell phone and takes the content, even more than needed for the school curriculum at that point, in that grade, and the teachers do not know how to handle this. (ET, State)

”

Sometimes it is much more motivating for the student to use his phone, a social network to talk to him about a homework assignment. For me, it's a paradigm shift. You do not have to be tied down, you can explore the school environment; but for the student, too, it is easier for him to go through other channels than you taking him to a multimedia room. You do not need to move the class, there is more freedom for the teacher, make the environment get accustomed to him and not him getting accustomed to the technological environment. (ET, State)

”

They are regulating it. The governor has not sanctioned a law regulating the prohibition of cell phone use in the classroom, allowing use only by teachers for educational purposes. [Today] the administrators end up taking the lead and organizing it, but I know of colleagues who cannot teach because the phone does not stop ringing. (IT, State)

”

There is a small school here with a box. The student enters the school, leaves the phone in the box, which is kept by the school's educational psychologist. It rings, she answers, if it is urgent, from the family... (IT, State)

”

We focus heavily on computer labs and sometimes do not value the other media that we have within the school. The television itself, the use of video, mobile technology that we have today... Most of our students have access to this technology, including the Internet. There are other technologies within the school that need to be used, and we have some experiences of schools that work a lot with cell phones. (IT, Municipal)

”

“Oh, I do not like students with cell phones in my classroom.” Is it not the time to take advantage of the fact that this student is doing research and to improve a little? “Since you have a cell phone, let’s try it, let’s create research groups, let’s create an interview, let’s do a study in our neighborhood...” Be more dynamic in your lessons. Students today do not want just more blah blah blah, no; the student wants to be part of the class. (ET, State)

”

Cell phone use in school: who will pay the bill? Parents of students? Our telephone service is very expensive. Even if there are many resources and development of resources for quick solutions, there is a cost. (ET, State)

”

[There was] a guy who was already working with cell phones with the students; so, the students could bring them and use them for math, videos, etc. Another [teacher] took the laptop and the projector home to do something... They were people of the same network, who were already inclined to work with innovation.

(ET, Municipal)

”

For everything I want to research, I use the phone, which is better than the tablet they gave me. (Teachers, High)

There are reports also of teachers who have their own equipment and take it to school or use it for educational purposes remotely. In any case, it is always individual actions and related to certain individual characteristics, as we will see in Chapter 8.

Box: 5.4: Local innovations

There are educational networks, especially state ones, which work directly with research and development in ICTs in education. If today the tendency is to think of the integration of technology in classrooms rather than laboratories, in 2007, the state network of Paraná already installed TVs with USB ports in classrooms to facilitate the use of digital files such as videos and presentations by teachers. In 2011, an internal survey reported that 1/3 of the school teachers in the network used the computer lab of the schools, while 2/3 used the multimedia TV sets or TV Pendrive, which showed the team that facilitating processes for technology use in the classroom can increase engagement.

Recently, in order to update the TV sets, a prototype was studied of what the team called “TV Multimedia” or “Super Tablet”, a 60-inch TV with a touch function. As the unit’s value was much higher than the interactive computers with smart boards that the federal government was launching in parallel and as there is no line of institutionalized credit for developing educational technologies locally, the project was discontinued.

In the opinion of the team it would have been more advantageous from the perspective of that school system, to invest in TV than in tablets, which, they believe, would allow more interaction in the classroom and bring more results.

In the federal government, the innovation was the creation of an integrated computer or ProInfo projector, developed in collaboration with the Federal University of Santa Catarina and the Federal University of Pernambuco. The equipment went through patent registration and in 2010 a tender was initiated for production of a batch of 20,000 units. IT administrators confirm that this equipment has a good cost-benefit ratio.¹

The research and development of educational technologies by the departments and the Ministry of Education seems to respond to the demand of having more resources available in this field.

The development timespan of ideas, however, in conjunction with the high dynamism of the market, raises questions about greater investment to develop innovations.

The big disappointment relative to the Super Tablet is that it comes with the arrival of the plasma TV on the market. The team recognizes that it was a great idea; however, the plasma TV has become cheaper than developing a new prototype and still there was no funding for the purchase of these recent innovations in the market.

¹ More information on: <http://portal.mec.gov.br/index.php?option=com_content&view=article&id=15587>. Last access on: 03/16/2015

”

In terms of teaching resources, this one really is a fantastic educational resource! Because it is a projector, but it is also a computer because it has a keyboard, mouse, wireless network, DVD slot... You have a pen drive and if the teacher wants to connect the laptop, it is possible. And it's also a digital board. Any clear surface, wall serves as a digital board. Think of a device that costs about a thousand dollars with all these features. For us, it's a very cheap investment to make for every classroom. (IT, State)

Given the local demand for innovations in the field of educational ICTs, it is worth reflecting on the best policy to address it in an agile and satisfactory way. Whereas the prototype development of a new product requires time, skilled personnel and investment, the creation of permanent partnerships and discussion forums with the private sector, which can contribute to the development of these ideas, could add agility and effectiveness to the innovations.

3.9 Maintenance

Maintenance is a critical area within the sphere of educational technology policies. As a reference point, there are networks that report that around 12% of the schools request service each week.

There are different models of equipment maintenance and connectivity at the departments. Services can be outsourced or performed by internal staff. In addition, they can be centralized in the education departments or decentralized in educational boards, which represent the main departments in each region, or even at schools.

”

I think there are 14 different contracts covering our infrastructure ... I have the Internet connection... There is a maintenance contract for the servers, and datacenter... There is the computer maintenance. In fact, it would be more than an equipment maintenance contract. It is the maintenance of computers and our entire first level [of technical support]...

We have other contracts: firewalls maintenance, switch maintenance... There is a Wi-Fi maintenance contract of the access points, the controllers and other... I have a supply contract for printing ... (IT, Municipal)

”

Today we have 140,000 computers in schools; in all schools, boards and central bodies ... and much of them we decided to lease. Today, 80,000 of our computers are outsourced. We are moving towards it being 100,000 by the end of the year. If your computer is stolen, breaks, in 48 hours the company must replace it. We do not have to worry about it. It is more expensive, the cost of this is 1 to 3. What is the advantage of it? Zero worries. The company takes over the operation. It is a process that works very well here in the office because the school is managing it; so there are very few problems from this outsourcing. If the school needed, it gets the board [of education] involved. If the board fails to address it, the department gets involved. Since they have the authority to call the company, we just keep the contract here and the operation stays there. (IT, State)

3.9.1 Outsourcing

Outsourcing can occur in different areas that require maintenance, transforming the IT areas of education departments into areas where the primary responsibility is the management of various contracts.

With regard to desktops, there are two types of outsourcing: **the rental of the machines** and **maintenance contracts for machines that are owned**. The first is presented by those who use it as relatively self-sufficient and is a local alternative to ProInfo, especially by big state departments.

There are networks, in contrast, that confirm they have problems with an outsourced contract because the contracted company underestimates the complexity of some service regions.

The departments that have mainly ProInfo desktops have the option of outsourcing only maintenance, since the replacement of machines is done by the MEC.

Most school systems have contracts with subcontractors who have technicians and a service desk that receives calls. These contracts can be centralized at the city hall or government, or may be a direct contract of the education department. Some departments also train educators to do basic maintenance of equipment, minimizing the wait time for correction of simple problems.

The support request usually comes directly from the unit that needs technical support to the outsourced company. The administration of the work is usually done by the IT of the department, which, via the information entered into the administrative systems, monitors whether the support is being provided, the service is performed on schedule, and, in addition, has a line for complaints.

However, the monitoring of the maintenance process is not always complete. There are networks that only accompany the request for service, or do it informally, leaving the **administration of the problem up to the schools.**

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There are suppliers that perform 100% of what is in the contract and there are vendors who give much more work than they should, they do not meet the deadlines. Administrative fines are applied, bans on contracts with the public administration, but yes, there are these kinds of headaches. There is always that one company that does not perform 100%. (IT, Municipal)

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There are 35,000 computers that are installed in these computer labs, they no longer have updates from ProInfo, because the federal government did not update. These computers are already outdated; they do not have spare parts anymore, they are no longer supported, and there, they are going now to [our] IT sector. And there, I have to study how the contract I have with the company that charges me for support will be able to service these machines; because under the contract with that company, I do not have parts replacement. My administrative machines are leased. (IT, State)

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These days, in the contact center, my number of complaints per month, on average, is 60 complaints. If you think of a universe of a thousand schools, then the complaint level here is very low. (IT, State)

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In the system, we can track [the calls], track and find out the amount. Now, for schools we stop there. If we cannot get it resolved [by phone], we leave it to the director: “You’ll have to replace a part”... And we do not have the feedback, because we do not have control of maintenance. (IT, State)

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We are following closely all these issues, mainly because of the educational management system. We made the company send a daily report. In addition to the schools that send a daily report, the operator sends a daily report of connection interruptions; the other company monitors and maintains the Wi-Fi network and also sends a daily report of how many access point are not working and what actions they are taking. (IT, Municipal)

Improved management of maintenance of schools may result from the pressure of new centrally administered projects requiring a functional infrastructure. As an example, when it was decided that the use of an educational management system in a network of municipal education is mandatory, demand in schools and the constant complaints generated switching of procedures and more monitoring.

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The greatest difficulty for the call center team is [that], when the school makes a request, is cannot guarantee a period of service, because a call depends 100% on the [internal] team. If it is an outsourced contractor with a contract and time, he will say: “it’s this many days and hours” and the company can get there. If the company does not arrive, you make any complaint and we will take care of the company... But when it depends entirely on our team, and they get there and it’s a part they do not have, this machine will be compromised... This generates a very big wait line and a lot of dissatisfaction of the schools. (IT, Municipal)

The outsourcing of IT maintenance services is the most widely used resource by the departments to ensure the operation of the infrastructure. Monitoring and management of service time and performance of services appear to be areas for improvement.

3.9.2 Internal service team

In some departments, especially municipal ones, rather than outsourcing services, there are internal maintenance teams to provide service to the schools. **This structure faces increasing difficulties, due to the lack of sufficient staff to carry out daily visits.** The alternative is to rely on the warranty of the equipment, to reduce the number of support calls.

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When we have a large volume of machines that are no longer under warranty, but are still in working condition, then we have a problem. Because this whole workload falls on our internal team, which has few people and not enough transportation logistics to meet all of them. (IT, Municipal)

In departments that have an internal maintenance team, teams of educational project partners such as for supply of digital content, end up being circumstantial collaborators, because they need the structure to be functional for them to develop their services.

Maintenance with video tutorials has also been used as an alternative in order to reduce the calls and to make the educators at schools more autonomous.

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Today, we are planning to make available, on the communication portal, a series of tutorials on setting up the proxy, even just to minimize the problems I solve with e-mail and such, to minimize the [support] actions for problems that can be solved by the user. So, from next month, we will provide video tutorials.

(ET, Municipal)

3.9.3

Decentralized models for maintenance services

I. At educational boards

Some school systems choose to have a technology specialists at the educational boards – outsourced or not – to facilitate the screening processes of the problems that occur in schools. This is an interesting model because it establishes a smaller number of schools for each specialist, which can speed up the resolution of certain problems. In a network of more than 2000 schools, the rate is 29 schools per technician or so. Administrative difficulties related to the control of calls, centrally, and the provided service have been pointed out

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In terms of contacting the technician they usually call here directly [the department]. What they do through the board is generally requests to purchase equipment: “Oh, I want five computers for my school.” So, yes, they send a memo there for the education board with a copy here... We say, “Send one here and one to the board so that [I] have knowledge of what is happening,” because if we wait for it the standard way, the bureaucracy incredible big and it takes a long time to arrive. “Mass grave” we call it. So, calling the technician, [contacting us] is straightforward.

(IT, Municipal)

II. At schools

Figure 5.20: Example of maintenance decentralization in schools

Source: visited educational networks

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The school has decentralized funds for computer repairs and therefore we hit a basic problem: it does not know how to manage and can even be deceived, willingly or not, because the guy can replace a part [of the computer] and things get worse. [There are also cases in which] it has a resource and does not use it; then the machine is standing there and nobody takes action. (IT, State)

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The school receives additional funding for computer lab maintenance, and this money is destined for several things, such as: buying toner for printer, buying keyboard and mouse replacements, things like that; because computer maintenance is the responsibility of the third party [hired by the city]. But schools prefer to pay a technician separately. And, since the third party [hired by the city] has no responsibility... That causes a lot of trouble for us, because the technician begins to do things that hurt the contract [with the third party]; example: changing the operating system, breaking the seal... We have a lot of difficulty with this. (IT, Municipal)

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We had one IT technician per school. But that was a high cost, a 56 million contract a year. There was one technician per school, plus a team to manage these technicians here, the phone support... And what would happen? The director began using this technician for all the IT tasks for him. So instead of having a technician per school, we started contracting a service from a company that charges per call. So there is a defect there on the other line and I pay this company to go there or pay for the call if it can resolve this by phone. So I have different levels. And instead of expenses of 56 million per year I now have expenses of 6 million a year within this model. (IT, State)

In networks in which schools receive funding directly, there may be technical contracting of maintenance by the school itself. This brings fast service and a direct relationship between the school administration and the technician. On the other hand, in the departments where this procedure occurs, there does not seem to have been new ways of remote monitoring developed, as needed in decentralization processes. Dissatisfaction of administrators arises in relation to the difficulties of forming a picture of the schools in this scenario and providing **support to the administration of the school, if necessary. There are cases where decentralization at schools is not institutionalized by the department**, but is a solution found by the schools because of the slow centralized maintenance service, which ultimately, from the point of view of the administration, generates a doubled financial expense.

■ An alternative between financial decentralization for the maintenance and control of spending by the department of education has been **organizing a list of accredited companies** for the performance of services by region. Centrally, the service value is negotiated, companies register and the schools can request them directly and make the payment. This procedure was reported in one department.

There were networks, however, that centralized contracting of a technician for a school, but the model was changed to outsourcing by call received, as occurs in most state networks, primarily due to the need for cost optimization, and also because of the difficulty of defining the role of technicians at schools.

■ In the case of outsourced services, the most common is to have centralized calls to call centers that send technicians if problems cannot be solved remotely.

3.9.4

The specifics of mobile equipment maintenance

For mobile devices such as tablets, the maintenance has a higher level of complexity due to the larger quantity of equipment and therefore the possibility of increased incidence of problems. After the manufacturer's warranty expires, the department's technicians are responsible for repairs, since the devices are their property, even when purchased under the price registration program of the federal government. But even within the warranty period, some monitoring is done by the departments, given the difficulties that may arise.

To facilitate follow-up of calls to all IT areas, an educational network hired a 0800 call service to centralize all requests, including those that will be made to the Internet providers, the hardware, software maintenance company etc. Another network also chose centralized control of calls; but in this case, via its own department.

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You have to rely on the goodwill of the company to meet the warranty, which is the case of the tablets we distributed last year. They had a year, including free transportation by the contracted company. In the second year, the transport would be on our account; then [our] technical team gets something [to fix]. Some things can be resolved here, some things are sent to the factory. Starting next year, we will get into the cycle where the school will buy the parts for repairs. Our team will do that [the repair], or, if not, will have [a third party] fix it.
(IT, State)

The maintenance model, whether centralized in the department or decentralized at education boards or schools, needs to be well-defined and track the support calls, support time, recurrence rates, etc. When centralized, maintenance requires much more control; however, if decentralized, mechanisms for monitoring need to be developed.

3.10 Replacement

Figure 5.21: Unused equipment in the computer lab at a school

Source: Visited educational networks

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The advantage of outsourcing is that every termination of contract, I make a new contract and I replace all of the machines again. If you go to the schools all have new machines. If you buy, despite being cheaper, in four years the machine is obsolete, I cannot even sell it; I have to write it off. Imagine disposing of 100,000 computers. Who wants them? You have to send to a social fund; it is a process that is disposing computers here for years. (IT, State)

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Every x years the federal government already has a systematic upgrade [update]. This one here was from such and such year. In five years, it will already go through an upgrade process, it will be part of a new kit for replacement. (IT, Municipal)

The replacement of equipment is an issue that also needs to become more central in the implementation of ICT policy in education and specifically in mobile learning campaigns. In the course of this research, schools were visited where equipment is piled up in rooms and there is no planned disposal or reuse.

In the case of fixed equipment, when the subject is ProInfo computers, the problem has been administered by the federal government, which replaces the machines periodically. In the educational systems that lease the equipment, the leasing companies do the replacement at the end of the contract.

In any case, there are difficulties reported in relation to the direct replacement by the MEC. Being federal property, even when broken, the ProInfo computers cannot be discarded or reused by local departments. **Depending on the replacement time, it generates a substantial volume of electronic waste stored at the schools, equipment that could be utilized for various projects and reused through recycling**, for example. However, we did not find any project of this kind in the schools we visited.¹¹

There are plans, however, by some of the administrators, to regularly do replacements, every three to four years in the case of desktops. However, several challenges complicate the matter, from budget limitations to an institutional arrangement of centralized purchasing at a department, which makes it difficult to implement this plan.

To decrease the replacement and equipment obsolescence, one IT director interviewed suggested decreasing dependence of the performance of equipment at school, centralizing and processing the information on large servers, a virtualization process, where local machines serve only as clients. **This requires high investment in Intranet and Internet infrastructure for the data to be transmitted quickly and safely; and it would change the model of school computerization of ProInfo, since, instead of complete computers, there would be screens with low processing capacity accessing virtual machines in the cloud**.

For mobile devices, state and municipal departments of education are responsible for the replacement of equipment. Even given the fact that the responding technicians estimate that the useful life of the equipment tends to be three years, on average, we did not find any project already outlined for the years ahead.

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[The federal government sent] the equipment in 2005, and I said that if the equipment is from 2005, it no longer exists. Nine years of equipment! There is no equipment on the market that lasts that long. And I wonder if they will send new equipment or we have to acquire it. We did this negotiation the year before last, sent an e-mail; [went] personally to Brasília, but did not solve much. I received a response now, saying that we do not have an upgrade; the machines are these, if you have to replace them, you cannot, because they are the property of the ministry. I asked what I do with these useless things, various scrapped machines that do not work. I need room for new computers and the school cannot keep them because they accumulate dust.
(IT, Municipal)

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When centralization was set up with the Department of Planning, it made things difficult... I knew already, from time to time, there had to be [a replacement] [The problem] is it being systemic. Because the computers are not just bought for me, they are also bought for Health, Tourism, Social Welfare, etc. So the needs of all of them have to be determined and this takes more time until it is clear and this alignment is done by the department.
(IT, Municipal)

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On the issue of obsolescence, I think we should study the machine virtualization... The 'thin client' is exactly that, i.e., you only transmit a part of the image and data, which is to be displayed [on the screen] but the processing is not in that machine. And then, for example, you can run an application remotely on a tablet that would not normally run on it. But as it is a screen client only, you could make it run this application. We have to relieve the point, because its maintenance is complicated.
(IT, State)

¹¹ A term used locally to characterize the process of electronic waste recycling is 'metarecycling', which brings together the idea of attributing new use to the hardware, redefining the technology in different ways: by creating new technological equipment, jewelry made with peripheral equipment, etc. Depending on the groups leading the projects, other goals can be added, such as digital inclusion, social inclusion and technological delineation, so that users understand the structure of equipment.

Few education networks consider the replacement of machines as a constituent part of plan for deployment of digital technologies in education, and none had plans for the replacement of mobile devices that are being purchased for schools. Metarecycling and reuse projects were not mentioned, and the issue of disposal arises occasionally. It is important to include this agenda in the discussions leading up to the implementation of mobile learning policies.

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We have a state organization that takes care of IT, but this organization is far from the reality of the clients. Its clients are in health, security, education, which are three areas of importance for our society and whose realities differ a lot, their needs are different. And often, the bodies are still too focused on traditional IT... and not on a dedicated solution for that specific activity. We find a lot of resistance in this adaptation of this conventional IT to new technologies and new requirements. (IT, State)

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For us, it was cheaper to go to the market to hire a state company; then it improved over time. But this part of the development here in the department, there are nearly 100 systems to maintain; so, it is very high. They have no staff to cover it all. (IT, State)

3.10.1 Software services

The development of software, in particular administrative software, can occupy a significant part of the IT sector. Programs can be developed by an internal team, by government companies or also by third party companies.

At least three state departments and one municipal department are served by public companies. According to IT managers from different regions, the main difficulties encountered are: wait time longer than expected, small structure for addressing the demand and limited vision for innovation.

There were also reported agreements and partnerships for the provision of e-mails, virtual storage space with the private sector, such as Google and Microsoft.

I. Open or proprietary software

A latent issue in education is the choice between using open or proprietary software. The federal government works with an open source approach for the operational system, Linux, and office programs such as word processors, spreadsheets, with open and free code and therefore at lower cost and greater autonomy of use and adaptation by IT areas. Local governments vary in their preferences, but there is a greater tendency towards proprietary software, with paid user licenses, because they are more common and facilitate the contracting of services.

Users of free software disagree and defend Linux precisely for facilitating the maintenance of equipment. So there is no consensus.

On the other hand, management and educational software systems are usually proprietary, with a user license paid per installed machine and a closed source code for the manufacturer only.

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The difficulty is to have professionals who know Linux well, for example, to set up a Linux server, they are not cheap. They are even more expensive than a professional who knows Microsoft. So, within the academy itself, there is a current of Linux advocates. I think it's valid, I think Linux has its application ... [but] the fact that it is free does not mean there are no costs. Our computer labs run on Linux, there is no license. (IT, State)

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I was interviewed by a journalist when we had the partnership with Microsoft. He interviewed me, and wrote an article speaking badly of the partnership. He said that we were installing Office for students only to create a market for the company and things like that. When I was asked personally I replied as follows: "My dream is that a Brazilian company were to do this [a partnership to distribute free software], invest that money in education. Here, we do not have it; so, am I going to deprive my student of something that the whole world has?" (IT, State)

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I use Linux Educational a lot in school activities. It is an excellent operating system, which brings most of the things that possibly the teacher will need to use; however, there is a culture of disqualification of that software, which hinders its use a little. (ET, State)

3.10.2 Hardware services and data storage

Private sector organizations are the hardware suppliers, and the expectation is that the sector will become more diverse to increase competition and expand the resources available.

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This is because “Ah I need a server structure, I need ‘storage’ to store content”, i.e., there is infrastructure to be built for this and you have to decide “Why invest in it? Or we will invest in a structure, for example, the cloud?” This is not the core business of the department, and we can pay for a space, without necessarily investing in it. There are already specialized companies; so we just have to contract them. (IT, State)

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It’s hard to make a decision, especially when you talk in terms of government, because then you start, “Ah, but [the data] are not inside your place”. You get used to that fact that [the data] are somewhere you do not know where, just made available on the Internet... That’s the big change with the question of cloud and, with that, the difficulty of changing these views. For the vision of the government is: “We will invest and have our own resources.” (IT, State)

A very timely issue here concerns the **methods of storing information** of educational networks. Cloud storage services have become widespread in the market and IT administrators are attracted to this option. Instead of acquiring high capacity servers in such cases, a remote storage service with access via the Internet is contracted. This model in the education sector is still fairly restricted, in any case.

Issues related to data security and privacy of users, teachers and students need more extensive discussion and regulation.

4

THE NEED FOR SETTING STANDARDS AND GUIDELINES

Faced with the complex discussion of infrastructure, it is essential to note that, despite the regional specificities, there are many common challenges between the education departments studied.

At the same time, there are many models of administration and implementation of infrastructure following the prospects of each new government, willing to correct and improve the ways taken by previous administrations. However, there is little interaction between IT managers from different departments to enable them to contribute to existing projects, analyze the objectives and achievements, and their applicability in new contexts.

At the other end of the chain, companies providing services in the digital content area end up serving as the contact points between the departments; they end up finding out about different experiences and putting educational systems in contact informally and ad hoc.

We reiterate the importance of thinking about organizations and periodic forums to discuss conceptual and technical models of infrastructure implementation, as well as to establish standards and guidelines to optimize the planning time of the departments based on variables that serve everyone, such as equipment configurations, Internet speed, promoting joint solutions for the sector.

This may be a step towards greater continuity and implementation of longer term projects.

CHAPTER 6

DIGITAL CONTENT

1

THE CURRENT SCENARIO

One of the pillars of a mobile learning policy, the digital educational content, has admittedly limited supply in Portuguese and Spanish, the most common languages of Latin America (ORTIZ & CRISTIA, 2014, p. 31). The statements of those interviewed confirm that the market is still incipient in Brazil, especially in the humanities area.

Not all municipal and state school systems have virtual learning objects, the name by which digital content is also known. Even if they have already distributed mobile devices to educators or students, the availability of digital educational content is not the norm and usually converges with the existence of administrators and decision makers who put the integration of ICTs as a priority in their school systems.

There are two major trends in relation to digital content. The first is the **acquisition of solutions** produced by companies in the education sector, which have greatly increased their market share, especially with the emergence of educational *startups*. The second trend is

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I even have the habit of joking around; when I leave here I'm going to start a business to create good educational content that runs on a mobile device. (IT, State)

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Products are lacking, Brazil has too little in all areas. In general, it's still little. There is limited stuff or simply a PDF of a book, or something like that, which is not necessarily an innovation. (Organizations)

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Companies don't know how to create digital content. The digital book is a pdf with links! (Federal Government)

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In the area of Portuguese language no one is producing anything. It is our main area of shortage of digital resources. What the MEC needs, and we were thinking about doing it here, it's to make an on demand contract: what is needed for the 1st to 5th grade, 6th to 9th and what is needed for high school in Portuguese. If not, it will always be the same: physics, chemistry, biology and mathematics because they have an affinity with computers, more proximity to the areas of the hard sciences, which means a strong connection. Most coordinators of the technology nuclei are from math. (IT, State)

the **local production of content** and sharing that material, either in their own school system or as an open¹ educational resource on the Internet.

It is important to clarify that the **local production of content does not preclude the hiring of specialized private sector**: you can bid on a company to produce a customized content with direct coordination from the department or to create a platform where content produced by teachers will be shared; we can have teachers and technicians producing classes, etc., by means of proprietary authoring software². Also, public companies can be hired to produce certain applications. In all cases, the coordination of the departments are involved in the production of new content. In addition, a new virtual learning object may also be developed by joining several existing ones: this can be a new game, a new video, but it can also be a lesson plan created with open educational resources available online, through a process of customization.

The MEC produces content internally through TV Escola and the *Portal do Professor* (Teacher's Portal). Besides. In addition, according to the Technology Guide 2011/2012, for example, found that of the 169 technologies analyzed in the document, 65 were produced by the MEC itself in the areas of education for diversity, professionals training, inclusive education, educational administration, among others.³

It is important to note that, in theory, local production and customization of digital content versus the acquisition of solutions in the market are not mutually exclusive. The complementarity of local production and acquisition of content, according to the education network design, can be an appropriate solution for

¹ Open Educational Resource, or REA (Recurso Educacional Aberto), "describes any educational resources (including maps of curricula, course materials, books, streaming videos, multimedia applications, podcasts and any other materials that are designed for use in teaching and learning, that are openly available for use by educators and students without the correspondent need to pay royalties or use licenses" (BUTCHER, KANWAR, & UVALIC-TRUMBIC, 2011, p. 5, our translation).

² Authoring software, also known as authoring tools, are accessible resources, for people without specialized programming skills, to develop programs and content in general.

³ Available in: http://portal.mec.gov.br/index.php?option=com_content&view=article&id=13018&Itemid=949 Last access on 27th December, 2014

educational environments with varied resources to be tapped based on the needs of teachers and students. In any event, it is rare to find departments diversifying their actions in this direction: among those providing digital content for their school system, either they opt for local production or the procurement of existing solutions in the market. So, these two trends, usually find adherents in different contexts, as we shall see.

(ORTIZ & CRISTIA, 2014) In addition to the availability of content, we analyze if the policy of the departments includes **guidance to the use of digital contents or not**, stipulating the time and content to be accessed. Therefore, we can segment the education departments as follows:

Table 6.1: Distribution of departments of education regarding the acquisition or production of content

Source: Authors' Creation

Most of our departments in our sample produce local content and do not guide use. In this group are the municipal education departments of Curitiba and Rio de Janeiro, and the state departments of Bahia, Paraná, Rio de Janeiro and São Paulo. The municipal department of Manaus acquires a solution on the market that requires the guided use of the content. It is the only department of our sample with guided use as a foundation. The State Department of the Amazon acquires content, but does not guide its use. And finally, at the time of the survey, four departments, most of them

municipal, did not provide digital educational content in their school system: the municipal department of Goiania, Salvador and São Paulo, and also the state department of Goiás.

As you can imagine, **many individual teachers can produce content locally, regardless of the department's profile, but here, we classify the departments based on their institutional actions.**⁴

Figure 6.1: Classification of departments regarding the distribution and use of digital educational content.

Source: Authors' Creation

⁴ At the Municipal Department of Salvador, a former experience of local content production was reported, but access channels, like a portal, widespread and institutionalized, were not identified throughout the school system, and it was only a project restricted to those who were acting in the NTE. Also in this school system, the acquisition of digital content from the market was being considered.

2 ACQUISITION OF CONTENT ON THE MARKET

In the sample of this research, there is a tendency to purchase digital educational content in **departments that are in the initial stages of planning ICT use** in education – especially those that already have equipment, but do not yet have a use plan. Among these departments, there are administrators who recognize the **low capacity to produce content locally** and those that hold a **conviction that internal production goes beyond the scope of the main goals** of an education department.

The acquisition of educational software on the market is emerging, as a great solution in these scenarios and **brings benefits by building networks and for their more refined services**.

It can happen that a department has purchased systems to partially respond to the school system, using staggered deployment, yielding a **large variability of resources available to schools and administrative challenges** that are inherent to it.

Even from the administration's point of view, some departments, especially the municipal ones, experience problems due **insufficient project oversight**. Due to lack of personnel and structure in the areas of educational technology, often there is a lack of monitoring by leadership of the educational sector at various stages of the content deployment process involving private organizations.

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I think we don't have a team to do that. Talk to the City Hall itself, so they could work it out, that content, to produce the same content, specific to education. So today I think it's more appropriate to buy. (Administration, Municipal)

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Let the market invest! Let the market invest! Let the market invest! We are here to teach students. They'll have to learn. Let the market work to develop content. (Administration, Municipal)

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There is some resistance from the pedagogical sector, 'No, we ourselves have to prepare our content, we ourselves have to do this' ... I think there's a lot already made and we can analyze and say "Look, that's cool, this can be used or adapted'. So, I think it's also necessary to open our minds to what we can find in the rest of the world. It's no use, as no one will reinvent the wheel. (IT, State)

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That system environment is interactive: the teacher can either make his own class project and publish it, or he can share it with environments throughout Brazil who use the system both of the public as of the private network. That's the cool part of the portal. (ET, Municipal)

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The student has access to complement of the book's contents, of games, to whatever is related to a particular subject in the portal, he can also conduct research ... If he searches out of the portal, on Google, for instance, he will find good things and also very bad ones. If he is out of school doing that research, there won't be any teacher there to mediate it. That doesn't happen in the portal as it already filters out what is best for the student, so that is the complement. (ET, Municipal)

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It is quite complicated, as the system is set to expand to 125 schools. It nearly doubled. Those who don't have keep asking for it, because if the other schools have it, why not us? But that is a decision of the Secretary, it implies costs, so you have to go slow, you cannot cover the whole network. (ET, Municipal)

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They [the companies] contribute, but there must be some sector following and monitoring all that, one of them stood still for an entire year, without taking any responsibility. And when they came, wanting to sell more, we stopped. It was partly the department's fault, but the company can't stay with their arms crossed, I see that partnerships are very positive.

(ET, Municipal)

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The software is a consequence of the equipment we are going to buy. The laboratory is there beautiful and great... But I have to be resolute, if the laboratory is not working and I want it to work, I need a solution, let's seek the solution [- the software].

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Right now, IT staff are waiting for us to tell them which are the schools where the software will be placed. To place the software involves training, a lot of things, and first, we will finalize an [other] project, because we need to know if there is space, resources to keep up with that other [project]. Friday, the technician said he was depending on us, that the secretary would ask why he had not put the software yet into the lab, and he would say that we hadn't given him the names of the schools...

We need to know how we will go from here. [We are] two people, the other one is here only at night; it is too complicated. I'll wait for them to call me!

(ET, Municipal)

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The technologies department manager is the one who buys all that technological part, Internet, those services they come to sell into the department, those software packages... He is the one responsible for the purchase. I have already approached him in order to talk about production, to have a portal of the department the teachers could have access to, where we could have contact with free software to be able to provide... that the teacher could start doing. This is something that is still maturing, we're still thinking, still in a design stage.

(ET, State)

In line with what has been discussed in the infrastructure chapter, in one of the Departments, the decision regarding the purchase of educational software was being led by the IT department manager, who, when making the plan for network infrastructure and purchase of equipment, was worried because there was no content to motivate the use of the devices. Options were taken to the department's NTE, which took part, in a secondary way, in the decision process. The project was in the process of implementation and the following lines convey the conflict between the departments.

A similar situation occurred in another municipality where the IT area had already purchased digital content from a company, while the educational area was seeking to influence the decisions toward the production of content.

The purchase of digital content or teaching solutions involving educational technologies should be used as an alternative to the composition of a plan, already designed, for the use of ICTs by departments, requiring clear definitions of roles of departments, companies and the requisite monitoring by the pedagogical coordination. Otherwise, there's a risk of delegating responsibilities. The lack of protagonism by the pedagogical area will unlikely bring positive results.

It is interesting to note that even among the departments prone to buying digital content, there is an emergence of demand for **customized products** to suite their needs.

For the companies mentioned by respondents and identified in schools, the most frequent in our sample were two: Positivo Informática, which operates in hardware production, software – this later focused especially onto the curriculum of Prova Brazil – and teacher training, and Evobooks, which produces digital textbooks in 3D, providing students a different visual experience with the content of subject matters.

NetBil is also mentioned, with activities and digital games to complement the curriculum, and Tamboro, which produces educational games with evaluation arrays. Among the most widely known companies in IT, Google Education and Microsoft Education are also mentioned as having initiatives that go beyond licensing of office software and cloud storage, including also customized programs.

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We have a process going on to buy a portal. The idea is this: we received the visit of several companies and built our terms of reference based on the proposals that were presented, and those who comply to that term of reference will be able to participate. We don't want to buy a ready-made product, which would not meet our demands... There are some specific features that most programs don't attend to. (IT, Municipal)

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Microsoft has a whole education area where they build a learning object, 'Oh, I have a curriculum item here, I want my teacher not to waste time so he can teach; Microsoft, can you do this for us?' They help to build these objects together with the Office suite to be used in the classroom in a simple way. (IT, State)

2.1 Guided content

The software from the Positivo company, called Aprimora, focusing on mathematics, Portuguese and text production, is of note as being part of an ICT-supported educational system, which has a **guided use plan based on clearly defined objectives**. It was the only system found in the sample for this paper, along with *Khan Academy*⁵, which is also used in some schools, that aims to guide the use of teachers and students, determining a time of use, in line with what Ortiz & Cristia (2014) describe, besides including monito-

⁵ Khan Academy is a digital platform of great success in the world for teaching Mathematics, Chemistry, Physics and Biology, whose content was translated into Portuguese by the Lemann Foundation and, in 2014, reached the number of 70,000 students in Brazil by partnering with departments of education.

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We expect them to use one hour and a half per week or something like that; it has an expected time. We learnt on the first year of the project's implementation, just like it is used elsewhere, that we should try to ensure once a week, usually math classes on the first level of fundamental learning, they put them together in some days, then there are two or three classes in a row on that day or on another day, or two sequential classes three times a week. It varies widely from network to network, but we usually recommend that we should use one hour and a half per week, and that is the sort of usage that seems to work, because this allows the teacher to have his classes the way he always had, but allowing a fixed day for a computer session in school. (Organizations)

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In our current system, if you look at our legislation, you see there is a space for the autonomy of the teacher, so, I cannot say that he has to use the notebook in the classroom, I'd be going against his autonomy. Even the minimum curriculum ... it's like giving childbirth to make people accept the proposed curriculum. Some people claim that [we are] going against the autonomy of the teacher, even more when you force teachers to use technological equipment. So, we really have to go by seduction, show how good it is, how he can use it. (IT, State)

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If you leave it undefined, 'Oh, whatever you can imagine, you had all the allowances for that,' and then nobody uses. Then you say, 'So, from now on, you will use like this and like this.' And then they think you are constraining their teaching freedom to what they want. So it's sort of a controversial matter. (IT, Municipal)

ring and evaluation tools. **In any case, we are not investigating the use and effectiveness of these platforms in the classroom** – here, our focus is on their design.

Among the challenges to establish usage guidelines, is the struggle to ensure the autonomy of the teacher in the classroom. It is a contentious issue, and needs to be better understood by administrators who are at the forefront of educational departments. **What are the boundaries between autonomy and the establishment of education policies?**

It is worth mentioning that, although it is not common to guide the use of content by the Departments, this is a latent theme and, among the coordinators of educational technology, there is tendency to be favourable and supportive.

With the spread of new companies producing digital content and growing organizations seeking to establish partnerships, **it is critical that the acquisition and the regulation of content also be developed at a federal level.** Local administrators resent the amount of vendors and organizations trying to meet them daily to offer their solutions. Uncertainty, similar to that which prevails in the purchase of equipment, also affects them when the subject is content. As this is an emerging field in education, in fact, there is little evaluation (individual and comparative) of the effectiveness of content for teaching, a fact that complicates the assessment of potential programs for acquisition or development.

2.2

Guide to educational technologies

To reduce the difficulties managers face in evaluating educational technologies offered to them daily, the guide to digital technologies of the Ministry of Education was created to be an entryway for companies that produce content and wish to sell their technologies to the states and municipalities. **It is not a requirement for the companies, but this type of pre-qualification becomes a positive attribute that local governments will take into account when analysing a product that is offered to them.**

The MEC mobilizes university professors to conduct this analysis following a public call to which companies apply.

On one side, there is demand for this type of resource to assist in purchasing decisions. On the other, there is still a lack of knowledge about their availability and little practical application in the acquisitions currently made.

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Look ... I don't know if it is the same in all Brazil, but here, maybe I am a little inexperienced in this area... I feel very confused. I mean, I don't know if, at some point, this will open up and it will be clearer to see things. I confess that the amount of stuff that appears, the offer, and we don't have a [guide] that could already include, for example, for the education area, some types of products that have been tested, that have already been approved. [I feel] I miss that, coming from some official institution.
(Administration, Municipal)

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Just like there is the national plan for textbooks, you must also have the national plan for digital objects.
(ET, Municipal)

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We are hoping to be pre-qualified [by the Technology Guide]. Although, nowadays, being pre-qualified is not a solution for anything. For the record, the MEC doesn't buy, or make available, any resources or anything else. [And school systems] have to open a tender. They cannot say, 'Look, I want to buy these resources'. And the private [schools] don't care much about the MEC. (Organizations)

3

CHALLENGES IN PUBLIC-PRIVATE RELATIONSHIPS

3.1

The interviewed organizations

Private companies and non-profit sector organizations, who were interviewed, have quite diverse activities, and, with regard to digital content, are hired to provide products already formulated, ready for use, or to assist in the development of platforms for the production of content authored by the departments themselves.

Three of the organizations are working in non-commercial partnership with states and municipalities, implementing projects that may involve hardware, software, network infrastructure, teacher training and educational assistance for the guided use of resources, giving conditions for partner schools to develop their own projects with the features offered.

Two other organizations sell digital content ready to support the teaching-learning processes in the classroom, while another one of the companies acts on the demand of the education departments, developing programs that can serve the learning process, the management of schools, of departments, or other presented needs.

Regarding the respondents, three are women, trained in mathematics, literature and pedagogy – two of them former primary school teachers, and four are men from the branches of law, economics,

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We really expect schools to adopt the program, to get the space for themselves and that [we] increasingly play a more minor role of cooperation and that it is actually absorbed by the school, the Departments also, if they think that they have an interesting solution there ... (Organizations)

advertising and IT. Of the seven respondents, two were in the same company with different job functions: the first serves as educational coordinator directly in the education departments who deploy the company's education system, while the latter manages the implementation of projects.

3.2

The expected role of the private sector

The mission of the activities of all organizations is the same: to improve the effectiveness of teaching and the quality of learning of students with technology resources, through greater engagement of teachers and students and resources more in line with the reality of today's society.

Companies are acting in a complementary manner to the public sector and feel part of a larger effort. They express that there are fears due to their arrival, revealed in the anguish and insecurity about changes. There is a work of building relations and persuasion that needs to be done based on the results achieved.

One of the important and enlightening points on the lack of adhesion to ICT is the scenario where projects are started. **Depending on implementations strategies, ICTs can become the executioner representing the government itself and its actions set apart from the expectations of teachers** who generally feel very undervalued.

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I ended up working with some governments, in education. That's where I got to understand the whole dynamics of the sector, then, and one of the challenges that I ended up realizing within the digital part was really how to generate pedagogical impact and we eventually decided to contribute, in that area of commitment to improvement, to create more interesting content for students, content that passes on super important things, the basic concepts of education, but more interactively, more enriched, appealing to the student to get inside it. (Organizations)

In our case what matters to us is to look at innovations that affect learning and make schools more effective school at that challenge of ensuring that all students learn. What I think and what I'm basically talking about [are] the platforms, games, devices, mechanisms, etc. that can contribute to processes that bring about learning. (Organizations)

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The technology is now part of the student; there is no longer a question of considering whether or not to provide the technology. It is part of the day-to-day in all spheres of society. If we look at medicine or finance, technology is everywhere, leading edge technologies with advanced features, and we [in education] are still limping along. (Organizations)

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We saw other media, for example, games, animations we have in the cinema... Education was at a stage of very simple animation, greatly simplified, and the games were at another level. We looked and said, why is education so far behind? We understood that the problem was not financial. There are really many resources. If you direct it well, you can have much more enriched learning materials. So that's where the inspiration came from: other industries. (Organizations)

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Technology doesn't make any difference; it only makes it motivating, but brings a different understanding. So we always try to come up with [content] that brings a different understanding of that concept. For example, you have the interactive atlas of geography: I want to see: what are the rivers of Brazil? What are the roads? Where are the ports? I want to see the HDI [Human Development Index] of the regions in Brazil, but I want to compare with the amount of road network there are. See who has the highest HDI, see who is best served by roads, by structures ... (Organizations)

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It's no use to think that the solution will come only from teachers. No use to think that a start-up will solve it, no use to consider that a single company will be the solution. It won't. You have to create an ecosystem for this to become strong, to mature, to have real utility. Number one: real utility. And number two: it's that you have, in addition to solutions, programs and policies. (Organizations)

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Our goal is that the student is happy and the teacher is also happy at the end. For that I will need training, and if for that I will have to offer the tablet, if for that I will have to do whatever it takes, it will be done. Things are yet to be defined. And that is the role of a start-up: to work from a blank sheet. We are not a publisher who has been here for 50 or 100 years. We are a blank sheet. So, if I want to tear the sheet apart at this point, we can re-imagine the way it is. (Organizations)

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The private sector's role is to try things – things a government cannot because it has too many responsibilities. Any trial, any innovation that it wants to implement within a network, will have to be thought at a large scale. It is quite complicated for them to test new solutions... (Organizations)

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I think companies can help with that. I don't think the government will be better at developing products. Developing technology is a very different business, you need engineers working around the clock, responding very quickly to the user. (Organizations)

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We sent a presentation [of our content] to an information scientist in the United States. He said: 'Look, it's very good. I can check that here, I can map it, but the return will have to be a teacher to do it, qualitatively. He'll have to look at this content, he'll have to look at the student and understand right there, in practice, what is not working to rethink the content.' That is, [our work] doesn't come out of the blue and it is not the computer that can rethink content. Just look at this subtle thing... It would be nice if some people could hear our voice a little bit, because we are here, in the war of the contents and on this side of the battle. (Organizations)

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Today, there are more than 30 teachers and coordinators within the company. These are people who already understand the challenge and the whole issue very well. Only now, you can provoke them and give them tools. Give them a chance to dare and leap. So we say: 'If you could rethink this content here, without limit, so it could be exactly the way you always dreamed about, now you can. Imagine you had a producer of games or movies in your hands'... (Organizations)

The issues relative to the sphere of politics in general, and infrastructure, which not only affect education but all sectors, are also recognized as limiting greater progress which requires new approaches.

Nevertheless, the vision is quite optimistic, because there is a consensus that it is a path with no return, where ICTs will increasingly cover all spheres of society.

For the respondents, the main feature that the private sector adds to the public sector is the flexibility and the freedom to take risks and to reformulate their products and services when needed. Learning from history, letting go of conventions and responding in a timely manner to a problem that demands solution. In a fairly new and changing scenario, without specifications and formulas that guarantee results, their attempts may generate new learning.

The private sector content production work is therefore very intense and diverse, with high level of professionalization and training of specialized teams.

The **absence of a national curriculum**, however, causes a tendency for content production to be focused on tests and external assessments, especially ENEM and the Prova Brasil. **And while there are criticisms to programs that focus only on test scores, this is the way private sector organizations have found to set goals and parameters for their education systems, in order to evaluate their effectiveness.**

On the other hand, both because of the absence of a standard curriculum and the demand for customization from the education departments, companies can also work through on demand production for the departments. Some companies offer complete education systems, focusing on the process management and planning schedules and content to be worked during the year - which sometimes causes conflicts with educators, not used to or receptive to this kind of direction.

Culture shocks are thus common with the integration of services of companies and social organizations in classrooms, given the increased focus on deadlines, procedures and measurable results. Adaptation periods are needed, as well as sensitivity from the organizations to this approach. In all cases, public administration, clarity of goals and the limits of each actor, all exert fundamental roles.

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When we got here, even with the 60 schools of last year, each [teacher] did what he wanted, each one adopted the book he wanted. The system is the book, the portal, the pedagogical assistance, and we have a network data monitoring system, which is a monitoring system of network performance. (Organizations)

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What we see is that the curriculum of the municipal government is a minimum curriculum in the face of what has been defined in the parameters, the guidelines of MEC, and our curriculum is what we call a fundamental curriculum, and this was a first impact within the network, having teachers faced with those amounts of things. (Organizations)

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We think that if Brazil was to create a national base as a national curriculum, that would greatly help in the development of this technology, of providing clear guidelines, and everyone would be working on the same basis. Today, more or less, each person develops his own, this is a lot of space there are widely different curricula. (Organizations)

3.3

Aspects for improvement

There is widespread recognition of the progress made in recent decades on the topic of provisioning ICTs for education via government actions, especially with regard to hardware, either by distance education structures and the establishment of fixed laboratories, or by the delivery of mobile technologies like tablets and laptops. However, **there is the perception of a public administration that does not cover all the dimensions required for the effective use of new tools, and delegates to educators, in the classroom, the function of thinking about solutions with the resources available - an expectation considered disproportionate to what teachers are able to offer.**

I think this wave we are experiencing now, of thinking about customization, has something that does not represent massification in education, on the contrary, it is a wave that says that technology lives in our world in general, that it is a wave for customization, engagement, distribution of information, and providing that information quickly for decision making. For that kind of thing I think we're at the very beginning. (Organizations)

Now, Brazil is going through a transition from the first to the second wave. It did so in recent years. It started with the resumption by the MEC, with the acquisition of 600 000 tablets by the FNDE. It went through the acquisition, by several states and municipalities, of digital whiteboards and tablets. And technology parks and laboratories and all that. And now we are realizing that we're in the early wave for companies, for start-ups that generate content, that generate methodological solutions, assessment solutions, various types of solutions of that type, to maximize its use, make good use of it, to justify where technology will generate value, or will add educational value. (Organizations)

The biggest challenge today, from our point of view, is to have the tendency, the will to innovate. Because you can already find good training on the market, you can already find good content. There is already a beginning for that, but what is missing is that the agenda of school [networks] give priority to such innovation. And priority in a structured way. Not prioritizing just for prioritizing, as it was done in the wake of hardware. That was just prioritizing without reason. It was said, "Look, we need technology. It is even a public demand. We must invest in technology. How? I really don't know. Find a solution. You are from the education area, find a solution. I'll give the financial resources, I'll give material resources, and you, educators, find a way to solve the rest of the puzzle. (Organizations)

The government has transitioned its purchase model. That's why the government buys tablets: because it knows how to buy tablets, to buy tablets is like buying desks, lunches, backpacks, books, it is a tender, everything more or less similar. It creates a logic, and that logic is spread out. But buying software, the government doesn't know how to do yet, at least here in Brazil. Buying things that will cost \$1.00 per student per month, buying a service, it's a difficult thing for governments. And as this is very new market, it is not very homogeneous, and not comparable. You cannot compare a game with a platform, with a test, so this is also a bottleneck. (Organizations)

In the case of the government, we hear often: "Let the private sector go first." And then, we hear a complaint saying that the private [school] is ahead in quality. That's why, because they can innovate, they can sign a contract in one or two months, while the government has a purchasing procedure that will take, at least, six months. Then, you even lose a little credibility to ask why private schools are ahead if you define that you have to be behind, you cannot innovate, that you have to wait for the others to innovate. (Organizations)

Even in this scenario, the view is promising, with increasing interest in digital content and consistent training.

Concerning **administrative procedures**, the public-private relationship is mediated by established purchasing processes, mostly by tenders, which seeks to create a levelled playing field for providers and enable decisions based on objective factors set out in a Public Notice for tender. One of the points raised by the organizations interviewed is the difficulty of these processes⁶. **Given the specific characteristics technology products and services have, it is necessary to think about buying procedures that will ensure impartiality and objectivity, but are open to new types of acquisitions.**

Finally, a very important point that affects the relationship between the public and private sectors is the **definition of roles**. For problems already mentioned like the lack of structure of the educational technology departments, there are difficulties in establishing the boundaries of each party, as **hiring private services in the area of technology for education does not necessarily entail less work for the Departments, but brings demands of a different nature, that particularly require greater administrative capacity**. Frequently, the lack of staff and planning generates lack of monitoring and leadership of the pedagogical sector at several stages of the process of content deployment. **The strengthening of the**

⁶ There are cases of exemption or impossibility to complete a tender that can be related, for example, to the lack of competition on the object under tender, or contract values below an established legal limit.

Departments' administrative teams is an on-going demand in response to the relationship established with the public sector when contracting services in this area.

The challenge is that it is insufficient for the Education Departments to have third party coordinators when they contract the service from the market, because the "service" must be integrated in the long term and the legacy of this integration should remain. Without a good administrator who has this scenario clearly in mind, the stability of the projects and the achievement of long-term results are likely undermined.

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The system has an expiration date, the idea is not to keep it for eternity in the municipality, but the system contributes to the organization, and the departments should take advantage of that. In some departments I worked in, they fully delegated things to [our company], even to supervise student's workbooks. (Organizations)

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They are structuring schools to receive the Khan [Academy]. Training already happened, mainly for teachers, and we are finalizing the laboratories in this process. Some of them need construction permits, engineering is already taking care of this and others are ok to start... They have already sent 78 computers as a complement. Of the 40 schools, we have 12 where everything is all right. (IT, Municipal)

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Now we have schools with the project Khan Academy. We have to follow-up, but we still didn't manage to, because we don't have legs to go there. So [the project] started, was given a follow up, and will conclude without our participation. (ET, Municipal)

3.4 Collaborative actions

The working partnership of non-governmental organizations with educational networks was repeatedly mentioned. When the partnership involves technology projects in education, often schools need to be adapted to be ready to use these technologies.

Difficulties of the educational sector to accompany the work done by partners are also mentioned, forcing projects to develop at a distance from the departments and, consequently, making it less likely that their legacy is absorbed institutionally.

The perception that partnership projects are not structuring, but localized and restricted to some schools may contribute to the lower priority given by educational technology teams of the Education Departments to such projects. In addition, there are critical visions from some respondents regarding adaptive education, which individualizes learning and is seen as contrary, to some extent, to well-

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Here we are adopting two, the Khan and the Geekie, which is the one simulated for the ENEM, [it] contributes to this specific purpose, and for this specific purpose they are very cool; however, we cannot lose the broader view of education, the rationale and the purpose of public education. Also a fundamental discussion arises about the role of the educator, if the tool will have to account for everything that “a priori” is the role of the educator, and if these tools encourage that, you don’t need to have a teacher. (ET, State)

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If the goal of education was solely to prepare for the exam, this methodology would be perfect, but we are taking care of building an integral human citizen, of culture, of human relationships, and we cannot limit ourselves only to training, to building capacity in selected objective contents. So, we believe there is much to be discussed on these proposals, which are increasingly popular, of adaptive learning, individualized instruction. (ET, State)

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“I really like what is being built here. It is being done very seriously, in a very balanced way, by our network. No external consultancy, I just have the network” (Administration, State)

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I always have a perception that the partnership is fundamental. Now, I believe they must be partnerships that help the projects we are developing. I constantly had here, during these four years, [situations to] buy miraculous content. I mean, you have private companies, and then the guy takes care of all content, takes care of everything, you almost transfer to a private company the education business. (Administration, State)

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For our video lessons, we don’t have a production company for us, we don’t have resources for this. But I have a team of people who close themselves in a room and make them. So, that must also be taken into account. The creative potential of teachers, when they are led to challenges. (Administration, Municipal)

-accepted concepts of education, demonstrating the challenges of dialogue around new learning methods.

4

THE LOCAL PRODUCTION OF CONTENT

Departments with a longer history of discussion on the use of ICTs in their school systems tend to have projects that **value the digital content production process by teachers within the network itself**. Their coordinators are proud to promote local authoring and, usually, there is an ICT integration plan and an active educational sector in the project. There are also new departments adhering to this movement, buttressed by the **defence of the collective construction of knowledge and the perception of the variety of free information on the internet**.

For administrators whose networks produce local content, it is assumed that the involvement of teachers in the production of content tends to **favor their involvement and adherence to projects that seek to expand the use of ICT in the teaching-learning process**.

For those who work directly with technologies in schools, the preference for content production is motivated mainly:

- » By understanding that while producing, teachers are practicing their skills and digital literacy, thus understanding digital production as a dimension of professional development;
- » By feelings of insecurity in regards to the interests of companies and the quality of products;
- » By a conviction for the need for greater appropriation of ICTs, which should be established at the expense of a more instrumental relationship with technology;
- » By the realization of the existence of a large amount of open educational resources available on the network, which can be organized.

From the point of view of businesses, **the production of content by the education departments themselves** is regarded with disrepute by some and seen as a new field of activity by others. On the one hand, there are those who draw attention to the limited resources and lack of agility of the public sector for this work. On the other, there are those who, hired by departments, are helping governments to create interactive portals for information sharing – which shows the demand for customized products. **An increasing diversification is evident in the**

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We produce a few things because we need to learn to be able to multiply it, and we can only learn by doing. So, today, our production [team] trains our group in order for them to train the teachers who are in the classroom. We understand that the skills to produce media are at the same level of knowledge as the skills to produce a text. It is a way to express ideas, a way to communicate, to claim rights, and is a necessity of today's society, for the student and for the teacher, to master this language, because that will allow him more alternatives to express their ideas. (IT, State)

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Today we have an education industry. Many companies producing content and wanting to sell mainly to municipal networks. [We received] a lot of companies... They come to sell all kinds of products, good products, of course, there is a lot of good things on the market, but we also we see people coming here to present products that... And the Secretary said 'We must have something, to produce something, we have to do it!' (IT, Municipal)

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We're not worried, for instance, with the science application that will generate... No, we are going beyond that. We think like this: 'How do I turn the student into a protagonist, how do I turn the teacher into a protagonist?' We started this thought transforming the teacher into a producer of his own material, when it's him who produces the lessons that are on the platform. So it was not a company that produced the lesson, it was him! And then how do I transform this student into a protagonist as well? (ET, Municipal)

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My concept of ICT, my understanding, is that they are new ways to inform oneself, to communicate and to transform society. By understanding this level of importance, I believe it is a right of every citizen to know how to master the use and production of these technologies, which is why we treat the relationship with technology at the level of appropriation. Creating a metaphor, which is the way we talk to students: 'My brother, digital inclusion is when you're standing in one place, then a wave comes and swallows you up and you are carried away by that wave. Technological appropriation is when you're walking, taking a stroll and, while you walk, you go on picking up and using things that will have a purpose for you, a benefit for you and the community you are part of'. (IT, State)

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Those who produce digital content sometimes produce it in a very simplistic way. Many think more on the results, forgetting the process, as if it was something like a hit and run. They had to stop and think about the development of such a thing. It's like doing a project thinking about finishing it and not giving any value to the way it is developed. (IT, State)

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The government structure is not designed for that [digital content production]. Our society built structures that are faster and more efficient, which are the companies. And the government has to trust, foment and calibrate for them to bring good solutions, being paid accordingly, not too much or too little.... So, governments have initiatives, yes, interesting, but they end up, in our point of view, somewhat reflecting the government profile, which is to take time, make it more expensively and end up with the same result they would get, with the same resources of time and money... (Organizations)

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The goal [of the portal we are creating] is to be a tool to facilitate the construction of this project [of finishing the course of elementary school], and share information with other students in the network. Let's assume that I'm here at my school and I want to make a project talking about the World Cup. I start by including the information on the World Cup and maybe another student, from another school, is doing the same project. He can look at the content, at what I am publishing and together they can complete a better job. (Organizations)

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At the same time, technology companies must be connected to the day-to-day routine of schools, and so, there is a lot of technology in search of a problem. Some guy creates a software that has no connection with the day-to-day of schools. (Organizations)

use of ICTs in school systems and the consequent demand for specialized services and authoring production tools for these school systems

There is the perception, in any case, of a disconnect or distance of certain solutions produced by the companies from the problems that schools and educators face. As supply increases, so does the diversity and quality of products, which reinforces the need for structures to assess new products by government agencies.

Below, we list the main forms of local content production in school systems.

4.1

Curation of online materials

The creation of platforms for sharing digital content connected to the curriculum has been an increasingly used resource. Local experiences in this area are reported since the 2000s. At the federal level, MEC's Teacher Portal is a reference, although not extensively used, where teachers can share lesson plans and access plans made by other registered teachers, as well as videos, audio and other digital content.

Locally, the Bahia state system, in its *Ambiente Educacional Web* (Educational Web Environment), brings together categorized

materials that enable search by school year, subject matter and curricular theme. The Educopédia, the municipal network in Rio de Janeiro, has become an outstanding experience due to its partnerships, in addition to segmenting content according to the curriculum with the help of active teachers, and also proposing guided content for classes, promoting its use for teachers while preparing their practices, so they can become more dynamic.

Other experiences tend to follow that of Educopédia, Currículo+ (Curriculum+), launched in 2014 by the state network of São Paulo, is the most recent one identified in this study.

Figure 6.2: Portal for access to digital content organized by the school systems

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We try to stimulate authorship. In the Teacher Portal you can take a class, change it and share it again. You become the author. But teachers don't do it. We have 18,000 published classes, but many of them fomented by us [made by university professors]. We have few classes with coauthors. We hire universities to work on specific topics. Classes for high school, because of the focus on the ENEM [National Examination of Secondary Education], for example.
(Federal Government)

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It's not necessarily required to produce content to access it, it's there, just the MEC alone has 16,000 in the Teacher Portal. I don't believe there is any need for any state or municipal department to invest in producing a full range of content for elementary education. (IT, State)

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What was done here was to define with the pedagogical area, the pedagogical project. I mean, first, what was the first condition? I have the official State curriculum. All that was built of learning objects and was curated, must be linked to the curriculum of the State. Otherwise, I end up simply deconstructing it. (Administration, State)

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Today we have nearly 2,000 already mapped contents in all subject matters, for all school years, all grades, a team of 80 teachers on the network; they are coordinators of pedagogical nuclei, they are not classroom teachers, they are teachers who are on the teaching board, who were trained, specialized, and have the monitoring of our team and it has been a very cool process to see their commitment to the proposal. (Administration, State)

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There are open educational resources, which are license-free media; however, many of these resources are produced by companies without the slightest relation to reality, to the places where these things will be used. When we bring a concept of free educational media, we are trying to consider this process, and to us, it is free from the moment the subject participates in the production, and that is why we do it like that. (IT, State)

“
There are platforms that I find very interesting, they have some interesting tools, but there's one thing they don't have that bothers me a bit and that is: who is producing what's there? It is not the teacher who is in the classroom... I think that's what is missing in other platforms, I still think they are insufficiently interactive. (ET, Municipal)

(Figure 6.2 – conclusion)

Bahia's State Department of Education and São Paulo's State Department of Education

At the federal level, the strategy followed is to hire teachers from universities to produce such materials, to serve as support for other educators.

More critical opinions consider that the fact that it is an open educational resource is not enough to represent the appropriation by educators in their school system. It is necessary that the production be made by the subjects of the action themselves.

Box 6.1 Educopédia: history of a policy and a trend**Educopédia: history of a policy and a trend****Figure 6.3:** Access to Educopédia Portal

Source: Municipal Department of Education of Rio de Janeiro

Educopédia is the experience with largest visibility within the field of local production of digital content in Brazil, and has emerged as part of a larger plan called School 3.0, which encompassed three areas of action: infrastructure and maintenance, development of desires and skills and development of new practices, cultural tools and mental models. Developed in the city of Rio de Janeiro starting in 2009, Educopédia emerged as a platform that brings together virtual learning objects organized according to the disciplinary curriculum of the school system, the school years and marking periods, counting on the curation of teaching fellows for this project. Through its format and pattern of content presentation, the material was intended to be used not only by teachers to guide their lessons, but also by students as a learning support, including outside of school and for other educational networks.

The municipal schools of Rio de Janeiro have more than 1,300 school units of elementary education, but the Educopédia project began as a pilot project in 10 schools and focusing only on mathematics. After six months, the evaluation of the experience showed the potential of the initiative and helped in deciding the next steps.

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We have our own methodology based on the neuroscience studies of the teacher Carla Verônica of UFRJ, who develops a whole process, and then all teachers who publish their classes follow that same script. We have those classes there on the platform and we follow the curriculum guidelines of the network. So, the student is not doing well in mathematics during the first quarter, so he can watch these lessons at home with his father, for example, and redo the exercises.
(ET, Municipal)

”

Most [platforms] are repositories, and Educopédia is as if they were digital books, you get in and you have the chapters. The digital lessons, in fact, are chapters with videos, texts, games, activities, which are as if they were the activities of a didactic book. It's much more ready and is much more easy to use than other platforms. It has the teacher's guide, a Power Point presentation for each of the classes... We followed the curriculum line by line. You already know that if you enter the 6th grade in Math, you're going to have there all you that's in the 6th year curriculum for Mathematics, all the competencies and skills are there.
(ET, Municipal)

”
I had a super selection for that staff, and everyone wanted to participate. We had 20 candidates per seat, but for the teacher to use it in class was optional, it would be used by those who wanted. (ET, Municipal)

”
All that [was made] was supported by the ministry, the institutes, and it didn't use much money from the department, but when things started to grow we really saw that, in fact, it was worth while, because there was money coming into the department to buy more computers, more Internet, more speakers. (ET, Municipal)

”
We pay a fellowship to the teacher in the classroom even as a matter of valorizing this teacher who is teaching a class. It's this teacher who knows about the needs of his cohort; he is the one who produces the lessons that are there on the platform. (ET, Municipal)

”
We do a single physical meeting with him so he can learn how he can publish on the platform. He gets a producer login and password, and then he has a coordinator, who is the person who will check if that content is in accordance with the guidelines of the department, including Portuguese language, to make the revision of the texts presented in class. He has a monthly target and he posts, the coordinator validates and then the class gets uploaded on the platform. The mechanism works like this. (ET, Municipal)

”
I can have the best of the worlds, the best technology, but I don't necessarily know what are the needs of the teacher and the student in the classroom; this is a point that I find makes Educopédia a reference, letting the teacher produce the class he will use. Usually the teacher is that guy who is called to choose the textbook produced by the publisher to be used in his school. And here he is called to produce the class he will use. (ET, Municipal)

In the second year, there was an expansion project to 170 school units and only in the third year, it was expanded to the entire network. The model provided fellowships for teachers, who, in addition to maintaining their classes, would contribute 10 hours per week to the organization of the platform materials.

For the expansion process, the number of teachers working on the project also had to be expanded gradually from approximately 80, at first, to 170 in 2013. Considering other related programs, there were a reported total of around 350 teachers with fellowships in 2013.

The grants range from 1,100 to 1,500 reais and were granted by the federal government after presentation of the project to the MEC administrative team, within a municipal Secretary initiative, who saw the need to raise funds and partners to support the project.

From an organizational point of view, the project was developed under the coordination of a Subsecretariat for New Technologies (Subsecretaria de Novas Tecnologias), which reported directly to the secretary's cabinet. After a change of administration in 2014, the coordination has become a management of technology projects, but continued to report to the cabinet, leading four activities: the Educopédia Platform, Teacher Training, Portal Communication of the teaching network and Social Networks.

The training of teachers to prepare materials is conducted with distance learning, with the follow-up of a coordinator. The work is also considered professional development, because the fellow teachers practice the planning of lessons and the use of digital educational resources while increasing the platform.

The training of the remaining teachers of the school system can be carried out remotely with materials available on the platform itself. Additionally, there are the ambassadors of Educopédia - schoolteachers responsible for spreading out the idea of the platform and its use in the schools - in addition to the student ambassadors, who also act as a support in the dissemination of the tools.

The infrastructure for connectivity is also heterogeneous in Rio de Janeiro, and this is a dimension that continues to exhibit demands for improvements.

Besides the pioneering actions of this experience and all its challenges, Educopédia also contributed to demonstrating that the adherence of teachers to the use of a new tool in their day-to-day is not fast and doesn't tend to be spontaneous. A World Bank survey (2015) showed that in 2010, when the platform was still in its infancy, municipal teachers in Rio de Janeiro used ICTs in only 1% of their time in the classroom. After one year, with the expansion of the project's scope, together with the strategy of providing individualized tutoring assistance from the department, this usage grew to 4%. Although the absolute numbers are low, the fourfold increase points out to the importance of a project's maturation time, training and constant monitoring.

Aiming at the **involvement of teachers** is a factor that project managers highlight as important.

The scope, as an open educational resource, is unlimited and the interest in Educopédia has exceeded the boundaries of the city.

”

[There is] the figure of the ambassadors in each school, who were the teachers. [Its role] was to help colleagues to use, to see where the difficulties were, whether it was the use of your projector, using the internet, whatever required help. I think it's much more efficient to have one person by your side talking to you, than one of those courses where you put everyone in the classroom, and there's that "blah blah blah" in front of you. (ET, Municipal)

”

[There are] the ambassadors-students as well. Two or four school students who also acted to help teachers and other students. They were appointed by the teacher ambassadors. There had to be a student in the morning and in the afternoon, and they earned a T-shirt that they could use instead of the uniform, so that was the motivation. They loved it and they earned a certificate as well. (ET, Municipal)

”

In fact, we created a growth in demand from the teachers, but we could not keep up with solutions to problems with internet, Wi-Fi; it was complicated to solve. We created that desire and failed to remedy the problems. (ET, Municipal)

”

It has to be something that everyone feels ownership, it can't be something that comes from above, it is a construction that needs to come up from the base, innovation, if you do not include everyone, it won't start, it is something very far from reality. (ET, Municipal)

”

These [teachers] ended up coming to me and saying they wanted to do more, they were many, but I could not bring everyone. (ET, Municipal)

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The great advantage of Educopédia is the valorization of the teacher, the protagonism of the teacher adding the materials he himself uses. That brings to the teacher the recovering of his self-esteem as a thinker and researcher. (ET, Municipal)

When we access Google Analytics, which is the way we measure accesses, we have accesses from Rio de Janeiro to Fortaleza, Pelotas, Vitória, Portugal, Angola, Argentina; we have accesses from everywhere, and it surprises us. (ET, Municipal)

The network policy nowadays thinks of a technology policy within the classroom. And then, what would be a solution for the classroom? First, a platform teachers could use in the classroom, and students could also use at home, and the father of the student could also use at home with his child, aiding and accompanying the development. So we point out to that. (ET, Municipal)

Today the teacher publishes the lesson, but we want to turn this into a greater interaction, where other teachers and students can make an assessment of the lesson. Simple mechanisms such as putting stars: this class was assessed with how many stars? Which lesson did you like most? The recommendation system that websites use, we also want to do that: "Someone who watched class No. Fifty-four of science, also watched class No. so-and-so, for example". And then, a social network: you can get in touch with teachers interested in this matter, as long as they want to build a profile into that specific Educopédia network to interact and discuss on that subject. (ET, Municipal)

What makes us happiest is to see parents coming to us, saying they are using the platform, because, thinking in a more social way, a father doesn't have much access to the materials his son sees in school, but, as Educopédia is on the Internet, it is based on the curriculum and has exercises, he might access the platform and know what his son is watching at school... It's a way to bring the father to follow the school life of his child as well. (ET, Municipal)

In the **future**, in addition to increasing the use of the platform in the teaching-learning process in and out of the classroom, the project team is hoping to increase interaction and cooperation among users. These are trends that point out to the formation of learning networks and to the expectations of students' autonomy and greater commitment to education via ICTs.

However, until now, there is no survey on the use and the effect of use on the teaching-learning process.

Figure 6.4: Access to content on the Educopédia Portal

Source: Municipal Department of Education of Rio de Janeiro

From the point of view of public policies, monitoring and evaluating the use of these tools shows much room for improvement, and studies on the intensity of use, like that of the World Bank (BRUNS & LUQUE, 2014), should be added to those that evaluate **how** they are being used, and the contribution of these new tools to increasing the **effectiveness** of student learning.

And with regard to **continuity**, a key aspect of policies for ICT integration, Educopédia proves to be a promising case that, despite the change of administration, continued as the driving action of the department. Adaptations and changes were made, but the administrators of the teams in the previous and current administrations transmit the essence of the project with the same intensity. No doubt, the method of networking, initially focusing on the engagement of teachers and students, usability of tools, and their features, is a fundamental aspect for the continuation of the project, whose biggest challenge is to expand its use in the classrooms.

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It is widely used compared to other educational platforms. Until today, we had 5,700 million hits this year, but I still think it's underused when we see, for example, the length of stay, the rejection percentage as far as it worth, we think it's very underutilized, both by the teacher as by the father or the student ... Do all the teacher use Educopédia? No. But have all the teachers heard of it? Yes.
(ET, Municipal)

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We will now engage in a study towards the end of the year: that part of the public who, in our research, said that Educopédia is what they use the most, we will want to know if this influences school performance? Because here in Rio de Janeiro we have a specific evaluation of the network, so we will try to cross that data, the school's performance and the fact that it uses new technologies. It won't be directly related, but we'll have a parameter.
(ET, Municipal)

4.2 Education portals

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It is a platform for transparency, to bring the parents to participate in the everyday life of the student. The teacher enters the classroom, there is a list of students, he takes attendance, and the father says: “Oh, my son just attended this class”. His son was missing, and the parent will receive a text message. We generated that type of interactivity. (IT, State)

”

Today we have the educational portal where parents can follow the student’s life over the Internet. He logs in and he has the report card, a daily schedule, he can change the main registration data, he has access to the school diary of his student... The idea is that the father can monitor in some other way, without necessarily being inside the school, as everyone has a Smartphone nowadays. You log in and you can check: “My son is present today? - Yes; “Oops, my son left home today and he is not at school, what happened?”. That is, the idea that the state is not responsible for everything. (IT, State)

The education portals of the Departments have been increasingly present, although the difficulties of municipal networks to structure their websites should be pointed out - the Municipal Department of Goiânia still didn’t have their own page with content on the web at the time of the survey.

Communication with teachers and students is a priority, but areas for parental access, where its possible follow their children’s grades and the content of classes, when available, have also become more common in municipal and state networks in different regions of the country.

Figure 6.5: Access to Student Portal

Municipal Department of Education of São Paulo

The departments have also started investing in creating mobile applications to increase interaction with parents. An example is the “Digital School Department,” of the State Department of Education of São Paulo, which connects teachers and parents to the department. The MEC has also invested in applications such as the one that puts together the schedule of their TV channel.

The support of classroom portals is still restricted. In addition to schools with experience curating content, such as the municipality of Rio de Janeiro, the state of São Paulo and the MEC Portal, the states of Bahia and Paraná stand out in this field, due to the vast production of audiovisual, online activities and possibilities to download materials to work offline.

In the Day to Day Portal (Portal Dia-a-Dia) of the Department of Education of Paraná, highlights include the productions made by educators, using their subject knowledge in the production of digital media: arts teachers creating animations, professors of sociology creating research guidelines and highly interdisciplinary teams. Among the productions are the book-trailers, which, in a format of short videos, feature stories of Brazilian literature as animations to encourage students to reading. There are also themed animations, where issues such as food labels, water, and online etiquette are addressed.

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You go to Google Play and you will find the Department's Digital School. From there, the teacher checks attendance, the parent downloads it and he can follow the life of the student. This was the first application we made in the department... The state government has invested heavily in the concept of interacting with citizens. People are using it, asking for it to be improved, then you generate interaction with the population ... (IT, State)

”

Everyone who works here is a teacher in the network, and we have a coordination that has multimedia production, and has an audiovisual production coordination. In multimedia production, we have teachers producing educational materials for learning, then producing cartoons, models, photographs, graphics, this is all our production. And we have another coordination, which is the TV Paulo Freire, which are audiovisual programs. (ET, State)

Figure 6.6: Book-trailer created by teachers

State Department of Education of Paraná

Figure 6.7: Thematic videos created by teachers

State Department of Education of Paraná

Despite the excellent productions, in terms of content and creativity, the challenge of giving continuity to the projects and keeping the production active is raised in different Departments. The frequency of the publication of animations is not regular, ranging from two, four or more months between one video and another. For example, the series of the State Department of Education of Paraná's book trailers, with 8 videos, had its last production in 2013.⁷

⁷ Available in: <<https://www.youtube.com/playlist?list=PL8D3134BCD669D227>>. Last access on: 03/28/2015.

The use of portals in the classroom also remains a challenge, even with content available, due to issues in training and infrastructure, apart from the fact that it is not a guided content – a reality not very far from that diagnosed by the World Bank, which indicates that the main resources for teachers in Brazilian classrooms still are the board and the lecture (BRUNS & LUQUE, 2014). Nevertheless, departments that started investing in content and administrative tools on their portals recently indicate positive changes.

As a trend, we see the expectation of having increasingly interactive portals, including chats at appointed hours, and networked activities between the departments. Concerning this, a joint effort was mentioned between state school networks to facilitate the organization and the search for virtual learning objects.

”

I think it improved a lot. Before, the portal was informative and, if you talked to the teachers, only a minority would access it, and today we can see by the results. You see 90,000 teachers accessing the portal in a month, to get resources. We achieved a lot in the sense of it being a tool for the teacher to retrieve material, but it's not a guarantee [of use in the classroom]. The board remains a challenge.

(ET, State)

”

We are working actually in partnerships with other states. Today we form a group with São Paulo, Espírito Santo, Goiás and other NGOs and we are launching a system for digital repository, content sharing, and some strategies to publicize the repositories that exist.

(ET, State)

4.3

TV and video channels

TV and videos channels, mainly available on YouTube, stand out for their diversified programming, ranging from videos focused on teacher training, to animations and educational series aimed also at the students. Given the large structure necessary to maintain programming and constant production, these are experiences that have been developed primarily at a state and federal level – of the six municipal departments and six state departments surveyed, only two of the state ones developed channels like this.

TV Escola, TV Anísio Teixeira, TV Paulo Freire are examples of channels available on the network by the MEC, the State Department of Education of Bahia and the State Department of Education of Paraná, respectively, and that provide content regularly.

The TV Escola offers a daily teaching schedule, besides a video library divided into themes, virtual games and other resources targeted at teachers and students.

Figure 6.8: TV Escola

Ministry of Education (MEC)

The programming of the TV Anísio Teixeira from Bahia is one of the contents available on the Educational Web Environment Portal (Portal Ambiente Educacional Web) where it's possible to access virtual learning objects organized by teachers from the school network, authoring tools to assist teachers and students in the production of digital content, and an educational content and programming blog.

The TV channel, a hybrid with availability on the web and public television channel, has as one of its highlights the program "Intervalo", which focuses on the culture of schools, students and teachers from Bahia with educational and locally significant content.

Figure 6.9: TV Paulo Freire

State Department of Education of Bahia

The TV Paulo Freire of the State Education Department of Paraná has, in its videos channel, the narration of excerpts from literary classics, recitation of poems, and biology lab, physics, chemistry and mathematics classes, geared to teachers, but available to all.

It is interesting that the materials produced by the departments have been made available as open educational resources and can potentially, if well publicized, broaden their scope to different regions of the country. Partnerships between educational networks could also be useful to decrease production costs without losing the possibility of authorship, valued by these departments.

4.4 Avatars and online communication

Interaction has been an increasingly present focus in the communication tools of the teaching departments. For this, the creation of blogs and chats, and the use of social networks and avatars have been common practices.

The State Department of Education of Bahia created the “Professor Web” and “Professora Online”, two characters who communicate with network teachers and students through a blog and Facebook with news, cultural tips, discussion of school subject matters or everyday topics, posted by teachers of the network. The Educopédia also has its avatar, which brands the platform’s communications.

Figure 6.10: Avatars of Educopédia and “Professor Web” and “Professora Online”

Municipal Department of Education of Rio de Janeiro and State Department of Education of Bahia

The use of social networks is done by many of the Departments, some with a more institutional and informative profile, others focusing on involvement in and occupation of network spaces for matters related to education. Schools have also made their own pages on social networks to communicate their actions. Membership is still limited if we consider the universe of teachers, but it is a positive shift in communication for these organizations.

Figure 6.11 Profiles of the departments of education on social networks

State Department of Education of Bahia, State Department of Education of Paraná and Municipal Department of Education of Rio de Janeiro

4.5 Gamification in education

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The Angry Bird teaches how to program. He has to say which way he has to go, then he has to do the programming language, forward, backward, turn right, forward ... You're working the game, but you're working the other part which is the teacher's objective. If it depends on the student, it will be just the game; the big goal of the teacher is to use that for a directed issue. (IT, State)

The use of digital games for learning is still very much restricted in Brazilian public education by the initiative of education departments. Although some educational technology teams have awakened to the pedagogical use of these applications, there are few references to them.

It is important to mention, in any case, the teaching department that tried to create their own games, and was faced with the huge challenge of producing original content, customized, and sufficient for the objectives initially set.

In 2011, under the leadership of the educational sector, this department hired a company through a tender to create a portal of educational games based on the network curriculum. The developers of this company installed themselves in department to facilitate dialogue with the coordination of the pedagogical team. After producing some games, despite the excellent reception of the students, the reports of the enormous effort have demonstrated that this was an activity that demanded much more than what the existing teaching staff could take on, particularly in relation to new and on going ideas for exercises, activities and game content. Developers were not skilled enough to take on the demands without coordination. At the same time, the pedagogical department was not prepared to provide content for a continuous programming schedule.

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I would never have enough money, nor staff, or developers to feed that within the limits it needs to be fed with. So I think [the project] was born unfeasible. The opposite, which is what we're trying to do, is to make it possible for that child to develop much simpler games, with less development resources, but the energy he will spend to develop that has an educational function, and it will be much larger than the energy he would have playing. (ET, Municipal)

The new administration interrupted the project and stopped using the applications already produced, considering that the free market competition could better develop this work.

Among the trends evident are the strong reception of students to games, associated with the recreational potential offered, is the

evolution of educational games, to keep the focus on learning without becoming strenuous and unattractive activities.

Another trend is the teaching of programming to children, including game programming, which will be seen later.

4.6 Authoring tools

Highly valued among professionals of educational technology and teachers, tools that allow the production of digital content such as programming platforms, editing digital media, creating objects and applications are a promising trend in the digital content area. Mostly distributed as free software and open educational resources, they meet the aspirations of educators who want to foster creativity, digital production by students, and their appropriation of technologies (MORI 2011, ROSA and DIAS, 2012) rather than skills of reproduction and consumption.

Several municipal and state school systems work with applications that allow content creation by students and teachers, such as videos, presentations, reading activities, geometry, interactive books, etc. Among those programs are the *EdiLim*, *Geogebra*, *Hot Potatoes*, *JClic*, *Luz do Saber* and *Visual Class*, which are explored by educational technology teams during training workshops, and each teacher who wants to use the tool does so individually, according to the subject matter he is working on.

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Some games are a complete crime; they just copy a book electronically. Like a quiz. Students want something to get excited about, provoked, not simply that! Many games are... He wouldn't need to make any more additions and subtractions [mathematics] to complete a level. This could be more veiled.

(Teachers, High)

”

If I compare an educational game with the entertainment the market has to offer, I don't even encourage my boy to play. (ET, Municipal)

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Existing content types [digital] are still behaviorist: stimulus-response. It's not necessary to use technology for that. There is no interaction. The student has to produce content with the teacher. The teacher's team produces, the student complements, all inside a virtuous cycle. You don't have to sell content. You have to market tools for producing content! The best applications that exist are those that allow you to create. They are those for authoring. (IT, Municipal)

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I wouldn't see any problem if there was no free content available because much more than a diagrammed magazine, which would be a tablet with the content that we are giving to teachers, we are giving a magazine making tool. While he is watching an already made video in the tablet, he can make his own video, he can listen to audio and record his own, he can create his image. (IT, State)

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There's no way for a center to represent all the cultural and historical diversity of our region. We believe that by giving autonomy to the subject in authorial production of these media, we can make so that this production is related to the reality of each subject. So, we believe that production should be a result of the training. (IT, State)

The Portuguese language teacher would say she wanted a game to work the initial letters of the name of her children. She makes games on paper [usually], relating the photo to the letter [initial of the child's name]. "Can I do this on the computer with the voice of the children? With photos of the children?" So I go to the boys who are the student-monitors and say: "I want to put together the letter with the voice and the photo of the child [on the computer], can you make a game like that for me?" "We can." "How are we going to do that? Who will take pictures, who will make the recordings in the classroom?" And then they make the game. 15 days later, the game is ready; they call the teacher and show the game to her. They are the developers, the teacher is the client. (ET, Municipal)

Recently people are using the "Luz do Saber", they are creating activities, applying them, checking if, on the website [of our portal], we can insert them, especially because of the 6th grade. They ask us for more resources for their level. (ET, Municipal)

We have some applications on the web, for instance, Geogebra. It's French software developed by the [University of] Texas, and it is a great geometry software, it's fantastic. You start by making geometric figures and there are equations in it, then you can produce, either via equation, or you produce the design and then you see the equation; it is a great software. (ET, State)

Sometimes a simple PowerPoint, for our colleague who works with basic educational computing, is a technological resource. The teachers call him, he makes a PowerPoint, he makes children's stories and takes it to them. It gives the rod and teaches to fish. (ET, Municipal)

The idea is that they take over various curricula related ICTs, to show to the teacher curriculum related use. In this question, we gained a lot. The reading program includes a part related to educational technology. They have to build a fan page to produce, they have to learn how to use the hashtag in productions related to school reading projects ... (TE, State)

Interestingly, office software such as word processors and presentation programs have also been used as authoring tool for educators with different purposes, from creating comic books to games.

All the examples shown here point to a growing demand to exploit the potential of ICTs, going beyond their instrumental use to technological appropriation approaches - a fact that is in line with successful international experiences in creating authoring applications, such as Scratch from MIT (Massachusetts Institute of Technology); programming language blocks for children; and the App Inventor, from the same institution that, through programming blocks, allows the creation of applications for users without in-depth knowledge of the subject.

These tools, when integrated into the curriculum and clearly directed, with goals and possible approaches, can greatly increase the current demand for digital content of the departments, as has already been done with the use of social networks for teaching and teaching-learning purposes.

4.6.1 Game programming

One of the forms of authorship that has gained prominence in the educational environment in many countries is programming. While in the UK this became mandatory in elementary school in 2014, France started offering it as a complementary curriculum right from the first years and, in the United States, laws have been discussed⁸ with a number of actions to encourage programming by young people, either from schools,

⁸ Available on: <<https://www.congress.gov/bill/113th-congress/house-bill/2536>> and <<https://www.congress.gov/bill/113th-congress/senate-bill/1407>>. Last access on: 04/29/2015.

individually, or non-governmental organizations that are leading projects that have quickly disseminated. One example is the Hour of Code, an annually scheduled event, but with online material available throughout the year, which aims at introducing anyone into the programming world. In Brazil, the event was translated as “Hora do Código” (The Hour of Code), and over 900 thousand Brazilians have participated to date.

In Brazil, localized initiatives originating from the education departments, or from individual teachers, are the most common scenario in public education. Some full time high schools (“*escolas integrais*”) have been created focusing on exact sciences, like the new Colégio Estadual Sergio Pessoa in Manaus, or focused on the programming of games, like the Colégio Nave – José Leite Lopes, in Rio de Janeiro, which stand out as public schools focused on this area.

Figure 6.12: Programming course in the Colégio Nave – José Leite Lopes

State Department of Education of Rio de Janeiro

The Scratch programming language has been an ally, even if its use has been limited to a few teachers and the resource is seen as a complementary activity, not integrated into the curriculum.

Figure 6.13: Game programming class at the Public School Prof. Rivadavia Marques Junior

Municipal Secretary of Education of São Paulo

The use of PowerPoint for game production has also been done through the initiative of individual teachers. It is an educational use not expected for this software, and won the recognition of the Microsoft company in the 2013 edition of the Innovative Teachers Award, at its national stage. The teacher Gislane Batista Munhoz leads a team of student monitors, who develop digital game projects to support students in the literacy process.

Figure 6.14: Students monitors and game developers at the Municipal School Prof. Rivadavia Marques Junior

Municipal Department of Education of São Paulo, Municipal School Professor Rivadavia Marques Junior

In the MEC, programming is yet undeveloped. A recent project in this direction is an online programming course for the development of games by the Federal University of Goiás⁹. Its goal is to develop Python programming skills among high school students in the public school network with a 120-hour course load. The platform used for the online course is Proinfo and the interaction with participants does not necessarily pass through the school, since students can access the course using any device with an internet

⁹ Information about the course is available here: <<http://www.labtime.ufg.br/labtime/cgames/index>>. Last accessed on: 12/23/2014.

connection.

The educators who are enthusiasts of including programming in the curriculum have high expectations about the results, because they see students as technology producers and authors of their own projects.

4.6.2 Programming and robotics

Municipal school systems, such as Curitiba, Manaus and São Paulo, and state ones, such as São Paulo, have developed robotics projects at schools and, although incipient, such projects are an emerging trend in the use of technology in schools.

In full-time schools, robotics is already an elective subject. Focusing on the process that involves programming, which is based on concepts of physics and mathematics and on teamwork, teachers and students develop automation projects with the use of educational robotics kits acquired by the education departments. The most frequently mentioned are the Lego kits, Brink Mobil – containing parts that fit together with various combinations – and Arduino – a control board with programmable open source code and with a language of its own. Furthermore, the use of recyclable materials is also mentioned.

The visibility and support to such projects in networks depend, to a large extent on the sensitivity of educational technology coordinators. There are departments that provide courses for teachers to develop the theme, and support participation in championships, promoted by manufacturers of kits or by professional associations from computation areas, for example.

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We have the presentation of some tools that we believe will need a slower and more specific appropriation. One of them is programming language. It is essential to work with this, because it is linked to the subject of authorship. When I learn the language, when I make an appropriation of any language, I become an author and not only the consumer of that product. In the 90s, we used a programming language software called Megalogo, with the famous little turtle, and then it was abandoned on behalf of a much easier and more intuitive interface, and there you start creating generations who learn to relate to the interface, but don't learn how to build an interface. (ET, Municipal)

”

We started a project [for] the boy to use the programming language, and using robotics on a second step, to seek solutions to territorial problems in his neighborhood, to improve the city. He wants to learn how to develop an application. What for? To map the Culture Points there are in the neighborhood. We'll see what programming he needs to do that... Who has ever done programming this way? Where can I find a community where the programming has something similar? And there it goes, through this process... He makes the appropriation of a programming language to solve territorial problems; that is the focus. (ET, Municipal)

”

The language used is Scratch. We form a community, and teachers now have two months to implement the projects with the students, and the community is trained. So, in addition to implementation, to training through reflection and practice, we go inserting some languages. (ET, Municipal)

However, in some cases, the lack of coordination of the departments' projects with their school units ultimately generates detachment and abandonment, leaving it to the teachers themselves to structure and ensure continuity of the projects. These cases lead to situations where some schools have underutilized kits; while other schools that have more structured projects, with administrative support, lack the necessary materials, worn out by extensive use. In addition, the lack of coordination of the Departments can lead to a lack of investment, such as buying more advanced robotics kits that help in strengthening the team's work. These conditions became evident during contact with other teams in regular tournaments. To compete with schools that have given robotics as a priority, many of them private schools, teachers resent the poor conditions they have to develop their work satisfactorily, and also feel undervalued by it.

Among the **features of robotics projects that were minimally structured, and to which had continuity**, we include: the assignment of an exclusive teacher at the school to lead the work, giving him a scouting function so he starts recruiting students to his group; selection of interested students through a knowledge test; creation of teams with regular meetings and a focus on, at least, an annual championship, which serves as a motivation for the practice of activities.

The integration of robotics into the curriculum is also a success factor in projects from other countries.

[...] The lack of institutionalization in robotics courses, which are usually extracurricular, ends up causing many teams to disband in a few years, as they are supported by volunteer work. The integration of the robotics course in the curriculum, helping to create a new curriculum where physics, engineering and art are worked together, in an interdisciplinary way, to cover the strict curriculum requirements of the University of California in the state, is an example of long lasting educational transformation. (WARSCHAUER, 2011, p. 72, our translation)

An interesting aspect that robotics projects report are the more general issues of education, **including the lack of involvement in the classroom, which generates a mutual discouraging stimulus for teachers and students, but gains another meaning in practical, interactive and team activities, like those of robotics.**

One example is a student with low grades in physics that was reported by teachers to be an excellent programmer in a robotics workshop.

Another evident aspect is the **issue of gender**, associated to studies on science and technology, usually associated with boys. It is necessary to encourage female participation in robotics teams to increase their interest and their findings in the area.

Applying the concepts in real projects, with shared goals for the group, with a real motivation to attend an event where you can show your work, it **changes the dynamics of teaching and learning**.

At the School Durival Britto da Silva, of the Municipal Department of Education of Curitiba, teacher Desirée Lopes' staff was awarded in the category of Team Work in the tournament *The First Lego League* in 2014.

Figure 6.15: Desirée Lopes and the work of her team at the Municipal School Colonel Durival Britto e Silva

Municipal Education Department of Curitiba.

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I had a student who was great at programming, better than I, who teaches mathematics! We had a problem and he went home, he studied it, then he came the next day and made a transfer of energy at 90 degrees, for which he needed knowledge of physics. But the Physics teacher said he knew nothing about that [the subject matter]. “But he doesn’t know how to do what?” I asked. “He can’t pass the Science test,” the teacher said. In other words, the school didn’t know how to motivate this student. (Teachers, Middle)

”

More children are coming. It results from that old thing: mechanical engineering, construction, robot, man. In the real league, the big teams are made of men. But in the league we participate in there is the robots launch test. The first [release] was for boys, the second for girls, and the third would be for the best group, and the girls won! And they reached the highest score of our school. (Teacher, Elementary)

”

The taste for it is awakened. You cannot do that in a traditional room. In robotics, they learn to like. They work on that for hours without complaining. While in a 40 minutes class they praise God when the bell rings. (Teacher, Elementary)

”

I’m sure that [robotics students] are no longer students like the others in the classroom. Teachers may not realize it and may think they are just the same as those others that memorize [the subjects] ... (Teacher, Elementary)

”

There is a whole research behind it, hypothetical work: what they would need, what items would be necessary to get to programming itself. This year the challenge was natural disasters. (ET, Municipal)

”

In robotics, there a whole team organization, the programmer, the rapporteur, each student takes on a role. (ET, Municipal)

”

When the boys have the possibility to pick up that little board [of the Arduino programming] and from that board build their computer, and then to edit video with that computer, then yes! The role of schools and the use of technology is that. (ET, Municipal)

”

The schools decide whether they want to create a robotics team. Sometimes it's a specific teacher; sometimes it's an extended time, the opposite shift, sometimes use in the classroom. (ET, Municipal)

”

[Lego] was purchased by the Department in 2006. It was only once and it still exists. In 2010, we had to remove it from the schools; the pieces were disappearing, it was impossible, so we picked it up, reassembled it, distributed it to 117 schools, all elementary schools received it in the first year. (ET, Municipal)

”

Recently, we received from Lego one kit for each school... But, so far, it is not under our responsibility, because it is part of a partner company. (ET, Municipal)

Another interesting aspect in robotics projects is the **role of teachers**, who, along with students, start deciphering the new languages. Their role as guides, organizers, drivers, is more evident than their role as a standard teacher, as they are in the classroom.

Self-esteem in this scenario also increases because of the interaction, the collective sense and feeling of producing something with a clear and worthwhile goal.

The prospects of such dynamics are very promising. And given the involvement of students reported by teachers, and of teachers reported by themselves, those education departments that can go beyond the logic of providing materials and put their focus on well-defined project management will be able to bring very promising results.

Digital content of good quality, and aligned to goals included in an ICT use plan, is a basic resource for implementing a mobile learning policy. Whether produced locally, or purchased in the market, such content gives meaning to the use of equipment in school. The motivation for the use and its suitability can determine the frequency and effectiveness. This is one of the fundamental pillars, which requires strong involvement and participation of the pedagogical sector of the departments.

4.7

Digital content for indigenous education

Figure 6.16: Indigenous Municipal School Kanata T-Ykua

Municipal Department of Education of Manaus

The representation of indigenous peoples in the digital environment is a considerable challenge, which is reflected in the context of education. Recent projects show early efforts to create software in indigenous languages in Mexico, calling attention to the relevance and urgency of the matter (ANDRADE & ZARZA, 2012).

In Brazil, the search to comply with Law 11.645/08¹⁰, which includes in the official curriculum the mandatory theme of "Afro-Brazilian and Indigenous History and Culture" in all the schools of the country, has educational technology mobilized teams on the matter. The State Department of Education of Bahia organized a conference on

¹⁰ Available in: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2008/lei/l11645.htm Last access on the 28th April, 2015.

the subject in 2014, and there is content, classified as “Indigenous History and Content”, on its Web Portal Virtual Environment in order to assist in the inclusion in the curriculum. Such initiatives are still very rare and are faced with the limitation of content on the network, although the demand exists.¹¹

The challenges, in terms of digital content, for indigenous schools to have their own curriculum and follow the resolution of differentiated education (BRAZIL, 2012), are immense and as yet not covered in the departments of education.

In the Municipal Indigenous School Kanata T-Ykua, in the “Três Unidos” Community, an hour and a half by boat from Manaus, Amazonas, the joy and satisfaction of the community of having recently received a fixed computer and internet laboratory with Wi-Fi, combines with the difficulties they face in using it, either due to the lack of symbols in the Kambeba language on the keyboards and tools of the installed programs, or because teachers’ limited knowledge to explore pedagogical tools to address their realities.

A course to learn about the features of the tools and assist in the initial access followed the arrival of equipment, allowing immersion, sometimes for the first time, of people from the community into the digital universe – a fact which has awoken even more people to the subject.

With the availability of the internet, community interaction with mobile technologies has been growing, and it’s part of the local reality the use of laptop by teachers, and the use of mobile phones without a chip to access the Wi-Fi network for children, who eagerly wait for the times when the Internet signal at school is connected.

”
We hadn’t heard the news. When you access, you can see what is happening. What will happen... I found it very interesting (Dona Diamantina)

”
When it arrived, I was even afraid to pick it up. I didn’t know how to handle the mouse, it was hard, you know. Little by little, we get used... It makes you want to know more, to go in... (Professor Arnaldo Bare)

¹¹ Available on: <http://www.educacao.ba.gov.br/culturasindigenas> Last access on the 28th April, 2015.

Faced with this context, it is not just introducing the information and communication technologies (ICTs) in the teaching and learning process, but also to introduce them in the local culture. Words related to ICTs have no match in the Kambeba language, and the common practice in these cases is to make a linguistic loan from the Portuguese.

”

Today, one of the hardest things to do is to prepare a text using these new words in our language. There is no computer in the Kambeba language. How can I think of a word that comes close to the meaning of “computer”?
(Professor Raimundo Kambeba)

In an exercise to understand how “computer” could be translated into the Kambeba language, the words that community representatives were expressing show the beneficial and valuable meaning that technologies have acquired for them: *T-Ykua* (knowledge, learn, learning), *Tauaka* (writing). The account of a writer of the Guarani community, participating in a meeting of indigenous literature at the University of San Carlos, complements and also brings a positive outlook:¹²

“White technology, if we see that it is good, why not use it? White people use our stuff and it never hurt. So we need to know how to take advantage, from both sides” (OLIVER JEKOPE)

Thus, the integration of ICTs in indigenous education faces special challenges, but has also been seen as having great potential for innovation in those efforts to preserve and disseminate their cultures and languages within their own indigenous communities, and increase knowledge of these cultures between other ethnic groups, or by the broader population.

The presence of languages historically depreciated (...) can find a new area of operation and possible survival in cyberspace and in information and communication technologies (ANDRADE & ZARZA, 2012, P. 163)

More than welcome are the projects that focus not only on community access to ICTs, but on its technological appropriation (MORI, 2011; ROSA & DIAS, 2012), encouraging indigenous technology production also in a virtual environment. Projects led by the departments of education to assist on the integration of ICTs that

¹² Available in: <http://g1.globo.com/sp/sao-carlos-regiao/noticia/2013/05/tecnologia-para-divulgar-cultura-do-indigena-e-tema-de-evento-na-ufscar.html> Last access on the 28th April, 2015.

”

There is not one project that integrates technologies with traditional knowledge [indigenous]. So, around here, we teach what we find interesting. I told the [technology teacher] we should work on a project about language and Kambeba culture and technology. We're wondering how this pedagogical project can be worked in school... I'm doing some research to know whether there are other technology projects, how are things. Because the Department itself doesn't give us guidance on how to work this issue. It's new for them as well.

(Professor Raimundo Kambeba)

”

The resource that appears in the Telecentre of [the indigenous school] is the same that appears in the urban area. To the teacher who works there, when he notices some need and he wants to transform, we make all training available for him... But there schools that are really indigenous, they speak their own dialect, it's even scary.

(ET, Municipal)

”

Focused [on indigenous schools], no, we work in a general sense. When I visited [an indigenous school], I showed the activity book that we did at EdiLim, which we did in JClíc. They wanted to change it to indigenous language; those are occasional things... not very focused. We work universally and sometimes one thing or another might appear, for instance **(ET, Municipal)**

recently arrived to the indigenous communities in the pedagogical practice are also sought.

Figure 6.17. Teachers Raimundo Kambeba and Arnaldo Baré and his students at the Municipal Indigenous School Kanata T-Ykua

Municipal Department of Education of Manaus

4.7.1.

Content management and students' privacy

One of the difficulties schools face is the fact that the use of the internet network operated by the government for access to content such as online videos and social networks needs to be filtered. Some networks are experimenting with models to control access from the school itself, with a central unit for content filtering, but even so, that is defined by the IT department and not by teachers.

The issue of the privacy of students with the digital inclusion of schools, and the legal frameworks on the subject, are still little discussed in Brazil. Ministries of Education from other countries show progress in this area, as is the case of the *Privacy Technical Assistance Center* established by the United States Department of Education that launched, in 2014, a document to guide schools and educators in the use of applications based on the Internet.¹³

Interestingly, social organizations that focus on this issue are working in partnership with Education Departments in a scenario where educators and school administrators lack guidelines.

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We have our servers hosted with a government entity that specifically takes care of all the computers in the state. So they create rules for Internet access that are restricted because of the government's network. Then, we are pressing on the network of the department of education, so they don't have the same rules as the government's network, because education, as a rule, it has to be different, so that we can allow schools, even via our link, to have access to educational content. (IT, State)

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Through it, I can analyze what is being browsed or not, I can make a... a lock on certain websites. So I step up to control access, not leaving it specifically in the teacher's hand. (IT, State)

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Within Microsoft, the social network Yammer will arrive, so we are going to make a school social network. Because by the time you say: "Oh, I'll release the social network for all schools", you are exposing the student to the outside world - which is a complicating factor. You cannot expose a minor on the Internet, on a social network. So, if you have a closed social network for education, this is already a step ahead for you. So, we will have to offer that social network, but it's in the Microsoft cloud, restricted to the Department of Education. (IT, State)

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To have autonomy in the use of technology, you have to understand how it's operation works. So we have a very strong work of partnership with an institution called Safernet, and its work is the ethical and safe use of the Internet... They try to raise awareness of those privacy features, of free speech on the use of Internet. (IT, State)

¹³ Available on: <<http://ptac.ed.gov/sites/default/files/Student%20Privacy%20and%20Online%20Educational%20Services%20%28February%202014%29.pdf>> Last access on: 04/29/2015.

CHAPTER 7

HUMAN RESOURCES AND TEACHER TRAINING

1 KEY ISSUES FOR ICT PROFESSIONAL DEVELOPMENT

“In face of something new, do not discard the old just because it is old and do not accept the new just because it is new. Accept what is valid in both of them” (FREIRE, 1979, p. 41) Authors’ translation

Teacher training is the third and vital pillar of a mobile learning policy with the aim of achieving better results in the teaching-learning process with the pedagogical use of ICTs.

It is a very challenging scenario, as there are more than 2 million teachers in the country. According to our research, the current formal requirements to become a basic education teacher don’t match the expectations of the education departments’ technology experts, as far as skills and abilities go. Due to this mismatch, the departments of education have to taken on the responsibility of leveling the teachers’ knowledge for ICT integration projects, in addition to their student teaching duties. **Therefore, continuing education for ICT usage is not a complement to the teacher’s prior training, but a foundational training that all the school networks studied are trying to take on.**

I sometimes joke around with people here, saying that some day they will deliver a helicopter to the school and we will need to rush to train [the teachers about] how they can use this in their disciplines. (ET, State)

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When I was an undergrad, I had a 30 credit hours course about the use of technologies in education. It was fundamentally a theoretical course, a little bit disconnected from practice, from reality really. And the curriculum is still the same. The course was extended from four to five years and has a 30 hours course for working with technology!
(ET, Municipal)

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At the college of education of the federal university, the largest [in the state], there is this subject in the eighth semester - the last semester, when the students are concerned with the course completion, the TCC [course completion study], the internship phase is already gone; and then comes this course called “Communication and Media”, dealing with technology issues in education. We have a very serious problem in initial training and continuing education has made an effort to compensate this fault. [But] we have seen that this training is also not enough. (IT, Municipal)

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If we discuss technology in the initial training, we won't need to invest as much later on. If I leave college with these questions of technology clear, I already can put it into practice. (Federal Government)

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I'm not sure if it is something general, but I have this impression that teacher training is now being valued. It started about three or four years ago. Because, until then, you just gave the tools and created schools. And then time passed gradually and our school labs started to be ceded for other entities. (ET, State)

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There is a serious problem within training, which is the issue of teachers' time, the time they have for training. Our courses are currently being offered outside working hours, its not on-the-job training and teachers need time to have that training. [But] all over Brazil, I think it doesn't happen with only us here, the teachers sometimes work in up to three schools networks: he teaches in state, municipal and also private schools. (IT, Municipal)

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We have this idea that every municipality should have at least one person who knows really well how to operate the equipment and that this person should be able to go there and spread this training with other school employees that received the tablet. (IT, State)

There are many criticisms on the part of the federal and local governments about the **initial training of the teachers**, regarding the degrees lack of a practical orientation, lack of ICT integration in the curriculum, and the lack of attractiveness of pursuing teacher licenses – which is also a product of the working conditions and salaries that are considered low. **In this case, continuing education and on the job training is an attempt to raise the teachers' training level and also serve as a palliative measure for this scenario of teacher licensing programs.**

Providing every teacher with ICT usage training is a goal that demands high investment and substantial structures directed at this objective – factors that are currently absent within every education department surveyed. Likewise, conciliating teachers training with their long workdays is a challenge in the current training model, especially when in-person.

If providing courses for working students is considered a fundamental condition to attend to mobile learning projects from the departments of education and to modify the current teaching-learning process with ICT usage – as indicated by experts interviewed in the course of this study – it becomes necessary to rethink the currently training practices to reach such goals.

It is also necessary to think about the requirements and selection methods to enter the school networks – a topic that is currently underexplored. If entering public service is the only step whereof, controllable by the departments of education that can issue to the universities their scholastic expectations regarding the current needs of the schools, this subject must not be neglected and could bring many themes to discuss the teachers role in the current times.

Box 7.1. The reach challenge

Experts from the MEC report that there were about 700,000 enrolments on ICT focused distance-learning courses within five years. Considering that Brazil has about 2 million teachers and that a teacher may have taken more than one course and, therefore, made more than one enrolment, it can be concluded that these figures are very far from those of universal access.

This challenge is also very evident within local governments. One of the smallest schools networks visited, comprised of about 9,000 teachers, 1,200 of which participated in courses or had individual counsel for ICT usage with regular visits to schools. Based on this scenario, we could conclude that 7 more years would be necessary to reach every teacher within that particular department of education.

Furthermore, training by itself would hardly translate into the use of school devices. A World Bank study found that Brazilian teachers spend only 2 % of their classroom time using ICTs as a pedagogical resource (BRUNS & LUQUE, 2014) .

In addition to the challenges already discussed, training for ICT usage is also affected by the **question of gender**. About 1,6 million of the elementary school teachers are female, a gender historically underrepresented in science and technology¹, that is currently being pressed to use technology in professional contexts in front of various youths within a classroom. As we will see in chapter 8, there are marked feelings of insecurity and inferiority among some teachers.

In addition to these pressing challenges, there is **the manner by which those new digital tools have been delivered to schools**. As shown before, the devices arrive at the schools before the trainings. As the experts from the education departments believe that many teachers do not have basic knowledge of technologies, they also believe that every new device requires new training, multiplying the workload of education departments.

This perspective presented above is based on the principle the teachers are never prepared for new technologies. This perception is grounded in the fact that the equipment reaches the schools and they are updated by the government over time, without effective pedagogical use of ICTs. This is the reason why the computer labs of the 1990s have not been fully integrated into pedagogical practices and are now side-to-side with mobile technologies, which generate new demands.

It is important to highlight that the structure of trainings focused on equipment have few prospects for sustaining in the long term, since the tendency that we find in the school networks are for there to be increasingly more device options in the reach of teachers. Furthermore, sometimes due to financial issues and some other times

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We had an emerging demand because all the teachers received the tablet. We needed to work on tablet training. We already had a training for this path; we needed to restore this training, and, urgently, train all that got a tablet. That's the reason we're now talking about the mobility course. (ET, State)

¹ According to the 2010 Census, among the science and technology professions in Brazil, women comprise only 27% of graduates in computer science, 27% of those trained in physics and 23% of engineering graduates. The under-representation of women in this universe tends to have probable origins in the social construction of gender expressed in practices and norms that start as early as childhood. As Orenstein (1995) shows us, in a qualitative study conducted in the state of North Carolina, there is a widespread stereotype starting as early as adolescence, for both sexes, that men are better able to learn math and science than women - a fact that tends to constrain the future career choices of youths.

due to implementation strategies, only part of the schools receive certain devices. The scenario, therefore, is very heterogeneous.

In this scenario, a focus on **the teacher's technological autonomy – or the development of their digital learning** (ROSA & DIAS, 2012) – is the most effective way in the medium and long terms to consolidate ICT appropriation within the school universe, no matter what devices are being used and the speed by which the technologies are updated.

Furthermore, there is a need for sensibility to understand that learning, and different forms of digital inclusion, happen in context. As will be discussed in Chapter 8, most of the surveyed teachers use communication tools and social network apps very often. The **ease of use and usefulness in everyday life** have been key factors in increasing the adoption rate of these technologies. In this sense, **training courses that detach ICT usage from the improvement of the teaching-learning process and their benefits to the work of teachers contribute little to change this scenario.**

The greater usability of current devices in association with the availability of educational platforms with clear applicability to the curriculum, are also fundamental aspects for favoring appropriation by the teachers.

The siloing of ICT training courses is another high impact factor on the results of continuing education that imposes a barrier to further progress. Independently, there are training schools or training teams with pedagogical and disciplinary focus. On the other side, there are the educational technology teams, typically in another department, with a smaller staff, that are responsible for the ICT training courses. It is a divided model, which perpetuates the structure created for the school computerization carried out by ProInfo, by which ICT usage training became a responsibility of the NTEs. This structure was developed separately from the existing teacher training structures, generating two kinds of trainers: the technology trainers *versus* the disciplinary trainers, which don't necessarily incorporate ICTs in their courses.

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There are 100 schools under Aprende Brasil (Learn Brazil) system, with smart boards and tablets. The other schools have the ProInfo projector whiteboard and, which we have to sit and stud, since its open software based, gradually trying to meet the training needs within our department of education.
(ET, Municipal)

”

An attempt I witnessed, involved teaching how to use the tablet with the projector, another available resource. That was something being done, but it was too little. Training [to use the tablets] was not given. This training, actually, was provided to the staff of the departments of education, but saying that it was a resource “that you can pass on to your teachers”.
(ET, State)

”

At the training schools, they have the digital whiteboards, all these. So the idea was to form teacher groups and train them on this new technology. So when the technology arrives, they would already be trained. Several teachers have already gone through the training school. (IT, State)

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The physical technology comes before the training itself. We think of the equipment to then think of the training. This happened to the ProInfo computer lab... The laboratory always comes before, the tablet arrives before, the digital board before, without thinking of the training, a training structure to meet this demand was not thought of, and you are always running after what is already at the school (IT, State)

”

We have a minimal training covering technical usage, but it's not associated with the most important, which are the school's results; in what way will this improve the students' performance. That would be a step forward. For this to happen, we would need integration [between the technical and pedagogical], which we don't have yet. (Administration, State)

This model perpetuates a dichotomy between ICT and education: if they are not together during planning or trainings, how can they be unified in the schools and in the classrooms? Further, given that the NTEs have limited structures and very low numbers of ICT trainers, the current training model makes it very difficult to develop more effective mobile learning policies.

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The teacher in the classroom, he has too many task, he does not have time for various task...To be able to put those tools to use that you know, you have to have time to plan, to draft, to be able to prepare the material, and this time most do not have. If you check, most teachers in our sector currently have a 60 hours workload, that is, this teacher gets home tired. He gets home and barely has time to see the family. What time do they have to plan? What time do they have to prepare their material, to research material? (ET, State)

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It is very complicated to be able to do an in-person training. Alas, at the beginning of our projects, we proposed 80, 100, 120 training hours for the teachers, which is impossible to do, because they are unable to get out of the classroom or the municipal government cannot get them to do this outside their working hours, because they don't pay for extra time. So, we had to reduce the training load to 20 hours. That's why this pedagogical monitoring at schools is so important, which is the in-person and on the job training, to compensate for what we can't do during the training courses. (Organizations)

”

I'm not even the least bit concerned about 100% of our network wanting to use digital technologies. Principally because you have an age group that is retiring. In ten years from now, one third of our teachers will be practically retired and replaced by young people who speak the language of technology (Administration, State)

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Our schools now have a lot of new people. The younger people are already more familiar. So, this facilitates and there are people that already work well with technology. (Administration, Municipal)

”

The next generation of teachers, in my humble opinion, will already have mastered this. I mean, in about 10 years from now; the old teachers, like me, will retire in about 5 or 8 years. (IT, State)

1.1 The day-to-day barriers

The **teachers workload** is one of the factors that most hinders training actions, leading the individuals responsible to create alternative designs to keep the training actions viable.

Some understand the lack of adherence to ICTs shown by some teachers as a **generational factor**, which tends to be reduced as new teachers join the school networks.

However, although age can facilitate to some extent the teachers' digital inclusion and their ability to use technologies, as will be discussed in Chapter 8, once they master the digital tools, age is not a determining factor in mobilizing the teachers to use ICTs pedagogically in their practices. **The mastering of new technologies by the teachers, even though it tends to facilitate the incorporation of**

ICTs into pedagogical actions, does not guarantee effective integration within the teaching-learning process. The challenge faced by departments of education, of integrating technologies pedagogically, thus, is not likely to be solved with the generational shift of teachers.

There is a need to **make the process easier for the teacher, make the use of digital technologies at schools practical and clearly define what he is expected of them**, with clear plans and strategies. In Uruguay, Plan Ceibal establishes that the technologies used at schools should be as simple and intuitive as possible to assure minimum training on tools so that the focus can be pedagogical. **Just like one learns how to use Facebook, WhatsApp and cellular phones by doing, should be the process for learning digital education resources.**

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Even the interface, we try to copy Facebook for various reasons. First, there is no need to spend on training for them to navigate their new tool – we believe that at least their child that knows how to navigate and will teach them. So, even if he has no great knowledge of Face[book], you’ve already eliminated the question of knowing how to navigate. The other is that we researched beforehand and the vast majority of them use Facebook in their day-to-day. If we put a similar tool in their hands, to deal with professional purposes, where he can log on and search something for the lesson he wants, he gets the lesson and will use that lesson. In sum, if you create this daily routine, if he tries it, he will at least be able to say if he likes it or not. (ET, State)

Figure 7.1. Plan Ceibal course page

Source: Plan Ceibal, Uruguay

2

TEACHER TRAINING CARRIED OUT BY THE DEPARTMENTS OF EDUCATION

We have 12,000 professionals; most of them have been working for 15, 18 or 20 years in their fields. So you have a group that already has this expertise, but there is another group that never had access. It's with them that you have to think of a training with a certain depth different the other group that already has this experience. So then you come up with other more in-depth courses to reach that point, to reach everyone with video classes and everything. (Administration, Municipal)

What we observe today and that is a reality in our schools – and also in many other Brazilian schools – [is that] there is a portion of teachers that have no basic understanding, and that before going to digital content use, need to master the previous content. (Administration, State)

Among the Integrated ProInfo's training courses we have this introductory course on digital education. This course starts with the Office package and involves email creation, email sending, blog creation, knowledge on hypermedia, hypertext, education portals... (ET, State)

We generally participate [in trainings] because they don't always know everything that could be taught during their training. As part of the [tablets] project is large training for teachers and, within the basic process created by us from the technical staff, we also have a plan to cover multiplier-training agents for tablet operationalization. (IT, State)

In most schools networks, the ICT training courses are targeted at two different knowledge levels. The first one are for those that need basic computer training, while the second is for those that already have some mastery of the tools and need encouragement to make a pedagogical use of technologies. This basic training involves not only software usage, but also hardware usage, like connecting mobile devices to a TV set, computer, etc. These are '**tool-oriented**' courses. The ICT use pedagogical training involves the identification of available digital tools to facilitate learning with a focus on specific disciplines. Those are courses '**oriented towards pedagogical practice**'.

The IT industry is also credited for tool-oriented training, also called 'technical' training, in some schools networks.

A critical approach to the technologies, influenced by the integrated ProInfo's courses, was also identified in the training courses of some education departments. If, on one hand, this is a positive aspect because it inserts the technologies into a wider social understanding scenario; on the other hand, it involves an attempt to overcome the difficulties some teachers have to get closer to ICTs, by parting from a familiar territory–critical analysis–without encouraging, however, the integration of those tools in their daily tasks and in the last instance ignoring the teacher's learning possibility. **Depending on the tenor of the approach and how negative it might sound, the effect can be adverse: it might distance the teachers instead of getting them closer, increasing the apprehensions that are common among them instead of stimulating their curiosity.**

In all scenarios, the training provided by the departments of education follow very traditional formats and, in a few exceptions, have approaches focusing on transforming the teaching methods, seeking to not reproduce extant pedagogical practices and are attentive to the learning results. The exceptions are mainly due to the insertion of authoring tools, robotics and programming tools², and the use of mobile technologies to produce audiovisual material and stimulate the students' technological appropriation.

Consequently, the best result one could expect from the application of all those training models is **ICT usage**, regardless of the results or approaches. When educational technology administrators, pedagogical coordinators, school principals and technology usage enthusiasts come to be satisfied with ICT usage by itself, there is a problem of focus, which tends to emphasize the process rather than the learning results— an undesirable situation, as it is incompatible with the concept of mobile learning concept articulated within this study.³

2.1

The need to overcome the segregated model of teacher training for ICTs

The limit of ICT inclusion in the teacher-training curriculum has been a course geared to technologies. In the school systems that new teachers undergo an initial training at their training schools, for example, there is the inclusion of a module focused on digital

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You want them to leave the class knowing how to operate the computer and he is not able to. And how are they going to be able to bring it to the classroom? How will they bring their students here if they are unable to work? So, that's why we have been doing this awareness-raising work. 'Teacher, you don't need to master this machine. And one more thing: the student will surely know how to operate that machine better than you, but [the student] doesn't know how to use it. That's why we he needs guidance, because the school doesn't provide this orientations, their families also won't do it and they will turn to the lan houses.' (IT, Municipal)

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We understand that it is very important factor to encourage cooperation among them, as the youngsters technically know how to operate the device and the teachers are aware they will work with the youth, which goes way beyond the technical stuff. How could we align those two types of knowledge? The teachers can work with technology without knowing anything about technology, the teacher can contribute with the students when its time to do research, showing how to distinguish a reliable source. When communicating with someone, what would be more ethical and safe during communication; personal production, comprehension and reading the reality. (ET, State)

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We see that, unfortunately, some schools just use, instead of the chalk and the blackboard, the projector and PowerPoint presentations. That's alright, there is a gain in efficiency for the teachers as they won't need to write everything down on the blackboard all the time, but that's not the potential of new technologies. When the schools realize this and are able to offer a pedagogical usage proposal, then there's a union. (Administration, State)

² See references to these resources in Chapter 6.

³ In one of the schools we visited, the pedagogical coordinator asked the teacher to give a class using the computer lab because a researcher would visit them. We observed the class and at the end of the day, the coordinator thanked us for coming. He was very happy that he had managed to make that teacher use the laboratory, available for years, but never used. For the coordinator, who did not follow the class, the use of space had value in itself, regardless of the practical effectiveness. The focus on the process supersedes, here, the focus on results, and this has been a recurring approach in different contexts.

When a teacher enters a municipal system in Rio de Janeiro, he takes a course at the [training] school. This course has several modules, ranging from how to do evaluation in the school system, literacy, and even the use of technologies in the municipal network. Every incoming teacher had to attend this course, and that's something that has been happening since about 10 years ago, I don't know the date for sure, but every incoming teacher took the educational technology course. (ET, Municipal)

We also have the distance learning courses, curriculum courses and current issues courses, environmental educations, school brigade, which are the needs of the school... and we also have specific courses targeting technology. (ET, State)

There was segregation. The training area became structured by a superintendency of personnel development. The part of curriculum and educational technology was delegated to the pedagogical superintendency. Each sector took care of their own trainings... that's actually a somewhat schizophrenic structure. The people management part took on a much more operational profile. It's all about people training... they don't think about the training contents, they only carry out the demands. For example, if we [from the educational technology] want a training to use the portal, we demand it and they provide it. (ET, State)

inclusion. At the federal level, the ProInfo Integrado (Integrated ProInfo) is an important resource at the federal level in this field, as it features basic courses focused on the digital inclusion of teachers. It is a model in which ICTs plays a certain role, but as a subject apart from curricular formation.

A fundamental dimension that is lost in using this segmented model is the simultaneity between digital technologies – as a language and communication tool – and traditional languages. Just as it is not necessary to teach Portuguese to a child before introducing her to digital technologies—as those languages are nowadays learned in parallel—there is no need to teach Portuguese to an adult or train them in any other subject to introduce them to digital technologies.⁴ There is a linked simultaneity that could even synergize certain learning potentials, a result different to that one could expect from the addition of a new subject.

Box 7.2: Brazilian Civil Rights Framework for the Internet

The Marco Civil da Internet (Law No. 12,965 of 2014), Brazilian Civil Rights Framework for the Internet, defines the rights and duties of users and companies operating internet services. Despite being highly regarded for its pioneering role in regulating the internet – and for this reason it is widely discussed in internet governance– this framework also addresses the need for technology education, in its Article 26 it affirms:

“The compliance with the constitutional duty to provide education at all teaching levels includes providing training, integrated with other educational practices, for safe, conscientious and responsible internet use as a tool to exercise citizenship, promote culture and foster technological development.”

⁴ The Teenager and Adult Education Courses (EJA) that follow this perspective and can inspire training activities are the “Luz do Saber” (Light of Knowledge), of the government of Ceará (available at: [http://institutoparamitas.org.br/web/noticias.php?id=5704](http://eja.luzdosaber.seduc.ce.gov.br/luzdosabereja/software/</p></p>Last accessed on 25th May, 2015) and the experience of the Paramitas Institute in the municipality of Santo André, São Paulo which description can be read at: <a href=) Last access on 25th March, 2015.

It is interesting to note that this Article does not require a teaching subject in which “conscientious and responsible internet use” is practiced. This could be a theme for interdisciplinary studies in sociological subjects, for instance, if the teacher training approach prepares them for such an enterprise. Nevertheless, companies and the press understood that this Article defines a subject¹. However, according to the discussion raised here, a subject crafted exclusively for that purpose would probably require an exclusive teacher and would further segregate technologies in the school environment.

¹ Interpretation of the need for a Digital Education subject matter can be read at: <http://www1.folha.uol.com.br/educacao/2015/05/1624829-escolas-desconhecem-lei-que-determina-ensino-de-educacao-digital.shtml> Last access on the 31st May, 2015.

Some municipalities and states are trying to break the trend towards a segregated approach to technologies, integrating them within courses of the teacher training curriculum, trespassing disciplinary boundaries. For this, it has been important to:

- » Have a pedagogical director for elementary and high school education that has a consistent view on ICT integration in the teaching-learning process, takes leadership in this process and plays a mediating role among the areas
- » Have an educational technology nucleus that is capable to dialog with other sectors, playing the role of a means-department that gives support to the other areas or that uses the structures of other areas to develop its own activities.

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Here we have a training center responsible for provide training the municipal network, except technology, that technology stays with the NTE. But, the NTE has links with the pedagogical department, the training center is also a part of the pedagogical department and we have this relation. Today, we managed that this group from the training center works with all the training areas carried out within the network, from early childhood education to youth and adults education... each training course specific to a certain topic, we are able, inside, some course hours to talk about technology. (IT, Municipal)

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We are reviewing our processes... we are currently in that time in which we call the curriculum departments. They gather for the technology training process, but, in Paraná, they were separated; so, here is technology and here is the curriculum. So, one goes up to a certain point, I go and then you go. [For example], I have the math course and the technology course; I do not have a math course with technology. (ET, State)

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I would say that the relationship [with the training school] could be much better, more structured, because, sometimes, it depends a lot on issues of a personal nature. It would help a lot if it were more structured. For example, every training that these programs are going to do, if they had something about media technology... For each situation, they have to find such a space for, and that is a bit tiresome and stressful. But this is becoming more and more organic. So, nowadays, for every training or event [of the training school], we are invited to participate, and are represented by some of our teachers. (ET, State)

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Accessing the internet and Google, he [the teacher] knows, but we have to guide that usage. The use didn't progress, because the courses had no relation with their practices, but now they do. Nowadays, he will have to create a project to apply in his classroom. He applies it and then writes a report about it. Then they complete the course, because he has to experiment with this training that he is receiving. In the past, everything was very comfortable, because they only needed to go there, watch, comply with everything, and get their certificates, and that's it. (ET, State)

In mobile learning policies, there is a need for mobile courses that are not necessarily ICT courses but are directed towards pedagogical processes, that explore digital technologies as a language, and that transcend the curricular structure of the school networks as well as explore their potentialities as transformative tools of the teaching-learning environment.

The approach that education technology coordinators expect to find in the classroom, with the resources currently available at schools, is also the same approach that should be delivered during the teacher trainings: understanding digital technologies as a language, focusing on the teachers and not the tools; with a practical approach, aimed at uses that make their work easier and build up a class experience on par with the possibilities that are currently being made available.

2.2 The ProInfo Integrado support

ProInfo Integrado is the federal government's ICT training program that provides courses like Introduction to Digital Education – targeted at the digital inclusion of teachers –, Education Technologies and Learning Networks – targeted at supporting the teachers to use digital technologies in their profession – and Project Development for ICT use in schools.

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Federal government funding [for producing education platforms] exists, but this relationship is still somewhat distant. Perhaps the MEC hasn't enough sensitivity to look and see that, like [our platform] is an open educational resource, they could transform it into a national platform so that each state, each municipality, could customize.

(ET, Municipal)

Some departments of education base their teacher training plans on *ProInfo Integrado*, while others complement that plan with new courses and tutorials. It is an important support for the schools, even though its options are limited.

Suggestions emerge for the program to dialog more with local experiences and socialize successful cases from the state and municipalities with other schools networks.

Box 7.3: “Education in Digital Culture” course

The MEC’s “Education in Digital Culture”¹ course is an innovative ProInfo Integrado action created to meet that need to train elementary school teachers on the pedagogical usage of digital information and communication technologies, with focus on integrating them into the school curriculum. This online course, developed through a partnership between the MEC and Federal University of Santa Catarina, was piloted in 2014 and launched in 2015, and has a 360 credit hours load and a duration of 1 and a half years. Among its innovations is this collective matriculation requirement by education unit or department of education, in an attempt to form groups of teachers and school managers instead of individual teachers, which would have limited capacity to transform everyday school practices. Another thing that draws attention is the collaborative content creation, which includes co-authorship between professors and elementary school teachers, as well as a dynamic design, with vast usage of digital media, to stimulate the teaching-learning process. Another relevant aspect is related to this attempt to work with the school practices of the course takers, via the creation of groups to discuss topics that range from the integration of digital technologies into curriculum, to discipline specific aspects of integration, allowing the course taker to direct the course to their own teaching field (Portuguese, Arts, etc.).

According to federal government representatives, the demand for this course has been high. The material is made available to everybody on the internet, but the matriculation for receipt of certificates from federal universities has limits on enrolments. Given the large universe of teachers in Brazil, the accessibility of this course is a challenge.

¹ Available in: <http://educacaonaculturaldigital.mec.gov.br/> Last access on the June 3, 2015.

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In the PDDE Interativo (Interactive PDDE), the platform by which teachers request their enrolments, the course on Education for Digital Culture received more than 50 thousand enrolments for the next year [2015]. It was the second most sought after course. It will take a lot of time to meet this demand, as our budget is a limiting factor. Of those 50 thousand, I might only be able to provide it for 8, 10 thousand in 2015. That doesn't mean that states and municipalities shouldn't invest in teacher training as well. (Federal Government)

2.3

Partnerships with universities

At the federal level, the federal universities are major partners of the MEC in designing professional development courses. Some departments of education replicate this model, partnering with federal and state universities to ensure a better theoretical basis for their training activities and increase their institutional capacity for execution.

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I'll give you an example: when a state public university wants to promote a technology course, they have to send the project for us to check and approve... then we get a lot of unrealistic projects that don't answer the needs of elementary education, nor those of the education department. As long as universities keep seeing us solely as an object of research, we will continue to suffer a lot. (IT, State)

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I think we need a more theoretical understanding to develop this work we are proposing. So we get very close to the state and federal universities with an education and technology group, communications and virtual communities... As we have difficulties to develop some actions due to bureaucratic procedures, we are able to do things freely in partnership with them and their friends (ET, Municipal)

Something that also deserves highlights are the innovative actions that involve university professors acting as mentors of implementation projects of teacher-researchers in their own schools networks – as happens in the Curitiba Municipal Department of Education (see box 7.4).

However, criticisms exist of the approaches and course proposals of some universities, under the argument of a disconnection between the education department needs and academic interests.

In any case, this collaboration between schools networks and universities, for reflecting on and reforming teacher training curriculum, collaboratively, within the next years point to good possibilities.

3

TEACHER TRAINING CARRIED OUT BY COMPANIES AND SOCIAL ORGANIZATIONS

The teacher training offering from private companies and social organizations has been increasing in Brazil. Each institution prepares their own diagnosis, based on the literature, for the projects they coordinate and their own platforms. They aim to innovate and, in addition to their efforts to keep up with the trends, their more flexible structures and the smaller scope of the projects they develop have favored successful attempts to introduce new approaches in the area.

One such example is the hybrid teaching (or blended learning) model where the student learning part of the content online, with time, location and rate controls, and another part in-classroom with in-person teaching. In a partnership between Instituto Península and Fundação Lemann, a course was designed based on experiences and practices with the aims of training teachers to personalize teaching, with planning and management that focuses on mapping student needs⁵. On demand trainings are also cited as an alternative to pragmatically tackle the problems faced, focusing not only in the teaching content, but also on administration.

In addition to new approaches, the teacher training strategies used by businesses and social organizations resemble the tools used by the departments of education: in-classroom training, distance training and local pedagogical advisement. Positivo, one of these

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Our trainings are very antiquated. For example, how to turn on the computer, Word and Excel... But training for blended learning, as I imagine it should be like nowadays...[there isn't]. We don't teach anybody to incorporate those technologies in their day-to-day lives.

(Organizations)

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We try to work in partnership [with the education departments]. The education coordinator says, "Look, I'm having training difficulties." But what are you training for, actually? Is it for digital training or for Portuguese and Mathematics? So let's design a training for you. "Look, I'm having difficulties because people can't get organized." We work for projects, trying to help solve them... there is no pre-established menu, there is no portfolio.

(Organizations)

⁵ Available at: <http://www3.veduca.com.br/cursos/extensao/ensino-hibrido-personalizacao-e-tecnologia-na-educacao> Last access on the May 31, 2015.

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We do it, during the contracted period, we create some projects [in which] a monitor stays in the school. This pedagogical monitor goes with the teacher to orient the planning of activities for students with technologies. The teacher would say, “I’m working with the addition of fractions here.” So the [monitor] checks what are the learning objects for the addition of fractions [and] plans together with the teacher. When the pedagogical monitor period ends, the usage falls drastically, even if there is still access to them... they end up using way less because they don’t have this support. (Organizations)

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We did a project with the Ministry of Education within a [small] municipality that had a very low IDEB score of 2,8. So we implemented it in every school, built all the infrastructure, installed all the equipment, trained the teachers, left the pedagogical monitor there and then the teacher didn’t plan their classes. In the beginning, the teachers’ enthusiasm was great, but after a month, everybody was complaining. This graph shows that it fell drastically. But why? Because it gave too much work. They would need to plan the class, otherwise they would be unable to use technology [with 40 students in class] This is fundamental. (Organizations)

companies, also uses their university and gives extension course certificates to the participating teachers/professors.

It is quite evident to these companies **how important it is to carry out *in loco* monitoring of teachers to demystify the available resources and demonstrate the benefits of available resources**. They are emphatic in affirming that the tracking of access to their tools shows that use diminishes when the local advisory period ends. Among the reasons, is the help their teams provide in planning – one of the greatest challenges to the teachers, which already have their lessons ready from previous cohorts, and also have long working hours and have limited digital literacy.

Managing to stimulate and disseminate among the teachers class planning, permeated by the technological resources available, is a main focus of the trainings provided by these companies.

4

THE TPACK MODEL AND A DIFFERENT TRAINING PROPOSAL

Studies focused on teacher training for ICT usage emphasize that technologies should be considered in an integrated way, as part of a complex knowledge arrangement which the teachers are expected to master. If ICT usage in classroom should be based on their integration

with other contents as a point of departure, the professional training within education should also be guided by the same approach – interaction rather than segregating technological knowledge. Mishra & Koehler (2006) criticize the fact that technology is often seen as a separate type of knowledge and skills, side-lining these in relation to the teaching, content and pedagogy.

Technological Pedagogical Content Knowledge (TPACK) is a model whose objective is to elucidate the diverse types of knowledge needed by teachers and their interrelations that enable the integration of ICTs in the teaching processes, highlighting the connections, interactions, possibilities and limitations among content, pedagogics and technology.

[TPACK is] an emergent form of knowledge that...is different from knowledge of a disciplinary or technology expert and also from the general pedagogical knowledge shared by teachers across disciplines. (MISHRA & KOEHLER, 2006, p. 1028-1029)

Figure 7.2: TPACK Model

Source: Reprinted with tpack.org permission

'Content knowledge' refers to the teachers' knowledge on the subject being taught and learned. 'Pedagogical knowledge,' refers to the knowledge about methods or processes and practices related to teaching and learning. 'Technical knowledge', in turn, is the knowledge of ways to think about technology, tools and resources and work with them. TPACK arises from the overlap and intersection of all these types of knowledge, and requires:

...requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. (MISHRA & KOEHLER, 2006, pp. 1029)

This model inspires other authors to understand that the function of teacher in this new scenario, is not limited too being a guide, but someone who has the capacity to instruct students in more complex activities by making good use of technologies, like, for example, collecting, analyzing, interpreting and discussing data before the students do their online activities (WARSCHAUER, 2011)

In this context, the tool-oriented training courses have little transformative potential, by virtue of being out of context and limited, requiring more comprehensive approaches towards teaching practice in all its dimensions.

Warschauer (2011) presents five teacher training strategies:

1. Engaging teachers through cross-articulating technology, pedagogy and content, as proposed by TPACK
2. Engaging teachers in projects involving research: finding and analyzing information, solving problems, evaluating and

reviewing results, sharing, publishing insights. It is a practical learning process that is in line with using digital technologies as a language.

‘During their professional development, it’s very important for the teachers to be immersed in project-based research processes to understand how to develop the skills group involving facilitation, coaching, improvisation and consulting. Similarly, the teachers need to get engaged in authentic intellectual work to reach the diverse multi-layered facets involved in creating comparable learning conditions within their students’ (WARSCHAUER, 2011, p. 245)

3. Engaging teachers in a new set of global skills, including those known as the skills of the 21st century that we previously discussed in this report and that are extremely useful.
4. Engaging teachers in evaluations based on classroom performance, rather than solely standardized tests. On this point, we understand that non-cognitive skills – such as self-control, motivation, organization and teamwork – which become evident in class activities and cannot be measured via standardized tests, are part of this scenario that teachers should be attentive to when using ICTs in their activities.
5. Engaging teachers in professional learning networks and communities. Warschauer (2011) mentions that the best schools in which laptops are used among those analyzed within his research have structures in which the teachers have the chance to collaborate and meet frequently.

The issues addressed herein are intended to help support or new ways develop teacher training. But it is important to discuss some highlighted experiences already underway in Brazil.

Box 7.4: Best practices in teacher education: research as a training pillar

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You see a noticeable change in the teacher's attitude, unlike a single course or a single workshop. Because he is also getting some foundations too. It has a theoretical foundation. They understand what research is and begin to think a little bit more about their practice. (ET, Municipal)

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There is the mentoring professor, there is the tutor, but there is also the study, the research and the production of scientific papers– which is a demand we already noticed, that the teachers want more. And we want them to learn to publish scientific articles, to search for knowledge through research... And this, certainly also impacts the way he is going to select content to be used in the classroom, so that this transforms, later, in something deeper, turns into an educational practice. (Administration, Municipal)

Edupesquisa is a distance learning and continued education project from the Curitiba Municipal Education Department, which invests in teachers as researchers. Through a partnership with the Federal University of Paraná, teachers respond to a call for projects, selecting one of the existing lines of research. Their objective, if selected, is to participate in an online course and some in-person lessons; conduct a study in the school system, under a professor's mentorship; and produce a scientific paper that may be published a journal created for the project. During the nine months of the project, the teacher receives a fellowship to support their participation. Among the 500 individuals enrolled in the courses available in 2013, 171 enrolled in digital technology courses.

In parallel, the EduTecnologia program also has a YouTube channel with tutorial videos, most of them with less than 5 minutes in length, in which teachers gives tips of applications that can be used in the classroom, explain how to edit videos, how to use apps in the cloud, ways to connect hardware. Videos that explain how to connect a tablet to a projector or TV and how to transform a mobile phone into a digital board were accessed a lot; they had 20 thousand and 7 thousand views, respectively.

Figure 7.3: EduTecnologia's YouTube Channel

Source: Curitiba Municipal Department of Education

In the Rio de Janeiro State Department of Education, Colégio Estadual José Leite Lopes, also known as the NAVE school – Núcleo Avançado em Educação (Advanced Education Center), aims to develop a teacher training model that solves the challenges of their innovative project. This full time high school has three technical courses: Roadmap for Digital Media, Multimedia and Games Programming. Based on a partnership with Oi Futuro, the school has other intermediary partners specialized in courses content development, including the organizations C.E.S.A.R., Planetapontocom and Vision Lab, the latter from the Pontifícia Universidade Católica do Rio de Janeiro.

This school, which achieved best score on the ENEM in 2013 and 2014, has a high competition in their “Vestibulinho”, the entrance test, with almost 30 applicants for each spot, where 90% of the students must come from other public schools.

As for the structure, all the classrooms have a projector, a whiteboard, a digital board, a TV set, speakers, DVD player and internet. It also has 5 laboratories scattered through the building and each of them has 23 computers. At the end of 2013, the State government gave tablets to 115 students. The teachers also received tablets acquired via the federal government. “The teachers have to be prepared to reinvent their practices”, says Principal Ana Paula Bessa, who has been at the school for over 6 years.

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We created a challenge where the teachers had to revisit the entire content [of the curriculum] create the integrations. It first goes like this: what do you wish the 1st grade had acquired. Then we open a Google Doc for the teacher to start fitting and even to see their colleague's content; see if the colleague is making some integrations... (Ana Paula Bessa)

The school model was conceived with the intention of being disseminated to other schools. A strategy in support of this was to make the teacher also a researcher, that thinks about this dissemination. The staff is comprised of about 60 teachers and, in addition to those hired by the department, there are those hired through partner organizations that act as instructors for the more technical disciplines of each course of study.

There are 10 class periods (“times”) from 7 AM to 5 PM. For every 18 periods the teachers spend in the classroom, 4 are for research. They are required to work exclusively for the school and get an R\$ 1,800 bonus to their wages. “The teachers know that they have to work hard around here. They must have a differentiated perspective,” says the principal.

The teachers meet every Thursday to discuss their practices. One of the results obtained by the group is thinking about integrated curricular proposals that feature interdisciplinarity and at the same time takes advantage of each teacher's expertise. For example, they come up with a topic – such as mathematical equations– and create a map that makes it possible to connect that topic with other subjects. In physical education, equations can help in calculating BMI [body mass index]...In the visual narratives subject, the equation may serve as a basis to think of an image; in programming, the equation could be used to write a code.

This model has evolved into an integrated planning that involves the minimum curriculum established by the state department, in combination with the matrix of the Saerjinho – a bimonthly standardized test of the school system containing questions in Portuguese, mathematics and science.

I give the file to educators. Call on each write on the white-board the main contents of that two-month period and request that each tell a how they are going to approach the content. With this, other educators begin to propose integrations. I take note of all integrations and create a concept map. [I] Distribute [the map] to everyone and they build the lesson plans class by class. (Ana Paula Bessa)

This model is displayed on the wall of the faculty room for everyone to follow the content of others and see possible integrations.

The interdisciplinarity becomes a method applied to the teaching-learning processes. The technologies become a support for pedagogical ends, available anytime and anywhere in the school, and allowing school administration with possibilities of diverse lesson arrangements.

The teacher training supports different classroom dynamics: training of self-managed research teams, with the teacher acting as a mentor and supporting key aspects that range from content to time organization.

In the realm of monitoring and evaluation, the school results are carefully tracked. By combining the school systems' standardized test – the "Saerjinho", that is applied every two months and contains Portuguese, Mathematics and Sciences questions – which includes 90 questions encompassing every subject, a school performance grade is generated that can be regularly tracked. Between 2013 and 2014, school improved from 57.8 to 66.5 points. The results of this tracking are shared with the administration and project partners. "They need numbers and I need to show them. I can't be limited to saying 'I believe that...'", says Ana Paula. The use of spreadsheets has become an integral part of her work.

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Sometimes [the chemistry teacher] enters [the classroom] with the math teacher because the problem is not chemistry-related, but math-related. Then, the teacher asks for help: 'People, I'm trying to convey this concept but I'm not able to.' Every day has a schedule, the students know they will have that subject, but don't know the order because I need to keep the schedule flexible to be able to make those entrances. (Ana Paula Bessa)

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[The students] choose 3 [classmates] that they would like to collaborate with, 3 that they would not like, 3 subjects they do well in and 3 subjects they need to learn more about... the idea is that everyone is able to walk together in a team, that people can help each other ... [from school, we say that] "that student back there always wanted to work with you, but never had the chance, you did not choose him, but he chose you." And they also have this chance to get closer to each other, and this makes this collaboration [become] very well founded... [it makes] that boy autonomous, supportive, competent. (Ana Paula Bessa)

Both at the Curitiba Municipal Department of Education and at the NAVE School, the project methodology and the use of research as an engagement tool are key strategies for teacher training initiatives. At NAVE school, what also stands out, is an environment with integrated technologies in all school spaces, with the faculty room also a reflection of this scenario, which is easily mistaken for other school areas that are mostly used by the students. **Fluidity defines the use of digital technologies at the NAVE school, in administration and pedagogical practices.**

Figures 7.4 and 7.5: NAVE School facade and commons

Source: Rio de Janeiro State Department of Education

Figures 7.6 and 7.7: NAVE School computer lab and faculty room

Source: Rio de Janeiro State Department of Education

Figures 7.8 and 7.9: Classes at the NAVE School

Source: Rio de Janeiro State Department of Education

5 CURRICULUM FOR TEACHER TRAINING?

Once the needs for in-service training for teachers to promote ICT integration at the schools is defined, the administrators stumble upon the difficulties of establishing a training program. The definition of courses are done *ad hoc*, based on the knowledge and experiences of educational technology coordinators and, more rarely, after surveying the teachers to identify their demands. There is a need for a basis that points out what should be taught and a curriculum that meets the necessities of integration.

In the absence of a basis that guides the trainings, creating tutorial videos is among the most commonly used strategies by education departments, as they are useful to clarify specific doubts of teachers and encourage them to learn new applications, but they are insufficient to effectively promote mobile learning policies.

The companies that provide platforms applicable to the field of education, in parallel with school systems, have developed their own curriculum and given shape to trainings aimed at teachers that are based on their applications, also trying to mix the guidance of tools with pedagogical use.

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Sometimes they need a course, the same way they needed one about creating comics with Hagaqué. Then we had to create a team at that moment for what we were being asked. Any school saying anything like 'I have twenty teachers that are struggling to use the projector, what should we do?' Then I send someone there or, if possible, they come here and we help them [with trainings]. (ET, State)

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We decide based on our research. When we see that they are necessary, they are cool... Edilin was downloaded for research. [Our experts] studied it and saw that it was a cool thing for the teachers... (ET, Municipal)

”

I can't establish a ceiling, of wanting every teacher to learn to use the digital board, if Jane can't even turn on the computer, take the data projector and connect it to the computer. It's was that initial idea that "we won't establish a ceiling" because we need to see, map the reality. Creating a minimal curriculum, they came to consider this. (ET, State)

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We take 2,000 thousand teachers out from the classrooms annually. These teachers will be in contact with the university, but they have a problem in their school; because they intend to work in the intervention project, they start writing on how they will act in school, they have a year to prepare and, in the second year, they have an exemption of 25% of their weekly working hours, to accompany this project. We do a technological training [with them]. The teacher will learn how to make a video for YouTube; he will learn to use the tools, [like] Dropbox ... (ET, State)

Figure 7.10: Curricular structure of the ‘Basics for Teaching’ course from Google

Course Structure		
Here is a list of each unit (bold) and the supporting lessons that can be found in each one.		
Research and Communicate	Create and Share	Enhance Classroom Experiences
Find videos and articles (Google Search)	Store Your Files and Records (Google Drive)	Hangout with Parents, Teachers, or Students (Google+ Hangouts)
Captivate your class (YouTube)	Collaborate using Shared Documents (Google Docs)	Bring School Groups Together (Google+ Communities)
Research Online (Google Chrome)	Create and Share Class Presentations (Google Slides)	Show Your Class the World (Google Maps)
Display Information and Work (Google Sites)	Organize Class Data (Google Sheets)	Take Your Class to the Museum (Google Cultural Institute)
Contact Parents, Teachers, or Students (Gmail)	Collect Class Data (Google Forms)	Manage Your Classroom (Google Classroom)
Schedule Your School Term (Google Calendar)		
Communicate to Your School or Region (Google Groups)		

Source: Google⁶

⁶ Available at: <https://basicsforteaching.withgoogle.com/unit?unit=4>, Last access on the July 24, 2015.

In addition, conventionally, the divisions between what is considered “basic” and what is considered “advanced” are widening in the curriculum for tools-focused teacher training: learning how to use office software, such as word processors, spread sheets and presentation software should be part of a core curriculum, while the use of files in the cloud, video editing, audio and educational software for specific subject matters are part of a more advanced curriculum. There has also been a movement towards teaching technological theory, allowing the teacher to reflect on these tools.

As parallel courses, such initiatives in a tutorial format and aimed at the digital inclusion of teachers, can fulfill their role. However, in order to develop an ICT integration approach to curricula, where it makes sense for teachers to appropriate technologies in their practice, those responsible for teacher training must **intertwine the technological resources available with the curriculum content required for the teachers and use a practical approach in training, that elucidates effective teaching-learning methods, facilitated by existing technologies.**

A curriculum to structure teacher training for mobile learning policies will become clearer when the comprehension of technological integration into the curriculum is the focus of teams responsible for the training of education departments.

The demands for varied digital content in line with the curriculum will tend to be more specific, also as a result of this approach.

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And outside [of basic information] we have more elite stuff, [which] teaches how to make videos, how you work in the cloud, how should you work with audio files for an English class; it gives you several topics, mobile app creation... it's a course that is not linear. You choose the subject and, then, you build the lessons. If I'm not mistaken, they are thirty-two classes, and thirty-two of them are non-linear. "Oh, I just became interested in working with software for video editing. So I'll go to that class that deals with videos." It was also a way of minimizing the issue of teacher training.

(ET, Municipal)

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We have been doing an itinerant training course for these teachers. It is always optional; we don't force schools; schools feel the need and ask us, "Oh, I'll be doing the class council, but I wanted someone from your team to come here and talk about the use of technological resources in literacy." So we send our training agent to the school and then, at a certain point of the class council, the teacher will talk about it. So, we try to sort of supplement... (ET, Municipal)

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The third course that involves technology is that [on] mobility. And the need came up due to the educational tablets. Teachers received the tablet and we realized the need to do the training. Before, training would focus on the more operational level of the tablet; it was almost like a training on Android. Then we realized the need to expand it to the matter of mobility, not limit it to the tablet, but talking about the use of mobile phones and mobile devices in general, and bringing references, so that teachers could reflect more from the theoretical point of view, also, on the use of such devices. (ET, State)

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I have made a considerable effort with the team to try and rescue the pedagogical sense of educational technology... that was a little loose. It was only by sparse initiatives of those who were in the schools. Even the digital objects that were produced in the NTE were produced without a large dialogue with knowledge coordination team. I think the big challenge is to make, all the time, the whole staff have strategic planning on how educational technology always dialogues with the curriculum. As much as we fought on that, it was not so evident. (ET, State)

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We will have a course on [digital] boards. I don't see that as a path. In fact, our main task is educational support, is on-the-job training. And it is not only the matter of equipment. It's what we talked about with the results of the evaluations, that the teacher appropriates this, to see what his students are achieving, in a manner that he can use the technological resource, to be able to show it in another manner. (ET, State)

On the one hand, some coordinators of educational technology are inclined to this possibility. In addition, digital content production experience with diversified features like Educopédia and Currículo+ (see Chapter 6) also point in this direction. **The design of these resources, based on the integration of ICTs, focused on curriculum and new teaching-learning methods, is fundamental in teacher training.**

Moreover, as we shall see in Chapter 8, there are distinct profiles of teachers in their relationship with technology. Knowing teachers better, thus, becomes of paramount importance, both in relation to their attitudes to digital literacy and their readiness for the skills required today. Studies to develop indicators that measure digital literacy (ROSA & DIAS, 2012), as well as the skills of the XXI century (BINKLEY, et al., 2012) have been conducted for different purposes. It is crucial that training areas base their actions on consistent diagnostics of the target audience in order to structure the teacher trainings, keeping in mind the heterogeneity of professionals working today in the school systems, the different contexts in which they practices and the necessary approaches for the effectiveness of initiatives.

Collaboration between departments of education, the federal government and universities to set new teacher training curricula is a latent need. In addition to contributing to identifying new paths and models, this dialogue is important to help identify, organize, refine and multiply the number of innovative initiatives at local and federal levels, which are already underway.

5.1

Implementation strategies

5.1.1

Pedagogical advisement: personalized approaches to ICT integration

One of the initiatives that aim to broaden the scope of teacher training is educational support in the schools for the use of ICTs. In some school systems where this function is implemented, pedagogical advisers – also called tech support, technology mediators, among other names – periodically visit teachers in their school units to help with their doubts and difficulties, share new resources and check the progress of proposed actions.

Pedagogical advisement has proven to be a **method for personalizing and customizing teachers' learning** – a very latent tendency in educational platforms focused on students' learning.

To carry out a proper advisory, a thorough mapping of teachers' skills is necessary, as well as of their schedules, in order to ensure consistency in the meetings and the development of goals.

You can see, then, that this is a new type of human resource in education departments, and a possible shift in the function of computer teachers from being exclusive to one school to taking on the role of advisers for a group of schools, aiming to assist school teachers in their subject-specific problems.

Although some departments are now choosing this alternative, sometimes informally, it is important to note that the continued success of this *n loco* training method, depends substantially on the combination of several other factors. One of the most important is the need to institutionalize the adviser function. Due to the lack of a

formal job title, teachers feel insecure about the position. Although it should be noted that there is great satisfaction with the responsibilities of those who are performing this job, presently, when change in administration are pending, or even elections, teachers show a preference to return to the classroom to ensure the stability of their status.

In addition, the viable distribution of the number of schools, the number of teachers, and the definition of service periods needs to be carefully planned. The use of **administrative tools to diagnose the target audience under their responsibility and to monitor their evolution** is also an integral part of successful initiatives. The pedagogical advisors have proven to be key elements contributing to the integration of technology in schools.

By virtue of this fundamental role, a latent issue from the administrative point of view, is how to achieve the necessary contingent to shape the team of pedagogical assistants, since there is still high demand for teachers in classrooms in many education networks and, in some networks, losses in salary are mentioned in the case of institutional relocation of teachers from schools to the departments.

Whether you can put into practice the pedagogical support model with current employees of the departments, or if it is necessary to hire new employees, or even if alternative plans should be considered, should all part of the planning and the definition of scale.

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[Another] component is the presence of technical support. We understand that this support is fundamental. We cannot, simply, put the equipment in schools without giving them a backup so the staff can absorb the knowledge. Technical support stays in for some time, but the sufficient time for the school to absorb how to make use of the tool in a pedagogical way. Two months is the time we are proposing. It is replicable, because we cannot have 5,300 technicians, one in each school... This is a model that is already present in 69 schools of the full time high school program of the state network.

(Administration, State)

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We are working, now, on mobility, because there is a demand for delivery of over one hundred thousand tablets and they want training and we need to concede that. We don't have a team to do more than that. It is limited. We have two hundred people spread over 399 municipalities. (ET, State)

Box 7.5: Technology Mediators in Rio de Janeiro

In 2012, the State Department of Education of Rio de Janeiro started implanting technology mediators in their school system. Until then, the so-called “multipliers” were established in the NTEs, and teachers in the network would go up to the NTEs to attend to the available courses. The Curriculum Articulation team then diagnosed that such a training design only partially met the training demands, because, although it was a useful approach to provide answers to the teachers of the school system when they had a specific motivation, such as the need for guidance on the use of new laptops received, after the initial phase of contact with the new equipment, the interest waned, and the pedagogical use in schools was not progressing as expected.

Parallel to this diagnosis, the educational administration system was structured by consolidating internal evaluations conducted with students, identifying skills that needed improvement, and allowing customized approaches for teachers, based on the profile of needs of their cohorts. The technology mediators have come to play a guiding role in understanding the results of the assessments and elaborating strategies, using technology to achieve the necessary skills and competencies.

In September 2014, there were 193 technology mediators in the school system. Considering the 1357 state schools, according to the 2013 census, the rate is of one mediator for each 7 schools. This is a number that may not correspond to reality because of circumstances defined by the departments. Due to large distances, schools may also remain without assistance. In any event, that calculation is made, and the approaches with teachers have been defined based on their necessities.

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We have the evaluations here in the state. The results of those assessments would come out and they weren't used. Then the mediators started going to schools with these results and showing it to the teacher: per cohort, per student, what are the skills and competencies that one class had failed to achieve in the assessment, and what resources he could use to work on those issues with students in another way, in a manner that he could reach the result. (ET, State)

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Showing all the resources that teachers could use as a suggestion to for pedagogical use... It entered their veins! They showed the teacher how he could take advantage of the result, how he could use the questions bank, how he could use the resources that are there, how he can use the software, the digital board to improve those skills... (ET, State)

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The cool thing is that everyone found a place! As much as we spoke, mediators were still feeling a bit detached from that administrative reality. When we showed them [with the assessments] how they had entered into those resources, they found themselves; everything made more sense, that matter of figuring out where the north is, started getting into their heads. (ET, State)

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Now, we are proposing training on Geogebra.

It was job completely done as a team, with [the departments of] Curriculum, Evaluation and Educational Technology. The skills where students had more difficulty were mapped.

A team conducted the mapping of what skills and prerequisites impacted the poor performance of those skills. The educational technology staff from the nuclei came to a meeting, and we thought about what kind of Geogebra dynamics could be assembled to reach the teacher, for us to try a new strategy for students to use in the classroom. We're doing a training of mediators to reach schools with the worst performance in these skills, to propose the use of this tool. (ET, State)

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When the implementation of the program initiated, we did a lot work focused on service to the school unit. Currently, we have a clearer vision of what we have to do for the teacher.

We have to talk about human resource management. Because of these problems we have, one teacher can be left out and another teacher be attended to several times... So [we need] to have a vision of the training plan, to see what will happen to each teacher. We are at this point. (ET, State)

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The teacher often fulfills his planning [time] at home. We don't have this mapping; I don't know what time professor X is in school. For the mediator, this makes his work very difficult.

He must seduce the teacher. (ET, State)

It can be seen that, after having implemented the minimum curriculum for the entire school system, teacher training has been put into practice based on the monitoring of compliance with this curriculum. There is enough flexibility for each mediator in relation to how the issues raised should be approached. And specific courses have been created according to needs. As articulated by the team, the action of mediators “Is a personal work with each teacher. There's no ceiling, nor a minimum.” The maturation of an array of skills to structure the action of these professionals, giving them more support and uniformity to address the recurrent issues that arise in the day-to-day, seems to be the next step of the policy.

In addition to the challenges of creating an operational framework, and adequate administration and monitoring of the necessities for an effective technology mediator initiative, another barrier previously discussed is the time available for teacher training.

Using online advisory means can greatly assist in these tasks.

Ways of technical and pedagogical support, instant and online, could be tested to determine uptake.

In Paraná, the Interactive Activity Hour is an engaging experience and discussion that can also serve as an inspiration.

Box 7.6: Interactive Activity Hour

A really interesting experience, tested in the State Department of Paraná is the Interactive Activity Hour, in which chat sessions were scheduled, during work hours for teachers, to address previously defined and advertised issues. Within this theme, there were also materials made available to support teachers' practices, with audio, video, suggestions for classes, among others. At the end of the activity, chats and materials remain available to be accessed. The average participation depends on the subject matter, but it varies between 700 to 2000 teachers. In one year, the participation of 16,000 teachers was registered.

Figure 7.11: Interface of Interactive Activity Hour

The interface of the Interactive Activity Hour is displayed. On the left, a sidebar menu lists various resources: Calendário Escolar 2015, Dia Nacional da Matemática, Gabaritando Enem, Hora Atividade Interativa, Jogos, Problemas Matemáticos, Recursos de Formação, Recursos Didáticos, and Sala de Aula. The main header features the 'Dia a Dia Educação' logo and a search bar with the text 'Matemática' and 'palavra-chave'. Below the header, the title 'Hora Atividade Interativa - Como vai o ensino de Geometria?' is shown. A message states: 'Neste espaço, estão disponíveis recursos didáticos e de informação sobre o tema.' A grid of icons represents different resource types: Áudios, Imagens, Problemas Matemáticos, Sugestões de Leitura, Vídeos, Debates, Links Interessantes, Sugestões de Aulas, and Trechos de filmes. On the left, a large graphic displays mathematical symbols like π , ∞ , ϕ , Σ , and geometric shapes. At the bottom, a chat window titled 'Matemática: Como vai o ensino de Geometria?' (Repetir) shows a timeline of messages from 14:02 to 14:03, discussing the use of manipulatives in geometry teaching. A status bar at the bottom indicates participation levels: '...ometria você : considera insuficiente. 60%', 'Você acha neces... .. manhã e tarde.: Sim 75%', and 'Você acha que o...'. Navigation controls are visible on the right side of the chat window.

Source: State Department of Education of Paraná

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All this material that has been worked on, the theoretical foundation and those experiences, are placed on the portal one week in advance, so that teachers who are going to discuss that topic and to talk about their experiences, can have access beforehand. It lasted up to an hour and we didn't need to talk about the subject, because this reading had been done; then we would introduce the discussion through chat. (ET, State)

The Interactive Activity Hour was converted into Interactive School – an online platform for teacher training in Paraná's education portal. From the viewpoint of training strategies, maintaining engagement via chat sessions does not replace other approaches for supporting and monitoring educators.

One sees a trend, in the training area, of making use of hybrid teaching strategies, which has already proven useful with students (see Chapter 6). In line with this trend, the customization of training requires understanding that some teachers, more than others, tend to be most reached by this type of virtual tool at the beginning, as we shall see in chapter 8. Because of this, training programs cannot do without considering the existing heterogeneity.

Thus, a continuing training initiative that considers the existence of pedagogical advisers to support the integration of ICTs should consider:

- » Number of pedagogical advisers by amount of schools and teachers
- » Clear planning and objectives to guide educators in their practices
- » Resources available in the school environment: adequate infrastructure and digital content available, including administrative tools that allow for the monitoring of results and give meaning to the actions of teachers
- » Hybrid teaching approaches to reach teachers at different times, in person and remotely in a complementary fashion.

There will also be an extra gain if **monitoring platforms to measure the effectiveness of the approaches and shared content on the practices of teachers**, are developed.

5.1.2

Actions for engagement

To involve educators, the Municipal Department of Goiânia promotes several events, such as educational blog competitions and art festivals including audio-visual work. Symposiums and pedagogical presentations on education and technology are also mentioned and positively evaluated.

Another mode of involvement that is also developing is the community of online practice: a type of forum and social network that enables teachers to share their experiences. The State Department of Education of São Paulo is developing a social network for all educators, including, in addition to teachers and pedagogical coordinators, schools administrators and the regional administrators of the state network. The idea is that, through the exchange of teaching methods, there may be some discussions that support on-going professional development.

Initiatives to promote debate and reflection, and that add elements of advances in learning can be excellent channels to increase the uptake of digital technologies.

It is continuous training, within context, but without that formal stuff of a certificate.
(ET, State)

5.1.3

Online education

Given the widespread dissemination of online courses as an alternative to increase the reach of teacher training, it is necessary to develop ways to better measure the reach and impact of the course on the participants.

As has been discussed, some networks have created YouTube channels or spaces in their education portals, providing short video lessons to clarify frequent doubts. Courses structured in modules have also been made available.

However, **the reach of these materials is still underexplored to support the evaluation of the effectiveness of these training – not just in terms of enrolments or views, but also in terms of impact.**

From data available on the Internet, we can see the efficacy of training via a YouTube counter, for example. If we take class 1 of the non-mandatory teacher training course of Educopédia⁷, which was released in 2012 by the Municipal Education Department of Rio de Janeiro, we have the following information:

Table 7.1: Views of the Educopédia training course

Video	Views*
Video 1	1.579
Video 2	544
Video 3	420
Video 4	291
Video 5	276
Video 6	416

Source: YouTube, Municipal Department of Education of Rio de Janeiro

*Available in: <http://www.educopedia.com.br/Cadastros/Atividade/Visualizar.aspx?pgn_id=121224&tipo=2>. Last access on the April 18, 2015.

Another example is the video tutorials to teach how to use the educational tablets in the State Department of Education of Paraná. The main tutorial video, showing the tablet characteristics, had 10,264 hits since 2013. But the video about using the camera, made available that same year, had 5,081 hits, and the video about how to insert image had 4388.⁸

It is difficult to draw conclusions from such data. To what numbers

⁷ About Educopédia, see chapter 6.

⁸ Available in: <<http://www.educacao.pr.gov.br/>>. Last access on: 04-19/2015.

can we compare these? What is the plurality index, that is, the same teacher watching different classes? Are there access patterns? What causes a lesson to be more watched than others: promotion, interest? Furthermore, the teachers' universe is much larger than the number of views. How should that information be interpreted? Level of digital literacy of teachers, adhesion to online courses, low interest, limited promotion?

There is no doubt about the importance of exploring the possibilities that online education provides for teacher training and professional development under a hybrid teaching model. The scale is the main factor by which mechanisms that allow the monitoring of teachers' evolution on the platforms need to be improved.

We cannot fail to mention the challenge that surrounds the online experiences of teacher training: the verification of identity. Teachers and people from the departments brought to our knowledge the difficulties concerning the recurrence of teachers who sign up for the courses but ask third parties to complete the requested tasks. Either due to difficulties in fulfilling the activities or to a lack of interest, some course participants use strategies difficult to control – a phenomenon known in the field of public policies as “gaming” (RADNOR, 2008).

The reason for signing up for these courses may be obligations made be the education department or it might be the possibility of having benefits in terms of career progression. As for the reasons for “gaming”, these need to be better analyzed. The analysis of the focus groups of teachers in Chapter 8 points out some possible directions, such as disappointment with the models and results of training that are currently in vogue. In any event, there are many interesting experiences under development and great possibilities of progress to be explored.

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How do you create continuing training for teachers when you have forty thousand teachers in a network? You have do not even have space to put a large number of teachers; so, you end up having to think about technological solutions to do that. And, beyond this issue, we still have to think about technology as a learning ally and not just as that laboratory (ET, Municipal)

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...[In] the first semester, the course spaces made available were 39,000 [seats] and, for this semester, it will be nearly 40 thousand. I know that, in total, there will be more than 69 000 spots offered for distance learning courses. (ET, State)

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Part of the training content is all done remotely, through the Training School. There is also AVO - Ambiente Virtual de Aprendizagem (Virtual Learning Environment) that we're using, and there are two types of content: existing training content and the content that we ourselves are producing. And there are two models: one with professionals from the department and [one where] we have the support of five experts who, voluntarily, accepted to produce content with practical tips and implementation strategies, on the reasons for doing [a digital content platform] now in education... In the first semester, we presented the first edition to 2,000 teachers, in a pilot model, so that we could feel and open to the entire network, so that the entire network could attend this course, with a duration of 6 weeks, 30 hours, and completely remote. (Administration, State)

CHAPTER 8

THE SCHOOL PERSPECTIVE: THE TEACHERS¹

1 METHODOLOGICAL APPROACH

Eleven focus groups were conducted with teachers from municipal schools (from 6th to 9th grade of elementary and middle schools) and state schools² (from 1st to 3rd year of high school) in 6 cities: Curitiba, Goiania, Manaus, Rio de Janeiro, Salvador and São Paulo.

After a memo sent by the departments of education to their regional offices and schools, a team of recruiters started the first contacts with the teachers. The contact script explained that the research would be about the use of digital technologies in education, and would be surveying the opinions of teachers from six different Brazilian cities on the use of new digital equipment in their personal and professional tasks, including not only teachers who were taking their first steps with these devices, but also those that were already considered longtime users.

For the state schools, listings with e-mails from teachers who had activated their tablets received via the federal government were used. In addition to this, due to the low return to initial emails, recruiting in person and calls to schools were also used. As for municipal schools, recruitment was done exclusively in person or via contact with schools.

¹ Em coautoria com Vera Lúcia Pompeu de Toledo.

² In Rio de Janeiro, focus groups were only conducted with teachers for the state network

The selection variables were: a) location of schools – to cover all regions of the surveyed cities; b) age – to have different age groups and, at least, 2 among 8 teachers in each group who were 35 years of age or more; c) gender – to ensure a minimum of 6 to 8 women and the presence of at least one man per group. It was also required to have a minimum of two years of work in public schools and having already accessed the Internet at least once.

The fieldwork was conducted between July and September 2014.

1.1 Classification study

The analysis of the interviews pointed to the possibility of conducting a study of qualitative classification of the investigated teachers. The marked heterogeneity in relation to technologies, facing similar scenarios with a lack of structure in different cities, showed consistent patterns and behaviors that demonstrated the need for systematization.

Generally speaking, in a classification study, the goal is to organize the features that recur in coherent groups; observing, first, the patterns that are alike and which, regularly happen in association with one another; and, secondly, those whose differences make them distinct, whereas they are alike in other characteristics. In short, classification unites the similar ones and separates the different ones, identifying patterns of attraction and repulsion among the characteristics studied.

From this analysis, five profiles of teachers were defined, seeking to synthesize the different relationships they have with the technologies in their workplace, namely: Trailblazer, Receptive, Perseverant, Apprehensive, and Avoiding. By definition, in a study of classification of people, the profiles will not be entirely mutually exclusive, and the same teacher may be identified with characteristics of more

than one profile, although there are no doubts about his or her belonging more to one of them, by identifying himself or herself mostly with that description.

Finally, it is important to mention that the profiles do not carry a value judgment, seeking, instead, to be a technical instrument to assist in developing more targeted initiatives, adapted to educators and their characteristics.

2

THE SCENARIO OF REFORM IMPLEMENTATION

There is a very strong connection between teachers and the past, which was expressed in the discussion groups in many ways. On the one hand, the longer the experience, the more pronounced the inevitable **melancholic comparison** to a time with more disciplined, respectful and interested students; a time where teachers had the status of “well educated” people, people who had learned a lot - more than their peers - and, therefore, they received the license to teach. The past can also remind them of the family members - mothers, aunts - who had been teachers. Spontaneously, it always seems to be something positive.

On the other hand, when we talk about the teaching methods of these teachers, they affirm that they have learned to do things in practice. In other words, you learn to be a teacher by being one. It does not matter if they have a few or many years of classroom experience, when their methods are examined, they seem to question themselves and their abilities, and, for them, a situation with more interested students would provide sufficient conditions to develop learning.

Thus, **the connection of the interviewed teachers with the past, and with their own habitual way of doing things, brings with it some aspects reminisce of efforts, learning, achievements, and evidence of success in their social environment.** Any attempt to reform the education departments, to disregard these factors, can build a relationship that expresses distance and can turn into unproductive confrontation.

There are changes desired by the interviewed teachers, who are not satisfied with the current condition of the schools. **They are unanimous in expressing the urgent need to improve the quality of the public education** combined with better working conditions and enhanced learning. In the first case, they argue for a greater appreciation of the teaching profession, an improvement of their self-esteem, better wages, more security, a greater involvement, and a better performance of all educators.

With regards to learning, **the educational use of technology is recognized by most as a possible ally for increasing the engagement of students – teachers were very involved with the entertainment offered by ICTs, but they spoke of their difficulties to use them to study, learn, research.**

There is, thus, a key common denominator for action; and one of the challenges of public managers is **to develop consistent plans with clear objectives, that consider the involvement of teachers in the process, and include the trust required to implement this action.**

In relation to the integration of ICTs in schools, in addition to the hindering aspects of administration noted in previous chapters, which contribute to concrete, physical, and even impeding aspects to change, this research also identifies as hindering some personal and behavioral profiles that teachers have to respond to the scenario of incompleteness of ICTs in schools. Therefore, there appears to be a lack of a contribution aimed at **providing more elements to develop actions, not of intervention, but of technological integration in a more promising way.**

3

THE NOT SO
DISTANT FUTURE

On being asked to project *how education will be like in 10 years*, teachers went beyond the more objective, concrete and feasible boundaries to dreams that expressed their desires in relation to their working conditions.

Their desires ranged from a well-equipped school, with airy and light rooms, with security guaranteed to students and teachers, to a more humanized school, with greater participation of the family, respect of ethnic groups and their differences, as well as with appreciation for the teachers, offering them good wages and suitable conditions for them to exert their profession– no accumulation of working hours and more time to study, plan, improve their professional performance.

There are teachers who imagine education models such as the *Escola da Ponte* – a school without walls, without divided classes, without closed disciplines, where students build their areas of interest and seek knowledge within a learning process that values their autonomy.

Distance education also appears in their projections for the next 10 years, but it is an alternative mainly to meet some social or geographic realities or to serve some more autonomous learners.

With regard to technology, greatly discussed during the group, when idealizing tomorrow's education, teachers imagine the school being fairly technologized and, thus, benefiting the autonomy of student learning. They say the technological resources will be available and in perfect working conditions all through the public schools, comparable to good private schools in large urban centers. The schools' infrastructure will be adequate for the needs of each

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Before, we had to just enter the grades. Now, you have to fill out the virtual attendance. So everything is virtualizing. For example, in 20 years, do you think we will continue to use chalk, daily? My opinion is that everything will be scanned. And what about the pressure upon us? We will lose freedom. They will control everything we do. (Teachers, High)

”
If we do not have, like, a follow up to be able to reach them [students] in technology, how are we going to do? Students were born connected. They will swallow us! (Teachers, High)

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Today, you have a teacher who understands that knowledge is available; various instruments are available for the youngsters to acquire knowledge. The teacher needs to have the ability to be a tutor and guide them in the pursuit of this knowledge. So, this change is that you have to enable, in the classroom, for a new dynamic of teacher-student relationship, leading to the need, for you to have infrastructure conditions for the teacher to have quick access to this information and make the class more dynamic. (Administration, State)

school unit, depending on its particularities. Equipment designed for the near future does not differ much from today's equipment: notebooks, tablets, digital whiteboards, interactive TVs with USB ports and Internet access are the ones primarily cited, with the big difference, according to the teachers, that they would have 'great quality,' would be from the 'latest generation' and would have guaranteed technical assistance and quick service. And, moreover, there would be no difficulty in using them.

In this virtualized environment, of rapid and profound changes, teachers feel pressured to show their qualities even more, showing that they "are good" and, especially, indispensable so technology does not replace them.

■ The question they ask is: what then will be the teacher's role, with the inclusion of so much technology in schools? The most recurring image is of a **mediator-tutor** who directs the student – now, more autonomous students – in their needs, helps them find answers to the problems; an advisor, more than a teacher as their role is configured today. It is a reflection quite in line with what administrators of education departments aspire for their teachers.

■ The difference is that the teachers' tone is permeated by feelings of pressure and anguish, associated with these new expectations about their role as a professional, which became evident during the discussions.

4

THE CURRENT REALITY

The focus groups demonstrate that the reality of teachers today is quite far from what they imagine it to be in 10 years. This projection can explain an intense desire to improve the teaching conditions in Brazil, which gives meaning to their efforts today, but, more than that, it shows that, in the view of most teachers, **today's situation is difficult and precarious, and tomorrow's situation may come to be appropriate and sufficient.**

4.1

The school environment

The school environment described by the interviewed teachers shows a scenario permeated by social problems and violence, which affects the schools where they teach. Many of these schools are in regions marked by physical precariousness (infrastructure and equipment) and inequality, vandalism and theft to public schools. Students are part of that reality and may, themselves, be the protagonists of such actions, generating environments of insecurity and distrust within schools. Therefore, the search for building an educational setting without considering the school surroundings is ineffective, since the walls are not always sufficient to define borders.

As integral parts of this environment full of conflict, schools experience extreme situations, and apply different strategies to combat crime and violence in their territories. Internally, we have seen the presence of installed and monitored cameras, security guards at the gate, etc. To control the surroundings, private security guards are hired and the presence of school patrol is required constantly.

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The maintenance company goes up on the roof [of the school] to fix it, because the rain is wetting the children. And, there, it finds guns, drugs, stolen things, and the people from the “mafia” surrounding that setting tells everyone to stop everything, and the lessons stop, and they have to stop the work. I mean, these things, so rude, so barbarous, still exist.
(Administration, Municipal)

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Today there is a very serious problem, because Internet routers, which we put in there, have been stolen and we could not install others. They steal a lot. There are still a lot of thefts in schools and, then, they took the routers because their value was quite high.
(IT, Municipal)

According to the OECD study by Talis (2013) 11.8% of school principals surveyed in Brazil have reported theft or vandalism, at least weekly, in their schools. As a point of reference, in Chile, this rate is 3.1%; in the United States, 5.5%; and in Mexico, 13.2%. Intimidation or verbal abuse of teachers and staff was an item cited by 12.5% of the Brazilian principals interviewed; 6.3% by the Chileans; 4.7% in the United States; and 3% in Mexico. Finally, Brazil is the country where there are most cited cases of possession of drugs and alcohol – 6.9% of school principals mention that this is commonplace in their schools. Again, for comparison, in Chile this rate is 1.1%; in the United States, 3.5%; and in Mexico, 3.6%.³

It is difficult for a municipal administrator to release [the equipment] to take it home. What if something happens with a student? The thief will kill the student because of a tablet? This is a very serious issue. So, no one ends up releasing the devices because of that, for security reasons. Even if they say, "ah, you can restrain access and it will not work if you do not have the school card", it does not help, since the child remains at risk. (Organizations)

Relations with security companies are inevitable, along with the necessary presence of the principal, these are the strategies found to deal daily with this scenario.

Violence cannot be ignored in any educational project to be implemented, since it has an impact on levels of acceptance and trust in the actions that may increase the risks to school. If you receive a digital device, it means a greater chance of the school being burglarized, creating a possible impediment for the adherence to such a project.

The relationships established in schools are understood, by the surveyed teachers, as too assistentialist – relations where too much is given and little is demanded from the students and their families. And what giving too much means, varies widely, given the profound differences between cities, states and types of schools – which also reflects in the availability of resources and conditions found.

³ Available at: <http://www.keepeek.com/Digital-Asset-Management/oecd/education/talis-2013-results_9789264196261-en#page290>. Accessed on: 04/20/2015.

In this sense, teachers criticize **the instrumental relationship that is generated among parents, students and schools** – a relationship based on exchange, but where the main product is not learning, but other important basic items that have schools as intermediaries.

”

You call the father or the mother to talk about a problem, and they ask, “But he will not stop receiving the milk, will he, teacher?” The school is the only reference for some things. Families are unstructured. (Teachers, Middle)

Regarding the physical condition of school units, the realities described by the teachers show very heterogeneous scenarios, ranging from well-managed installations and equipment – a minority in the sample – to many schools with precarious physical facilities and inadequate amount of resources.

”

It is a very well equipped school. It has a computer lab, it has a very good DVD collection that has arrived, and it has a very good material for classes, books, all very good. Regarding educational material, we have no complaints. It has been 15 days since the material arrived for the teacher, for elementary school I and II, quality material, excellent. It is a material for teacher's to study, for them to qualify themselves. (Teachers, Middle)

The lack of teachers is also mentioned as a recurring problem, due to **the devaluation of the profession** – among younger teachers, we found some that were studying for their second college degree, to change careers. Regarding **the pedagogical knowhow** they possess, they do not talk about it spontaneously, although, when they mention full time schools, and the expectation that they will increasingly expand, they express greater need for training and updating, to match the extended working hours and the extra skills that will be added to traditional disciplines – including technological skills.

”

The place where I work is far away, it is a poor community, and it is burglarized every day. They need a lot of attention. It is a cozy school, although the community is suburban, simple, but the community welcomes you. It is a reality that escapes our capacity. (Teachers, Middle)

This generation of teachers is experiencing a time of many **attempts to change** education, as well **as intense social transformation as an effect of the technological revolution** (CASTELLS, 2005). The future approaches the present of with many imperfections, and this is symbolized by ICTs in their work environments: the equipment, the new programs, the Internet and its huge possibilities, not always known.

By deepening the understanding of the impact of ICTs in the lives of the teachers we listened to in this study, what emerges are **non-linear scenarios of digital technology integration** in personal and professional life, as well as **spaces of anguish and conflict** that they face in the workplace as a result of this transformation in course.

4.2 Teachers and technology

The vast majority of teachers affirm that they have a lot of electronic equipment at home, including notebooks, tablets, desktop computers and, especially, mobile phones, with many smartphone models with Internet access. This result is in line with the ICT Education (TIC Educação) survey (CETIC, 2013), which shows that 98% of teachers in Brazil have a computer at home, including laptops (82%), desktop computers (70%) and tablets (33%). We have not identified, therefore, problems of access to ICT among the interviewed teachers. However, when explored in more depth, they are not satisfied with the skills they have to use them – **many rate their knowledge as basic, to handle an email account and instinctively navigate social networks or sites of interest.**

Teachers, however, are far from being homogeneous. On the topic of the familiarity and use of technology, different profiles were identified, which may explain the higher or lower involvement with technological tools and, therefore, with greater or lesser ease of adopting them as teaching instruments and supports for teaching.

Despite the differences, it is important to note that **all respondents perceive the advantages of mobility as great breakthrough in the use of technology.** The vast majority have migrated from desktop computers to laptops. **Tablets are also cited, but more rarely used than cell phones** – useful equipment to keep them connected with friends and family and to get to keep informed about news highlights in real time. Without such access, which varies in frequency, the vast majority of teachers expressed the feeling that they would be alienated from the world, not knowing what is going on.

Technology, as a theoretical entity, in any case, is personified by teachers with very ambiguous features, but consistent with the very different ways in which they relate to it. On the one hand, the “technological being” is perceived as useful, necessary, available, interactive, practical, efficient, on the other hand, he or she can also be described as intrusive, deceitful, selfish, overbearing, oppressive, artificial. While some teachers lean to one side or another of this ambivalent profile, the vast majority experience the two feelings – at times approaching it, at times distancing from it.

Interestingly, the gap may already be seen as the result of a previous approach, and not necessarily a rejection that prevents initial use. It is an attempt to better control their use and the consequences that any excess can bring to people’s lives.

Concepts quite widespread in the field of education, such as “digital native” and “digital immigrant” (PRENSKY, 2001) are not that helpful to understanding some teachers and their relationship with technologies. That’s because **there is not a static digital environment, from which someone descends or to which someone moves**, as supposed by the terms “native” and “immigrant”. There are always changes, whether in software, or in hardware; and, therefore, to develop well in this environment, individuals must be flexible or, to use the author’s term constant “immigrants” in this sphere to continuously adapt to its changes. We agree, therefore, that the native versus immigrant terminology tends to increase differences not always real (SELWYN, 2009).

Nevertheless, these categories are commonly used by teachers and representatives of education departments to represent educators (“immigrants”) and students (“natives”) and, often, this contrast is used as an explanatory variable of posture they have in their use, or non use, of ICTs in schools. The evidences found points in another direction.

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I believe that, at times, it comes to hinder, because I get home and my son is with the notebook in his room, my husband in the living room with his, and I in my room with mine; and we even come to talk over the Internet, even being all in the same house.

(Teachers, Middle)

”

I have a notebook and a tablet, but I avoid using them at home because I used them a lot and I think that this really separates people. My mother lives next to my house, but she stays in front of her notebook; I leave mine and I go there to be with her. I think the emotional bonds are over. I was feeling that my mother was distancing herself from me, and I decided to change it. (Teachers, Middle)

Below are the main teachers' profiles identified in this study in relation to their use of technology. This analysis is combined with the way teachers present themselves, in their own words, and how, interestingly, professionals of the departments of education, spontaneously describe their views on teachers and describe attributes present in the profiles that we have identified in this research, describing their perceptions that arise from daily contact.

4.2.1 Teachers' ICT engagement styles

I. Trailblazer

Representatives of this group have access to different devices – smartphone with Internet access, tablet (personal one and/or distributed by the government), notebook, and desktop computer. Each device has its particularity and fills a specific need. This teacher ICT engagement style makes use of technology to meet personal needs (entertainment, communication, research, study, etc.), and uses it also for educational purposes, not only in accordance with what the infrastructure of establishments permits, but often as a result of their efforts and individual attitudes to operate different class technologies. They research materials to use in class and diversify their practices with exercises, videos, texts, cartoons, songs, etc. **The verb is 'to experience'.**

This teacher has a propensity to seek, and intuitively learn how to use, the different technological equipment. They learn to handle the projectors, with the smart board, with major search tools, demonstrating higher photo-visual information literacy than their peers

(ESHET-ALKALAI, 2008; DIAS & ROSA, 2012). **They show that they are open to novelty and, especially, that they can extrapolate their personal technological interest to the professional world**, trying to make their lessons more dynamic, motivating and inserting the student into the subject matter. With their knowledge, this teacher ICT engagement style can overcome some barriers imposed by the precarious infrastructure of most schools and the lack of teacher training, to add technology to their performance of their teaching duties. They work hard in order to introduce technological resources in their classes, not only because they see in technology an ally to produce more interesting lessons and, thus, get closer to their students, but also because they want to meet the expectations coming from superiors.

These teachers are a minority in our sample, but they do a lot to improve the teacher-student relationship through the link with technology and innovation. They show **pride, satisfaction and pleasure with their new achievements in this area**.

Some characteristics appear to match this profile, which seems to be formed mainly by teachers who work both in public and private schools, or who teach in full time schools, or who work as special education teachers, or who have been technology teachers in a teaching network. Despite the fact that those teachers who teach some specific subjects such as English and Mathematics, seem more likely to belong to this profile, as well as male teachers, the design of our sample does permit us to assert and consistent disciplinary and gender differences.

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My classes all happen through the use of technology. I take eight digital tables for [my special students] to draw; eight tablets. (Teachers, High)

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At school, I am the teacher who most uses technology in English classes, to research, to learn pronunciation, vocabulary. YouTube has complete lessons, there are complete English courses; then I get a part of the simpler classes, take them to the students, show it on the projector in the classroom, or else, take them to the computer lab. Two students sit at each machine. (Teachers, High)

”

I want to buy that new cell phone that has a projector; have you seen it? I cannot wait because carrying the projector from room to room is very heavy. (Teachers, High)

”

I take my tablet, and I ask those who have cell phones with Internet to take them [also]. We make a circle, I show the topic and I ask them to do research. I work that way, because, with the Internet that is available, I would not have conditions to do that. Then I use my 3G, and ask students who have Internet access, and then I can sensitize the class for them to participate. As they want to stay all the time on Face[book], on Whats[app], then I give 10 minutes for everyone to use Whats[app], but only at the end. (Teachers, High)

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I work a lot with images. I try to involve their knowledge, inviting them to create videos, and we see them on the cell phone. I am seeking those ideas, creating my blog, where I put all my classes, to access, so they can watch the videos there; so they can watch the movie I'm indicating. (Teachers, High)

”

I'm training to work with dynamic geometry. There is a program that I really like and I have always wanted to use it in the lab; but, first, it was awful to try to install the program; we needed Java, but Java wouldn't install. I'm not allowed to install anything in their machine. I looked quickly for a solution; I searched for several alternatives but nothing worked. So, if I have a different idea, it is hard to implement it. (Teachers, Middle)

This is the profile that tends to respond well to online training and could have their actions driven by courses that address more advanced strategies to use ICTs. It is also on those with this teacher ICT engagement style that one must rely for ICT integration programs in schools, whether to validate the ideas, test new approaches or assist someone in their implementation.

Administrators and technicians of the departments of education describe this ICT engagement style spontaneously as they see it in their school systems.

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For me, the first myth that there was a strong resistance regarding the use of the Internet and machines has already fallen to the ground... And, in fact, they are very eager to do something different, very eager to create together; but what is missing is space, time to do things together, conditions are lacking, an environment for innovation to happen is lacking. So, there's no use wanting a great work if you do not give the conditions for it. (ET, Municipal)

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I'll go to conferences and hear that teachers resist using new technologies. Here you do not any great resistance, very much on the contrary, our big problem is that teachers are outraged by the lack of investment. For example, the Internet is not good, I want to use the platform, but the Internet does not help. So in fact, our audience does not complain about the use, he complains about the [investment] that often prevents him from using that resource in an optimized manner. (ET, Municipal)

II. Receptive

Teachers of this profile also have skills for the use of ICTs, using them massively on a personal level with friends and family, and also researching topics for their classes; however, they do not use them in schools, and the main factor is the additional work and wasted time associated with such use. They want to give their lessons, to fulfill the program of their discipline, and they strive to achieve these goals with the board, the chalk and the tools they have at hand.

They may use the multimedia room and the pre-configured lab, but with limited frequency and very specific goals. They consider it a waste to spend their energies trying to make school technology work, and they have do not have willingness to try to solve the problems with their own devices.

If the ICTs were well established, accessible and reliable in operation, they could be their allies; otherwise, they may never be used pedagogically because these teachers demonstrate that they believe the traditional classroom brings more gains than wasting effort on the insufficient infrastructure in schools. This is a teacher ICT engagement style that values technologies less as engagement tools than the pathfinders do.

The feeling that teachers belonging to this profile demonstrate, with respect to ICTs in schools, is that they constitute a waste of time, offer low productivity, and have their availability dependent on the surroundings.

For these teachers, as long as facility in the process of using ICTs is lacking, the trainings may not be effective. In any event, with their skills, they are able to follow online courses focusing on pedagogical approaches to their discipline.

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In my school, I want to show a movie, but there is no video room, a specific room for you to perform this activity. Then, you have to make the connections available by yourself. By the time you are able to do all this, the class is over. There is a lack of supplies and human resources. (Teachers, High)

”

I do not like to take [the students] there because the room is not big enough. In the case of my school, I have classrooms with 40 students, and the Telecentro cannot bear all that. It has 15 computers, so there are no conditions. It will be difficult. You cannot control. So, it's a lesson that is not productive, in my view. Then, I'd rather not [go to the lab]. (Teachers, Middle)

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There, as we have netbooks, the teachers from Elementary I level, in one way or another, are using them at least once a week. However, the Elementary II teachers tried to bring the equipment to the classrooms, but they realized that, for a 45-minute lesson, it is very difficult to carry equipment, connect it, unplug it, etc. So it's a dynamic that has not worked. (Teachers, Middle)

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I think the tablet greatly facilitates, but what does not match is that the tablet does not work. If the Internet connection were good, we would not be discussing this right now. It would be very easy for you to use it. You would do everything you already did, but in an easier way. But it does not work. (Teachers, Middle)

Administrators and technicians in the departments of education describe this ICT engagement style spontaneously, as they see it in their school systems.

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This thing out there to say that the teacher belongs to an analog generation ... He is, but [saying] that he has no access, that's why there is resistance, [no]. He uses it a lot! He has computers at home. There are few teachers who do not have a computer. Through our experience in the course, we have realized that the teacher has technology at home, he accesses it, and he cannot live without this technology. He has a cell phone with Internet. So what's missing? He uses it in the classroom. He uses it a lot, but he does not know that it can be a teaching tool. Likewise, the student is using it a lot, but he still has not perceived that that there is a condition of knowledge. It is not yet systematized, and that's where the teacher is important, in giving this orientation. (IT, Municipal)

III. Perseverant

Although somewhat unfamiliar with the digital age, these teachers realize the importance of technology in order to be current and, more importantly, **to show that they are current**, and in line with what is new and modern. They see ICTs as a means to mark a breakthrough and to be able to compete with younger teachers; and they also feel that, through ICTs, they can preserve the role of the teacher as an authority in education. They constantly ask young people (students, children, grandchildren) for help. They are at the stage of exploring, understanding, and they get excited about the findings. **The verb is 'to seek'.**

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Today, the teacher is the first one who has to use the Internet, researching things to bring news to the students, right? And we keep researching and learning this way, the hard way. (Teachers, Middle)

”

I ended up learning the hard way. I said, "I need to improve my lessons." I began to demand from myself, "I will have to start dealing with that". And not only dealing with it for myself, but for the profession. Even more in my area, it has a thousand and one things, resources, and films, examples that you can use to improve your lessons. (Teachers, High)

”

I had a very strong resistance. I thought I was very stupid. And, then, my oldest daughter began to show me; and, then, we see that it makes things so quick, much easier ... The other day I did something I had never done: I did supermarket shopping. I found it very cool. I found it much better than stressing myself out inside the supermarket. (Teachers, High)

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The changes are coming. We have to adapt to these changes, especially the elementary school II level. We have the necessity to use technology in the classroom; we have to use the TV with a pen drive; we have to use it all. The school could have someone to help, once it provides the tools. (Teachers, Middle)

This teacher ICT engagement style already uses technological equipment in their houses, mainly to communicate through social networks like WhatsApp and Facebook. And they have noticed that **the professional use of these and other tools can make things easier**, but they still find it difficult in transposing their own ways of using them to the school environment for pedagogical ends. Their knowledge, still precarious, about the reach and the potentialities of the equipment makes them dependent on others to connect, install, download programs, use applications and, hence, to make use of these in the classroom. Without such support and with the instability of the resources in the schools, not always fully operational, they feel negatively exposed in front of their students, and feelings of weakness and lack of authority on the subject may prevent them from taking chances. Therefore, they still need technical support to more frequently and better use the technologies available at the school.

Teachers with this ICT engagement style may respond well to platforms of online study, provided that these platforms have good usability. These courses may increase the integration of ICTs in their lessons if there are follow-up actions *in loco*, and if the courses cover the different stages of their skills and expertise.

Administrators and technicians in the departments of education describe this ICT engagement style spontaneously, as they see it in their school systems.

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The teacher, alone there with the machine, for everyday things, he can do it well. To go in front of the students, still there is a certain reticence ... He does not like to show weaknesses. As he knows that students are much more attuned to these technologies than he is, and he's the teacher, and the teacher has that thing that he should call the shots in class, he talks and the students listen. Not everyone thinks like that, but unfortunately, in my perception, they are still the majority. This, to me, is still the biggest problem. (IT, State)

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With the digital diary, I ended up having my preconception broken, because what we have heard a lot over the years is that teachers, especially the older ones, they are not interested in technology. [But] this gives me the expectation that this situation has changed. I myself was surprised by the actions of the teachers; they went there, they released [the information to the diary]; they themselves have done it and have released the information. (IT, State)

IV. Apprehensive

Some teachers try to distance themselves from technology, especially from certain media, on the grounds that these technologies sidetrack them from their main objectives. They think that excess is harmful. They forget about the social network during working hours; they only respond to e-mails at the end of the day; they restrict their access to the Internet by selecting and prioritizing daily entries, among other examples. **The verb is 'to control'.**

Such behavior may derive from a personal experience or from the experiences of other people that have become dependent on technology, among other factors.

This kind of attitude can also be covering up personal fears of testing their behavior in face of technologies, which are seen as ambiguous, as if they are already anticipating the possibility of becoming their hostages. These teachers feel afraid of losing control and they seek balance between the traditional style of teaching – by simply displaying content – and that with technological use, not only

because they see benefits in both, but also because they want to put technology in its 'place' and they do not want to be subject to the unpredictable and to the difficulties and squandering of time through using unstable ICTs in their schools. **These teachers' voices qualify technology as invasive, treacherous, dominating** in the projective exercise in the focus groups.

These teachers restrict the use of technology in general terms – a fact that reflects directly in their limiting the use of ICT for teaching purposes. They tend to use the resources that exist in schools with very low frequency, usually with planning well in advance. In the literature, some characteristics typical of this teacher engagement style are already outlined, like the fear of technology affecting the "authenticity" of his or her class and making it "inhuman".

'Equipment, such as audiovisual players (ranging from the old overhead projectors to powerful datashows) may support this 'authentic class', as long as the intervention of the teacher operates in overcoming the aspect of consuming (download), which may come to be the main feature.' (SOBREIRA, 2012, p. 41)

Teachers with this ICT engagement style need incentives and clarity of the educational benefits of integrating ICTs more widely in his or her work, with an approach that strengthens the role of the teacher, for him or her to feel in control of the situation.

I think that technology is something that alienates people, which does not let you think for yourself. (Teachers, High)

Technology has to be our 'slave'; it has to serve us. We cannot be her slaves. It has to serve us and not vice versa. Today, it imprisons you, enslaves you. (Teachers, High)

Technology comes to stay. It will become a metastasis, a cancer, and we have to know how to use it with balance. (Teachers, High)

Administrators and technicians of the departments of education describe this ICT engagement style spontaneously as they see it in their school systems.

[There is] that [teacher] who doesn't cohabitate with technology and has a great prejudice against it because they link technology to a fad or a depreciation of other experiences. So, if he believes that those who live intimately with technology are people who do not read books, and that those who do not read books are intellectually inferior, that is what he or she will believe. He or she sees actions using technology as opposed to storytelling, for example. And then he or she becomes a militant against technology, and uses it as a flag; and that's bad. (ET, Municipal)

V. Avoiding

These teachers consider themselves to be short of the requirements of the digital world and, therefore, avoid or even refuse to use technologies. Some of them claim lack of time or lack of desire to approach technological tools. They think it is not their world, neither their personal nor professional worlds. They feel unskilled and uncomfortable, and **adopt an attitude of aversion**. In the focus groups, they were silent whenever the discussion on ICTs was initiated. However, **this avoidance of the ICT universe has become increasingly unviable, putting them in a situation of constant conflict**. Between the lines, they show that there is a growing social imposition for them to engage with the digital world, especially for professional use and, with this, make the classes more attractive. **The verb is 'to confront'.**

They demonstrate **fear, anxiety, feelings of inferiority**, when facing students or the demands of the school guidelines, and they maintain a biased position against adverse scenarios of connectivity and against the lack of training. They are recognized by most as 'resistant', as those 'who refuse to use ICTs', but, as this research shows, they need to be better understood, since there are clear reasons for their attitudes against the adoption of ICTs.

They need trainings in person and practical approaches focused on solving the problems that they may come to face with their students, trainings that show that the benefits of engaging with ICTs are larger than their emotional costs. Online training only adds to the difficulties of teachers with this engagement style, since they may have problems to complete their online activities or may ask others to do them for them.

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I have a serious problem: I just come in to work, and I am obligated to access, but I do not say it is pleasurable. I do not know if it's because it's not from my generation, or because I am almost illiterate at this thing. I access, do what I have to do, submit it all quickly and leave. I do not like it. I prefer to read my book, walk, and talk to people. I do not like it. (Teachers, High)

”

I stay in a super awkward position. I feel a little guilty because I'm not at the same point as they [students] are. First, I do not have all this interest in technology, and even if I did, at school I wouldn't be able to use it because of the lack of structure. (Teachers, High)

”

I know I have to do it, but I have no ability to do it. And, even if I did, it would not be the way that [the students] would like to receive it. Today, you put a topic on the board, and they do not copy it, they take photos. We are already open to accept these differences, but I always feel guilty. I think I'm always in debt. (Teachers, Middle)

Administrators and technicians of the departments of education describe this ICT engagement style spontaneously as they see it in their school systems.

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Some teachers came here [to be trained] because the principal gave their names for them to come. But he did not want to not come because he does not like cell phones, he does not like tablets, he does not like Notebooks, he does not like the Internet. But he came because the principal ordered. So, this is the guy that I say is resistant. He has everything, but he does not use it because he does not like it. We have teachers in this style, that do not even like to use technology for their own use, imagine for teaching. (ET, State)

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We have today being implemented in schools here the digital diary, but it's not 100% of the teachers sitting there on their tablet, or their notebook, or their computer and filling out their journals. We have teachers today who call the lab teacher, from the media center, to fill it out for them because they do not know how to use the tool. (ET, State)

4.2.1.1

Conflicts in the workplace

With the heterogeneity of ICT engagement styles among teachers in schools, it is very unlikely that the Trailblazers, by themselves, will change the school environment towards a greater integration of ICTs in pedagogical practices. Although this profile of teacher is quite attached to ICTs, it does not necessarily become an example to be followed. Often, teachers with this engagement style suffer criticism from their peers, explicitly or not, for their high effort to circumvent the difficulties facing infrastructure, and can be seen as teachers who rely more on technology to teach than in knowledge.

We have noticed that, as technology is an intrinsic characteristic of contemporary society, which one cannot help but interact, either to

assimilate it or to reject it, using it remains a challenge for the vast majority of those interviewed, and stances like these can denote resentment and rivalry, since teachers with more dynamic lessons often end up being more popular among students, with the principal and the coordinators.

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I've had the opportunity to see situations when the teacher becomes a piece of the technology, when he or she is so within it that he or she cannot do otherwise. They get imprisoned and limited. (Teachers, High)

”

I take up my modem in order to use it. I try to show the other teachers that it would be very easy. (Teachers, Middle)

4.2.1.2

Summary of the ICT engagement styles

Below, we summarize the five engagement styles and their main features:

Table 8.1: Summary of the profiles of teacher ICT engagement styles

	Trailblazer	Receptive	Perseverant	Apprehensive	Avoiding

Main Features	<ul style="list-style-type: none"> » Makes widespread use of technology (personal and professional) » Researches tools and new content » Looks for ways to make lessons more attractive » Aims to reach the expectations from above and builds rapport with student through technology 	<ul style="list-style-type: none"> » Makes widespread use of technology for personal matters and in the planning of lessons » Has a focus on fulfillment of the class program » Considers that it is not worth the effort to configure the ICTs » Values more the results than the experience itself 	<ul style="list-style-type: none"> » Feels fragility and lack of authority for not mastering the technological universe » Wants to engage with ICTs » Is willing to learn » Relies on others (including students) » Needs support 	<ul style="list-style-type: none"> » Feels that excess is harmful » Is afraid of losing control (over technology and loss of identity as a teacher / person) » Restricts the use of technological tools and internet access 	<ul style="list-style-type: none"> » Has no intimacy with the world of technology (neither personal nor professional) » Is not disposed to develop intimacy » Views access into the digital world as an imposition and is thus unwilling » Feels he or she has no skills and feels uncomfortable

(continue)

(Table 8.1 – continued)

In their own words	» At school I am the teacher who most uses technology in the classroom.	» It is a lesson that is not productive, so I'd rather not [go to the lab]	» I ended up learning the hard way.	» Technology comes to stay. It will become a metastasis, a cancer, and we have to know how to use it with balance.	» I know I have to do it, but I have no ability to do it. And, even if I did, it would not be the way that [the students] would like to receive it.
Feelings and Sensations	» Pride, satisfaction and joy	» Waste of time, low productivity, disposition conditioned by the environment	» Lack of knowhow on the subject, but willingness to learn and desire to show his or her ability	» Fear of losing control, and the focus of his or her core objectives; preference for traditional lessons	» Insecurity, discomfort from the lack of skills; does not want to talk about the topic
Facing the lack of structure	Purchases his or her own equipment	May use the lab or the video room for a specific activity	Adjusts the activities, and seeks to maintain the use of ICTs to the extent possible	May use the lab or the video room for a specific activity	Uses the situation to justify his or her position
Facing the lack of content in the educational network	Searches in different sources, produces new content and guides students to produce also	Searches in different sources, but only for classroom planning	Searches in new sources that he or she is discovering	Has contents already selected and saved	This situation does not affect their day-to-day life
Facing insufficient training	Already has basic skills to develop continuously	Already has the basic skills for continuous development	Strives to learn and asks for help, even from students	New skills are not priorities, because he or she already has the skills that they use	Uses the situation to justify his or her position
Action	Ally and Increase Count on them to develop new policies, to experience new tools, and to assist peers; provide more advanced training and online training	To provide conditions Provide support and provide training focusing on his or her discipline and online training	To provide support Support and provide focused trainings to encourage discoveries and new uses	To encourage Give support and provide trainings focused on benefits and control tools	To initiate Support and give trainings focused on basic skills, readiness and troubleshooting with practical approaches and in person

Source: Authors' creation

There is a great diversity in the universe of teachers in relation to ICT, which requires a close look at professional development. **Different engagement styles require different curriculum and may respond better to different approaches.** Some education administrators complain that the distance learning courses have been underutilized, as some educators have dedicated less than expected, relying on the help of others to complete the activities. Perhaps distance learning is not a continuing education approach appropriate to some engagement styles, such as the Avoiding style, whereas Trailblazers may respond very well to it.

In addition, **when analyzing the different engagement styles, we can, more easily, think of a curriculum that responds to their levels of digital literacy and their pedagogical use of ICTs.** Courses that cover theory, much criticized by some teachers, may be more desirable for those with an Apprehensive style for the Avoiding one. On the other hand, programs with more advanced tools can be very important for Trailblazers to improve their uses.

Importantly, **the generational issue may explain the level of digital literacy of teachers in general, but does not necessarily explain their propensity to pedagogical use of ICTs in the classroom:** although no young teacher was found that would be characterized within the Avoiding style, several young teachers can be characterized in the research as Apprehensive or even as Receptive, while we find older teachers in the group of Trailblazers and the Perseverant styles. Thus, other **features such as previous experiences and trajectories associated with the infrastructure environment in school are more explanatory of the pedagogical use than age itself;** and good training programs for teachers that focus on their characteristics can equalize these differences.

Although ICTs are physically present in school environments in the studied capital cities, those with different engagement style teachers face them differently and explain their underuse – a fact that is due not only to the teachers' characteristics, which could

be further explored from the point of view of training, but also to the difficulties presented by the insufficient infrastructure in public school systems. Undoubtedly, with appropriate training and infrastructure, some engagement styles could make pedagogical use of ICTs much more frequently than they currently do. And, with a pedagogical plan of the departments of education and digital content, as discussed in previous chapters, the actions tend to converge to a positive scenario of integrating ICTs in the teaching-learning process.

Future studies to further investigate the teachers' engagement styles presented here can raise their number in the school systems, tailor the necessary courses and explore new training approaches.

4.2.2

Forms of ICT use by teachers in schools

When asked about the frequency of use of ICTs in their classes in the two weeks prior to the survey, teachers mostly reported having used ICTs in less than half of their classes. Some affirmed not having used them at all, with the main reasons stated being: the limitations of **infrastructure**, including equipment, combined with the lack of adequate **training**, including access to the Linux operating system, adopted in some educational networks and ProInfo laboratories, and not fully known by the teachers. Rarely did they report high frequency of use.

Despite the limited use, some examples were given of how technologies have been used in the teaching-learning processes.

Content exposure

- » Use of the screen and data projector in the classroom or auditorium to show or present some relevant material to the theme of the lesson. In these cases, most teachers prepare the material before and carry a Pendrive to avoid problems with the school infrastructure
- » Presentations prepared by groups of students in presentation software and shared with other students
- » Use of YouTube to project videos, tutorials and classes given by other teachers

Research

- » Going to the Computer Laboratory with students to research about a topic of interest
- » Use of the cell phone to check some data, or to use the calculator or a translator

Programming

- » Technology teachers teach students to program in Scratch, using games or using presentation software

Collaborative production

- » Collective creations using mobile phones from the teacher and the students (e.g. photographing the productions of the students and posting them at the teacher's blog, or producing videos)

Communication

- » Facebook Groups for the publication of texts and tips about what to read
- » Groups on WhatsApp to encourage some activities

Several teachers have, individually, been trying to diversify their lessons including ICTs. Among those who have overcome the barrier of entering the technological universe, the difficulty is to think of a planned and effective pedagogical use to absorb all the potential that ICTs can provide. An expression of this is that some of the examples of technological use given by the teachers **reproduce already established class standards**, mainly for content exposure.

Pointing to other possibilities, we also see technology being used **as a communication facilitator** – being this a function already fully disseminated for personal uses – which seems to be gaining ground in the teacher-student relationship – and to develop more informational skills, **such as producing and publishing online content and conducting research on the Internet**.

Mapping and systematizing the density and consistency of these uses is essential to contribute to future evaluation studies on the impact of the use of ICT in learning. It is evident that there is still no consistency or regularity of use, nor guidelines that conduct teachers in the classroom for this purpose, leaving the responsibility up to themselves of searching for online content and of deciding about the best approaches and applications for the devices, a scenario which tends to bring a less positive impact on learning, according to Ortiz & Cristia (2014).

No experiment with uses of digital content platforms, available for some school systems, was mentioned – which is a possible expression of the short-term existence or of the poorly disseminated use.

4.3

Schools and technology

4.3.1

The environment of aspirations and pressures

Perhaps few expectations of change in education have been as large as those associated with the integration of digital technologies in the educational process. With the considerable investments made by states, municipalities and the federal government, and the arrival of varied equipment in schools, the pressure to increase the integration of ICTs increases. Pedagogical coordinators and directors play an important role in this context, to point out the directions and expectations.

The pressure, combined with the expectations of having more dynamic classes, greater student engagement and a more effective learning, is clearly felt by teachers who react in different ways. The Apprehensive style, as well as the Avoiding style, sees the use of ICTs as a constant external demand, sometimes excessive. In full time schools, there were principals' reports stating that teachers had quit because they did not adapt to this environment.

Other teachers, especially those with Trailblazer and the Perseverant styles, who already put ICTs to use in their classes, have different positions, showing their uses and aspiring to integrate them more and more. So, they demand more standardization and better conditions of use, demonstrating expectations of practical actions by public authorities that make their wishes viable and meet their demands.

”

We, from the full time [school] receive a lot of demands, because they say to our faces all the time that we have all possible conditions to give that perfect class. And it's not like that. It does not happen. Students give us feedback through their participation, and we try to follow our feeling and will give the lessons according to the student. (Teachers, High)

”

I think we teachers are not mature enough for such technology, to filter this much information. It is very new. It's a lot of technology, it's too much pressure. (Teachers, High)

”

Technology is a very major advance in our time. It has created that expectation that we can work better. I have many difficulties as well. So, it was only with much effort that I became able to do what I do, but I have always realized that there was that expectation, “you have to learn.” (Teachers, High)

4.3.1.1

Infrastructure

The use of technology in public schools meets relevant physical barriers, which are reflected in the handling of the available technological equipment and, ultimately, hamper the use of ICTs for pedagogical purpose.

”

In our school, computers were kept stored without use because there was no fiber optic. I think it took 6 years to install fiber optics and to install the same computers that were already outdated. (Teachers, Middle)

”

The school had a desktop computer in the coordination office, one in the staff room, two in the main office, but they were stolen and now there are none in the main office. So, every teacher finds their own way; they carry with them their backpacks with their notebooks. There is wi-fi connection, but it is not made available to us, not even to the coordinators because, otherwise, the intranet stops working. As the main office depends on the intranet, which is hyper, mega slow, so each one finds his or her own way! (Teachers, Middle)

”

I work in two schools; one of them has wi-fi connection and computers, but the other doesn't. I have to keep carrying the TV. There are very antagonistic realities today in the state. (Teachers, High)

”

In my discipline, I do not use it much, but I see colleagues who use it a lot: they show video, movies, because the school is able to provide it. But everything has a schedule and we have to book it because what is available is not enough. (Teachers, High)

The teachers' views confirm the heterogeneous scenarios found through the interviews in the departments of education. The vast majority is emphatic in affirming that the infrastructure in schools does not seem appropriate for the expected uses of technological equipment available for the users. The electric grid has not been changed to support the load required by the widespread and consistent use of ICT. Internet access is precarious and limited to a few school staff members, who often belong to the administrative and management areas. Not all schools have wi-fi connections and, when they do, the signal is restricted to a few people and school environments, and at a low speed. No wonder teachers and students have routed the signal of their cellular phones to access the Internet in certain circumstances. The bureaucracy and difficult contact with the Internet companies are mentioned because they cause delays in the requests and installations.

However, there are some teachers who have good infrastructure available, although not always accessible because it is a limited resource and because there are other teachers using it.

Still concerning the infrastructure, for the interviewed teachers, the available equipment does not meet the usage demands. Both in terms of quantity – it does not match the number of students per class – and in terms of quality – for example the tablets purchased via federal government, a topic we will discuss later. This negative perception may have a greater or a lesser impact on the use of ICTs in schools, depending on the engagement style of the educator. Nevertheless, it is essential that the administration of the departments of education have more effective plans to improve the schools infrastructure in order to facilitate the use and mitigate possible predispositions to not using ICTs.

I. Computing environments: logistic challenges impede use

The vast majority of teachers have mentioned that there are laboratories or computer rooms in their schools, but they said their use is limited to a few professionals. The reasons for not using these places go from difficulty of access, such as having to wait for their shift and having to schedule in advance; the privileging of some teachers and their subjects; the need to configure the equipment themselves; and, finally, moving students around and loss of time. Making students move around is not viewed positively by the schools administration because it causes turmoil, indiscipline, and the coming and going takes away from class time for going; and this moving around also occurs when there are projections of material, because there is no projection equipment in the classrooms.

”

I think most schools have a computer room, but I'll speak for my school. The teacher who intends to use it has to schedule a time for it; but most teachers do not take students there because they fear indiscipline.

(Teachers, High)

”

The detail is that, at my school, there are 10 teachers, and a laboratory, but those who use it are just the arts teacher and I; the others find it complicated and have given up.

(Teachers, Middle)

II. The trend to equip classrooms

Reports from teachers confirm the trend of states and municipalities to provide mobile technologies to facilitate the use of ICT in an integrated way in classrooms, with tablets, notebooks, and also mention projectors and digital whiteboards. This alternative serves, to some extent, the demands of not making students move around, avowing their undesirable consequences, such as loss of time and loss of focus from students.

However, the teachers' criticisms point to a lack of clarity regarding the use of the equipment, and their availability. Something that also bothers teachers is that they have to schedule the use of the equipment beforehand, which requires planning, sometimes a few weeks in advance. In this case, as more teachers begin to use the available technologies, models such as the sharing of equipment carts among classrooms impose limitations on use, since the number of carts would not meet the required amount to serve all the rooms.

”

If we had more time to use them in the classroom, it would be better, because we are not alone in school; the other teachers also want to use them and we see that there are improvements in lessons. Students participate a lot. They like it, right? But, unfortunately, we cannot all the time be carrying that device around, bringing it everywhere.

(Teachers, Middle)

”

I use them, but when there are many students, it is not possible. There are many rooms, and other teachers have already scheduled it. There are teachers who take them the whole week for them and then you end up letting go. Then you promise a movie for the students and they keep demanding it from you.

(Teachers, High)

Smart boards had generated great expectations when they were announced; but, when they arrived, they disappointed many teachers because their use necessitated connectivity that was nonexistent in most classrooms. In addition to this, in some cases, teachers report that only one smart board was received for the whole school, which also frustrated the expectations of use that teachers had imagined for this equipment –of having this technology available in the classroom.

III. The tendency to equip teachers: notebooks and tablets

States and municipalities have made the distribution of laptops to teachers, who view these actions favorably. Notebooks are more positively assessed within the list of available equipment because they offer a robustness similar to a desktop computer, but are lightweight, portable and, hence, more practical. Some teachers, however, criticize the notebooks received because of their limited ability to access the Internet and because of their little memory space.

Tablets are seen as modern, practical, and lightweight and also have the advantage of mobility and can be carried with much more ease than notebooks and, therefore, they could be a great alternative for teachers and students. However, at the same time, the distributed tablets are more fragile and vulnerable to falls and damage. Teachers also mention the limitations and the little memory capacity. The tablets distributed to high school teachers by the federal government were unused by a large portion of them. When we showed the image of a tablet, and asked the high school teachers to write down on paper any words that came to mind, the words that we got were:

Figure 8.1: Tablet – Stimulus used in the focus groups

Source: Internet

These projections show that, while the teachers see the distribution of devices to the public schools as positive, there is the need for training and guidance for the use and we have noticed **a strong disappointment with the received equipment and their abandonment**.

The biggest complaint among teachers is related with **the poor quality and outdated technology of the tablets**, with low speed, low storage capacity, and little accuracy at the touch screen system. The difficulty to register oneself, the constant crashes and the problems with loading were also mentioned. The comparison with the privately owned equipment, when they have them, or other equipment received directly from their school systems, is inevitable; and, in the interviews, personal devices or devices purchased by local networks were considered better and more modern than the “little yellow ones” purchased with money from the federal government.

For teachers, the limited concern with teachers accounts for the low quality of the equipment. **This fact is interpreted in relation to a larger context of disappointments with the pay and the working conditions. Administration problems are also cited:** the

time between the purchase and the arrival of the devices in schools is seen as a cause for the equipment's obsolescence. The desire to be consulted before the acquisitions is constant.

Given this scenario, **the vast majority of teachers do not mention the use of the equipment** – some gave them to their children, and many put them away due to not having good user experience. A few, who reported using them, do that at home and not at school, because they associate the use of the tablet to the availability of Internet connectivity, not accessible at work.

Confirming this scenario, during the visit to schools conducted in this research, **we found only one teacher using the tablet in the classroom**, where she consulted physics exercises saved on the device. We also found the tablet being used by school inspectors to facilitate communication between the administrative staff in a quite large full time school building served with wi-fi. In more than one school, we were told that the tablets were stored away by decision of the directors, for fear of being blamed for something, or because they were waiting for directions for distribution.

Figure 8.2: School inspector in Amazonas and a teacher in Bahia using the tablet

Source: Amazon State Secretariat of Education and Bahia State Secretariat of Education

Figure 8.3: Equipment still kept unused in a school

Source: State School

The distribution of tablets to high school teachers, acquired via the first price registration process, held by the federal government in 2012, was not a success. Teachers' testimonials show that most tablets were kept unused, or with little use, due to technical limitations of the equipment itself and to the lack of support. The lack of infrastructure for the use of wi-fi in schools, and the lack of guidelines to encourage the use, also contributed to this scenario.

Some school systems had recently implemented or were in the implementation process of the online attendance reports during the course of this research, and the tablet was considered an ideal device for teachers to feed this kind of information daily. Although this

”

I feel more satisfied with the municipality's notebook than with the tablet purchased by the state. Working with the tablet is difficult and, moreover, it is very light and it may fall; it is easy to break. (Teachers, Middle)

”

Working with the tablet is very bad. At home, the wi-fi allows Internet access, but I think it is so slow, so slow, that I left the tablet with my daughter. (Teachers, Middle)

”

The notebook, I use it, but the tablet is at home; it has never worked. (Teachers, Middle)

”

The tablets come with obsolete programs; so, some teachers didn't even want to take [them] because of that commitment you have to sign the paper and commit to taking a course where you will learn to use it as a pedagogical tool. So, most of my colleagues from the state schools didn't want to get it. Where's this training? (Teachers, Middle)

”

I also use it only at home, because, in the school, it is not possible. And, if you take it to the video room to connect it, the equipment in that room is full of viruses. So, if I had used it there, I would have ruined it. (Teachers, High)

”

The tablet that the government has purchased does not recognize the digital board; it only accepts wi-fi connection. It does not accept 3G. Mine, if I knew, I would not even have accepted it [when distributed]. It is thrown somewhere in the car; it only works with Internet. It is not compatible with chips neither with modems. (Teachers, High)

”

The tablet is already slow, and the school connection is slow; then the connection keeps dropping all the time. There's no way to use it. (Teachers, High)

”

We are already used to a more advanced technology; then, we have no patience to use another one. It was already obsolete when it came to us. (Teachers, High)

”

This gift, instead of improving our work, made it worse; and the worst thing is that they informed us that we, teachers, do not know how to use it. But it's not because we do not know, it is because it is outdated. (Teachers, High)

”

In my school, the equipment that arrived was the tablet. At first, they said that those would be for use in the classroom and, after almost two years, the tablet ended up being used for us teachers to type our lessons materials, and do our educational work, which are the attendance reports, the lesson plans and the grades. But the worst thing is that my tablet does not synchronize data; so I stopped using the tablet because I typed things, tried to synchronize the data, but, at the end of the day, where was everything? The data had disappeared. (Teachers, Middle)

”

For example, in state schools, the reports are no longer on paper; it ended, it's all online. It is great and it made things easier for the coordinators, and for us, teachers. For example, you attributed to the student a grade that said "unsatisfactory", and there were also recommendations to parents, to the student... and there are the grids, you just have to click. (Teachers, Middle)

”

You know what's funny? They start the processes and do not ask us anything. What would be best for you, teachers? What is better for your school, a notebook or a tablet? What brand? What model? Which one? You know, we do not have autonomy. Everything is 'thrown' from the top down. (Teachers, High)

”

Before, you would need to have a consultation with the teacher to learn what device he or she needs, to learn if the tablet is needed, to learn which kind of tablet you need, and not get [any brand] because you are a friend of the company's president and get some commission. Maybe you do not need a tablet and you need something else. An ultra book, for example. (Teachers, High)

”

The tablets have arrived! All teachers from the 3rd grade have to go to the sports court." We went there with the greatest happiness in the world. Imagine, making our student happy for receiving a tablet; it was all they wanted. We got there; we saw those tables for us to sit at, and a little pile of tables. How many tablets were there? 20. It is not enough for a group! Each classroom has 45 students. Oh, for the love of God, making a fool of us in front of the students! (Teachers, High)

”

There is a misuse of public resources. The state bought 50,000 computers at the time, for R\$ 1,800.00 each, and the same notebook configuration at Ponto Frio (a Brazilian store) cost R\$ 1,100.00. It is hard for me to understand why the state system, at such a big purchase, paid way much more than retail. Another thing is the obsolescence of the equipment that we receive. The tablet – the equipment that arrives in the faculty's hands – should last longer so that we could make better use of all the features it offers; but, unfortunately, this has not been our reality. (Teachers, High)

”

And what is most revolting is that the government has invested money in bidding, but the way it was conducted was inadequate; it was public money thrown away. These tablets belong to a model that is not even sold. The Android system in them is that old version. Then you start to analyze that, for us, what comes is always junk, outdated things, there are no replacement parts. You will see that there are schools that started the process last year and the teacher did not even see this tablet; they are stuck in storage somewhere because of the bureaucracy. (Teachers, High)

experience was rarely reported in the groups, it was possible to realize that it faced the same difficulties related to infrastructure and connectivity that have already been mentioned.

IV. Distrust of the government and criticisms on the lack of participation

Teachers express a lot of criticism regarding how governments, in all stages, have conducted the acquisition and distribution of digital devices. The main complaints fall on the exclusion of teachers from the process, that is, a lack of dialogue with the end user. What is also clear is that teachers feel bothered by the great importance given by administrators to the public delivery of equipment, as well as by the lack of faith they feel in relation to the purchasing processes.

V. Maintenance and technical assistance: a constant problem

The technical assistance for the school equipment is perceived as very problematic. The teachers mention the lack of funds for maintenance and, when there is assistance, they speak of long and slow bureaucratic processes – which, ultimately, discourage them not

only from using the equipment, but also asking for repairs when the devices present some kind of problem.

4.3.2

Teacher training: reality and desire

Within this context of difficulties, shortcomings, teachers are exposed to the equipment, and the demands resulting from their use, with little or no training. Those who were already integrated with ICTs before the equipment got to the schools, felt more at ease to handle the devices delivered to them (notebooks, tablets); others, however, who are that constitute the majority, felt very helpless and frustrated, because they wanted to make good use of the new tools.

Lack of skills aggravated the reservations of many teachers, encouraging them to stay in their comfort zones, in addition to not enabling any progress among those willing to learn. This training, according to the teachers, **should meet requirements related to the use of the equipment, the contents and the handling of the available programs and applications**, while maintaining a focus on both teachers and students, each group with their specific needs. The practical approach, focused on real classroom situations, and on each teacher's subject, is often solicited, whereas the trainings they have today are widely criticized, with rare exceptions.

When we showed teachers the picture below, which simulates training for the use of tablets, and asked them to write a word that came to mind, these were the most cited words:

Figure 8.4: Teacher Training – Stimulus used in the focus groups

Search
Without hurry
Meeting (a serious one)
Possibility x difficulty
Disappointment
Being fooled
Sameness/ Routine
Traditionalism

Source: Internet.

”

When you have maintenance issues, there is no specific budget for it; what funding already has a destination. Then, once there is a problem, the equipment is set aside because it is government property, it is public property; you have to keep a little room reserved only for [electronic] waste. (Teachers, High)

”
You have to teach technological didactics, because it is no use only providing the equipment, right? How are you going to take what exists at the school and what is there on the Internet and use it pedagogically? (Teachers, Middle)

”
It has to be a practical training because one thing I don't like is when I go to training and people only want to reflect, and reflect. The classroom does not allow for this reflection. You have to get out there and you have to master the tool and show the student what you know; but the student looks at you and says, 'that's it, another teacher who knows nothing, who has nothing new to show me...' (Teachers, Middle)

”
I go for trainings provided by the city. We always have trainings. There you show what you know, you make your colleagues take part of what you already know how to do. If it worked for you, why won't it work out for them too? (Teachers, High)

”
There is a partnership with the municipal department of education to work with school videos. I took this course. Very good. It deals with short movies and things like that; and we work with cameras, with the cell phone and also with a computer with Internet. It's cool. (Teachers, Middle)

”
I think schools have had some autonomy. The teachers and coordinators were told to attend the training [of the new administrative system] in a pedagogical meeting. So, what the [pedagogical] coordinators did was: they dismembered this pedagogical meeting and received two teachers at a time. So, I did not go into the classroom and attended the training on management system. This was done with the whole school and lasted a long time. It was hard for coordinators; they were raw at first; but, later, it was easy. (Teachers, Middle)

These projections help us understand that **initiatives to train teachers, so that they feel able to integrate ICTs in their classes, usually fail to achieve their goals**, either because they are courses administered using traditional and routine training models, or because they are unsystematic and inadequate, or even because they are not yet connected to the specific needs of the different school subjects. Due to the lack of digital content and clear objectives in the school systems to use the new tools, the training is usually limited to technical and operational literacy of the use and recognition of devices and operating systems (ROSA & DIAS, 2012), without considering informational literacy or the different ICT engagement styles of teachers and their different stages of use. All these factors contribute to the disinterest and disappointment expressed by educators.

The expectations of administrators of the departments from the teachers to deliver more stimulating lessons for students, are also the expectations of teachers for their in-service training.

The interviewed teachers yearn for **practical trainings** that simulate the activities that they could apply in the classroom, putting the in-train teacher in the role of a teacher and also a student.

The **multiplier model** – used by some school systems due to the lack of staff and structure to reach all educators – commonly does not work: the teachers who received the training do not have time to pass their

knowledge on to their peers, who, on their side, do not show any willingness to accept instruction from those who have just learned.

The courses focused on **career progression** are also criticized for their poor effectiveness: they take them out of obligation. Furthermore, there are cases of teachers who have never received training, with undesirable consequences for those who still have difficulties approaching ICTs.

There are complaints about the **logistics of the courses** in different departments of education. Teachers affirm that they are held at inappropriate times, with limited spots and, when they are in person, they are offered in remote areas difficult to get to. In addition to this, there is the perception that the advertising about them is lacking and, thus, only a few teachers become aware.

The teachers testimonials explicitly express the difficulties that the departments of education have, with their limited educational technology structures, in meeting the increasing demands to accompany the arrival of the equipment in the schools.

”

In a school that has 80 teachers, only two took the course; and when are they going to be able to pass on their knowledge? (Teachers, Middle)

”

It's not something I'm doing voluntarily; it makes me want to give up. But, as I know that if I give up, I will not get my raise, I do it. But I access the platform feeling hatred, because I'm being forced to do something. (Teachers, High)

”

I think there should be a government policy. The tablets arrived, and all teachers are required to take the course or else they lose the working day. The government offers a sporadic course. If everyone were to take it, there would not be enough spots, so those who signed up [did so because] they learned about it by chance. If it were well advertised, there would not be sufficient spots. (Teachers, High)

”

If the government wants us to use all the technological tools, it would be like obvious that they would have to offer us a course where they explained to us all the skills that we would need to have to deal with that equipment. (Teachers, High)

”

A math teacher who takes students to the computer room and tries to propose an assignment in a chess program, or through educational games used for memorization, for example about multiplication tables, trigonometry, she does not even know where it is, or how to access it. She starts to get frightened. She won't try to mess with it because it's the schools, she's afraid of damaging it. So, you start to have a lot of insecurities, because there was no training. When you need some information and you go into the main office, and ask for help, no one knows. To avoid finishing the lesson before the time, the teacher navigates on the Internet and the students stay there browsing, great. (Teachers, High)

4.3.2.1

Pedagogical support for ICTs

As seen in the previous chapter, **the pedagogical support for the use of ICTs has not been implemented in all school systems**, and it varies among those schools that have already implemented them. There may be a technology teacher with scheduled time inside the students' schedule; technology monitors, who are students; technology mediators, who visit schools regularly; computer technicians, among others.

”

Each school would need to have a specific professional to take care of the technology, a responsible technician. (Teachers, High)

”

[We should have] a helper, or two trained teachers per room, good quality wi-fi in every school and passwords, to prevent students from using the connection without purpose. (Teachers, Middle)

”

I think there should be a government project. A multiplying agent came here, but he can only be here once a week to teach these technologies to the teachers; he only has two hours in each school. No one can sit with him. He only stays for two hours. It never fits. (Teachers, High)

Teachers recognize the need for support to assist them in their ICT use, and demand these roles. However, even school systems that have implemented these functions face objections due to their insufficient personnel and their limits to meet all the demands.

On these professionals, at different levels, the teachers place expectations to for them to teach them the proper use of the equipment for the purpose of generating attractive and dynamic educational content. However, in school systems where there are technology teachers who have their own classrooms, their focus is on students. As they give their classes in laboratories, these end up being their classrooms, and some conflicts are created between these teachers and others. There are complaints that the laboratories or equipment are used exclusively, or determined, by these teachers, making it difficult for others who do not yet feel as comfortable with the technology.

On the other hand, school networks that have technology mediators have presented logistical problems to reconcile the schedules of the teachers with their classroom visits. Typically, they are responsible for several schools and they need to guarantee a minimum numbers of visits.

What is noticeable is that for the pedagogical advice to be successful it must necessarily be grounded on an ICT integration plan that guides their work. In addition to this, it is fundamental to have cla-

ality about the target audience. You need to be clear whether the learners will be teachers or students. The technology teacher will rarely be able to share his or her focus with students and teachers at the same time, and, paradoxically, he or she may start to be used by peers as the expert in ICTs, to whom the demands should be directed, mitigating the peer effort to do things for themselves. Finally, the management of the pedagogical advisory work needs to be well planned: arrangements to ensure the monitoring of a viable number of teachers and tools to monitor the progresses and the difficulties, and also coordinators to assist them in their thinking of strategies, among other things. They need to be part of such planning.

4.3.3 Digital content used

To make use of ICTs in schools, it is necessary that the teachers think of the digital content that their lessons can address and how the subjects can be addressed, besides thinking of the teaching materials available on the web.

Today, the availability of the content of school systems linked to the academic curriculum is scarce and, where the availability of digital content is more advanced, such as in Bahia, Parana, São Paulo, not all teachers know how to use the resources. When teachers are prompted, for example, to evaluate the sites of their departments of education containing content, they consider it a good idea; however, in some school networks, there are problems of navigability, of content search, and some teachers have mentioned mistakes that other teachers have found there.

By listening to teachers discussions in the focus groups, it became clear that some of them, especially those closest to technology, access different portals, websites or blogs, to consult contents to study, to catch up and to get inspired to plan their lessons.

Among the various reference sources cited, the most mentioned one was the *Portal do Professor* (Teacher Portal), praised for its vast material, where you can also download videos. But many other examples (below) guide us as to what kinds of content teachers have consulted more often in the absence of specific materials in their school systems.

Educational Portals

- » *Cidade do Conhecimento* (City of Knowledge) – Portal of the State Department of Education of Curitiba
- » *Currículo +* (Curriculum +) – Portal of the State Department of Education of São Paulo
- » *Dia-a-Dia Educação* (Day-to-Day Education) – Portal of the State Department of Education of Paraná
- » *Portal do Positivo* – (Positivo Portal)
- » *Portal do Professor* (Teacher's Portal)

The general evaluations of the teachers point to the expectation of having materials focused on their disciplines, well-organized materials and with an easy search mechanism. They hope to have up-to-date and ready for use materials. Portals with old posts are considered outdated and generates distance. Teachers also cite portals that belong to their school systems and to the MEC, offering services and information about projects and programs.

The Teacher Portal (*Portal do Professor*) is the most often mentioned portal among the interviewed teachers, with suggestions of classes, courses, diverse educational materials, including educational games. As the portals that belong to the educational networks are, for the most part, more recent, and given the heterogeneous engagement styles of the teachers, they were often mentioned after prompting of the moderator, suggesting a disjunction between the communications of departments of education and the engagement of educators.

Platforms and educational sites

- » Geekie - adaptive learning platform with solutions for teachers and students.
- » Racha Cuca (Puzzles) - site dedicated to offering varied games that develop students' skills in different areas: cognition, reasoning, logic, etc.
- » Sites from public universities - consulted for sample questions for entrance examinations
- » Sites from book publishers - with books, videos, simulators, movies, etc. for consultation
- » Teacher Tube - community that shares varied educational videos with teachers, students and parents
- » TV Escola (School TV) - public television from the Ministry of Education where you can consult videos and materials aimed at students

Knowledge Networks

- » *Café História* (History Cafe) - a social network focusing on history, with over 59,000 members and groups of interest with diverse subjects
- » Professores Unidos (United Teachers) - Permanent Forum on Facebook, with nearly 30,000 participants, which enables teachers to comment on matters of interest and current events related to the field of education
- » Conexão Escola (School Connection) - State Department of Education of Parana - Site that enables connections between schools and communities. Exhibition of projects and events that can be inspiring to other schools

Social networks bringing together teachers around their interests are a trend on several educational portals, hoping to mobilize and connect educators online.

Café História, *Professores Unidos* and *Conexão Escola* were cited as sources and forums that are accessed and useful.

Searches (General)

- » Google - the search engine often used for searches and research in general
- » Edubar - Linux Educational toolbar, which aims to facilitate access to educational applications such as *Domínio Público* (Public Domain), *TV Escola* and other utilities available on devices.

Query tools are the first entry for teachers on the web when they want to search for something. In addition to Google, tools that bring shortcuts to contents of their interest, such as Edubar, are cited as helping to locate them.

Articles and News

- » *Nova Escola* (New School) - site that offers an extensive menu of topics related to education. Columns and blogs written by experts, suggestions for lesson plans. In-depth discussion of important issues.
- » *Info Escola* (Info School) - news site related to courses and competitions in the field of education, content related to different school subjects
- » Sites and Facebook pages that belong to the schools - used to view, post, inquire, verify schedules, etc.

In addition to pages of publications and news portals of education, it is increasingly common for teachers to participate in their schools pages, created on social networks.

Other content

- » *Café Filosófico* (Philosophical Cafe) – this project includes a site, some events and a TV show – it provides access to suggestions of books, music, videos, and speakers addressing various topics

- » Discovery Channel – videos, news, documentaries that can illustrate and supplement educational themes
- » YouTube – for checking videos of well known and respected teachers such as professors from the University of São Paulo (USP), teacher Jubilut, and others

Accessing videos is salient as a source of information, not directly related to education. Platforms like YouTube, TV shows and documentaries are cited in detriment to articles written for newspapers and magazines.

It is worth noting YouTube Channels produced by teachers, which are highlighted for their school appropriate language and content according to grade levels, as well as for the tests they bring, like ENEM, etc.

There is a range of content sources that have served as the basis for the preparation of lessons and been used within the class, depending on their engagement style and the resources available in their schools. It is possible to notice a varied repertoire, with sites that provide virtual learning objects predominating, such as educational portals and sites, along with education-specific platforms, still limited in the country.

In any case, it is necessary to underscore that the consultation of these sites respond to immediate needs, not reaching all teachers, while also varying widely in frequency and consistency, allowing us to conclude that the support of these contents, to help the use of ICTs by teachers, it is still quite limited.

The long working hours, of up to three shifts in parallel in different school systems, results in the lack of time to plan and systematize lessons and themes, or to navigate freely through the material and think of different approaches. Most commonly, the sources are used to seek new formats and specific materials in an ad hoc way, since direction from the educational networks is absent or limited.

”

To prepare the lessons, I go on YouTube; I go on Google and start building. Then, I take the prepared plan to the classroom in the notebook, and give the lesson normally.
(Teachers, High)

”

The portal [our network] is old, out of date. He is in need of an update. Its quality has fallen.
(Teachers, High)

”

I've used the MEC Portal. It is a good one, with interesting material. I looked at it, I took a few things, I managed to get some things; but I it was one or two times at most. (Teachers, High)

”

I use the website from FTD, Moderna (book publishers); they are the ones I use more, more to watch videos, see books. Some have a video related to ENEM issues; it is more practical to get. You don't need to search a lot. (Teachers, High)

5

ICT IMPLEMENTATION PROJECTS IN SCHOOLS, ACCORDING TO THE DESIRES OF THE TEACHERS

To understand how teachers idealize the implementation of ICTs in their work environments, we asked them to make a list of what was essential in a successful implementation plan.

The idealized projects are made up of several stages, considering not only the physical part of the process, but also the intellectual and pedagogical ones, and can come to help define some elements in common. We have summarized here the teachers' wishes, in a single project, how the implementation of ICTs in their school systems should ideally be.

Infrastructural issues

- » Installation of good quality infrastructure, suitable and compatible to the needs of each school, region, city and state (cables, plugs, adapters, broadband - optic fiber, modem, router, wi-fi, provider)

Prior consultation

- » Previous research with teachers to discuss the acquisition of ICTs

Adequate installations

- » The adequacy of the physical environment. Ideally, each classroom would have all the technological apparatus available to prevent the need to schedules and / or move the students to other spaces. They cite notebooks, tablets, smart boards, projectors, and speakers, digital TVs with USB and Internet access,

printers. A mobile laboratory could possibly be an alternative solution. Teachers would like to have:

- » Fewer students per class (ideally, between 20 and 30);
- » Security guarantee to students and school equipment;
- » Inspection in schools to enable them to use the equipment.

Support

- » The Technician
 - » To meet practical needs, like updating software, installation of applications, and to perform any repairs to the equipment;
 - » Equipment purchases that are swift and with little bureaucracy, to avoid discouraging use and to avoid the obsolescence of equipment and programs;

Agile and competent assistance.

Training

- » Courses for teachers in order to learn all the uses and potentialities of each equipment – Technical-Operational literacy (ROSA & DIAS, 2012);
- » Courses that show how to integrate the use of different technologies with appropriate pedagogical content, especially developed for use with ICTs – Pedagogical-Technological Knowledge (MISHRA & KOEHLER, 2006). Teachers would like:
 - » Consideration of different school subjects in these trainings, because the needs are discipline-specific;
 - » Practical approaches that make you feel like you were in the classroom, facing the real problems that can arise;
 - » Systems that integrate test grading, inputting of students' grades, and class attendance – automation of tasks.

- » Software for the administration and control of students' tablets in class from the teacher's computer

Physical environment

- » The creation of specific rooms: rooms decorated according to themes
- » Where teachers have at their disposal a wide variety of materials and equipment in order to offer a lesson-experience to students. All the technological equipment would be available that can be collectively used in their disciplines.
- » In the classrooms, there would be laptops and tablets, for teachers and students, and a data projector.

The teachers' ideal conditions, when considering the integration of ICTs in schools, is an environment with technologies up and running, in which they have the skills to use them, and could count on support and an inspiring physical environment, which values their role as teachers and also the students' achievements. They seek logical solutions to the problems they face. For machines that do not work: a technician at school. For an Internet connection that does not work: optical fiber. For difficulties in use: training. For inadequate equipment: consultation with teachers before purchasing the equipment.

Rather than pointing to an implementation guide for public managers, this exercise with teachers aims to show **the main difficulties they would like to see addressed**. And it helps to understand **for what an ICT integration plan for the school systems should aim**, as shown in the following section.

5.1

Imagined environment after the implementation of their projects

The sensations and feelings that teachers experience in envisioning this project being implemented are mostly positive, involving themselves, the students and the school environment.

When imagining this project, teachers feel more motivated, secure in their abilities, but also frustrated by them. They feel happy, satisfied, using technology to their advantage, relieved, and, why not, imagine themselves having a dignified salary.

They imagine that their students are happy, take pleasure in learning and are involved in interesting projects.

They think of a modern school, providing an education that makes sense to the student and that is within their context.

It is an ideal world, reached after a successful ICT implementation project in schools and which would meet the wishes of the majority of the interviewed teachers.

Table 8.2: Aspects imagined by teachers thinking of a successful ICT implementation project

Teachers	Students	School
<ul style="list-style-type: none"> » Motivation » Security » Use of 3D technologies » Anxiety from having to learn how to use ICTs » Happiness » Professional Fulfillment » Less work (technology working in their favor) » Relief » Sensation of being heard » Adequate wage 	<ul style="list-style-type: none"> » Happy/excited » Learning » Enjoying learning » Interesting projects » Discipline » Interest 	<ul style="list-style-type: none"> » Modern » Integrated to the student's context » Meaningful education

Figures 8.5: Written testimonials from teachers when imagining their schools after the implementation of a successful ICT project

My gaze to 2024, students and motivated teachers for a production of knowledge, without these questions of how to use, simply use the three. A harmonious coexistence

*Sense of relief
Feelings of joy
Sense of satisfaction.
Sensation of seeing anxiety diminished. teachers and students)*

I'm imagining a classroom where all are seated. The class in a semi-circle everyone using notebooks and I sit lecturing with my notebook accessing the same content.

I noticed the arrival of my students looking forward to be in the classroom, satisfied and happy.

*School 2024
A school where teachers and students learn with joy
A well-equipped school, with everything working for more human education, practical, with sense/meaning
Professional satisfaction
How nice to be in that school*

A modern school
Feeling good.
Anxious because I have to
learn more about computing.
Students feeling more pleasure
in school engaged in the present.

I'm happy because I do not need to
work so hard anymore to support my
family. Today I earn a dignified salary.
I have a brand new classroom where
I find a latest generation notebook, a
big screen, wi-fi and tablets for
my students follow lessons.
I have my tablet too, I do not need to
take so much more work home anymore
for I use the technology of my choice
and he helps me.

2024 - Brazilian literature class

- feeling that my voice was heard -
after the study in 2014
- Rooms properly equipped with perfectly
functioning technological resources.
- Happy to be able to demonstrate
characters
- " Lifelike " in 3D, of " O cortiço".
- Class excited with the scenario reproduced
in the classroom.

I am happy at this school with a more
pleasant and productive environment.
Students and teachers working on
interesting projects and making their
productions. Students are researching and
learning with these technologies.

It is an education that meets
the demands of the modern
world, where the student
realizes his school is part of
this context, and not
disassociated.

CHAPTER 9

NEXT STEPS

1

MONITORING AND EVALUATION

As seen in Chapter 2, monitoring and evaluation of education in Brazil are uniquely strong due to the existence of the IDEB, an indicator that allows comparison schools in different states and municipalities for students' knowledge of both Portuguese and Mathematics, as measured by "Prova Brasil", and from the approvals index of the educational system. This experience, at federal level, have inspired local diagnostic assessments with a focus on Portuguese, Mathematics and, most recently, Science, and is a guidepost in the pursuit of quality education in the country.

On the other hand, monitoring and evaluation of initiatives and routinely implemented programs with the aim of generating corrective actions have shown to be very rare in the studied departments, resulting in limited objective accompaniment of projects involving the implementation of digital technology in school systems.

The School Census, a survey of great relevance produced by INEP, which, among other areas, takes inventory of existing technologies in schools, includes questions about the existence of computers and Internet. Despite creating important indicators of access with

such data, it has not yet been adapted to cover mobile technologies. And, because it only serves to objective of mapping, the Census does not include data on the usage of existing technologies and their appropriation in schools.

It is important to underscore that, as widely seen in this study, the existence of equipment is not indicative of the presence of mobile learning policies. **And any attempt to correlate the presence of equipment measured by the Census and the students' learning performance, will certainly not yield results that can point to the impact of ICTs in the schools.**

At the local level, municipal and state education departments present many difficulties in developing mechanisms to monitor and consistently assess the evolution of their initiatives, which also results from the lack of clear objectives in the planning of ICT policies in education and un-systemic approaches in terms of the pillars of infrastructure, digital content, and teachers training. Those departments that exhibit more progress in installing plans for the integration of ICTs in the curriculum, focusing on administration for learning, have more structure to develop monitoring and evaluation plans, but none have been developed in an institutionalized manner at the time of our field research.

In any event, even if there are no formally structured monitoring and evaluation programs, qualitative and quantitative studies, internally developed by the departments and the federal government, are gaining more and more traction. Educational technology teams have developed surveys with questions to be answered by technology mediators, based on their experiences in schools; teacher training teams have asked course participants to report on their

practices; the MEC and the departments have hired consultants to understand how acquired equipment has been used.

The ability to analyze the collected data is, however, still limited because **the evaluation tools that were created lack systematization and linking of responses as feedback for ongoing adjustments and corrective measures.**

Considering an entire monitoring and evaluation cycle, after diagnosis, made on the basis of variables representing the policy objective, there is a need for the systematization of collected information, which enables the formulation of action plans. Its implementation should ensure adjustments and corrective actions so that new diagnoses are made in a defined timeframe.

As a result, policies for the guided use of technologies in education tend to have monitoring and evaluation processes that are simpler to plan, as there is, necessarily, previous planning on the objectives to be achieved, as related by Ortiz & Cristia (2014).

“The evaluation of guided-use programs is simpler than nonguided-use programs. Because the former clearly define the expected use of computers and the areas of impact, it is possible to contrast expected with actual use and check the effects in the focused areas. In contrast, the evaluation of nonguided-use programs is more complex because there is no ‘model’ of use that can be compared with the practices observed in the field. In addition, the impact areas that the program is more likely to affect are not always defined” (ORTIZ & CRISTIA, 2014, p. 18)

”

At this time, we have a group of consultants doing evaluation to know the efficacy... Looking at the infrastructure, if the teacher is using it in the classroom. They are also evaluating the infrastructure of the NTEs. Another action is a consultant mapping what each state is doing. He is interviewing ProInfo coordinators in all states... (Federal Government)

”

You cannot measure [students' learning]; there is no document that legitimizes the results, anywhere. There's no return on this. We can even obtain results from the work that's happening [with the use of technologies]; then, the magazine comes, does an interview at the event, the teacher makes a presentation, receives congratulations [but] effectively measure it, we cannot, in any way. Schools that have technology labs, must have a change in the IDEB. We can't do this; we can't actually see the result (ET, Municipal)

”

No, [there is no formal assessment]. Everything is done in meetings; we talk, we ask how they are doing, it's all observation. (ET, State)

”

The media lab teachers are our legs and arms inside the school. They make a report and forward it to us. In this report, we have an entire inventory of equipment, Internet, teachers who use them, [number of] students they take there, resources used, all that. (ET, State)

”

We are going to roll out at the end of the year a more qualitative assessment to try to measure what impact [the platform] is having on the learning process. What we can perceive from the statements is that there is an enormous potential. It is not easy to move forward and it's necessary to build new models and evaluation tools to measure this. (Administration, State)

Box 9.1: The Saugus Program in Los Angeles, California

The program “Student Writing Achievement Through Technology Enhanced Collaboration” (SWATTEC) is a great example of the guided use of technologies in the Saugus district, north of Los Angeles, California, in the United States.

In this program, which began in 2009, all 4th grade students of the 15 district schools received a netbook and, according to the pedagogical plan, the use of the devices was set to be for 2 hours per day. The main activities included writing, editing and online research, besides using blogs and wiki pages. Initially, the program’s teachers went through 40 hours of training per year, for two years. Mentors in each school, responsible for monitoring the implementation of the initiative, received training with twice this course load.

The evaluation of the program was made by the professor and researcher at the University of California - Irvine, Mark Warschauer, who enthusiastically presented the results two years after the program began.

“The gains were sizeable, with students test scores increasing from 3rd to 4th grade at a 33% greater rate in English language arts after the program was implemented as compared to prior to implementation.”
(WARSCHAUER, 2011, p. 58, our translation)

For the author:

"The fact that at risk learners improved their growth in literacy at an especially high rate in the netbook program is thus a valuable outcome, and testament to the way that the Saugus program skillfully combined the appropriate hardware, software, curriculum, pedagogy, and professional development." (WARSCHAUER, 2011, p. 59)

Based on the arguments presented thus far, what is noteworthy about this program is the existence of an objective plan, focused on learning, with actions addressing all the pillars of mobile learning, and without losing sight of the monitoring and evaluation of the initiative in partnership with the university.

Figure 9.1: Saugus District students

Source: Program page on the Internet¹

We emphasize, therefore, that actions focused only on delivering digital devices to schools give little basis for monitoring and evaluation plans. On the other hand, **ICT integration initiatives, articulated in conjunction with learning improvement objectives, provide more substantive conditions to develop comprehensive indicators of program realities, which are attuned to results.**

¹ Available in: <http://community.saugusd.org/swattec/page/> Last access on the 18th June, 2015.

Figure 9.2: Monitoring and evaluation cycle

Source: Authors' creation

”

In one of the products, which they did, they sent a very generic survey and the schools answered... We bought [the ProInfo projector] in 2012, also, for all schools. So, what was it used for, how was it used, and such. And it was cool this assessment they did. In kindergarten, I thought: “The projector is there and they don’t use it for anything... there’s no Wi-Fi; so, it must be sort of dead”. But, then, I discovered that they used it to project movies. Because then, all right, if I spoke like this, “ah, a DVD and a projector also would do” but there, in the equipment, it is already connected. (IT, Municipal)

”

I think that, in the United States, we realize that many schools were able to get greater autonomy, and autonomy is done with decentralized resources, but, also with demands for results, and to talk about such demands in Brazil is a sin, and no one wants to be responsible for that. It’s the responsibility of parents, teachers, the administrator of the municipal and state departments, and the federal government, but we don’t have this culture. If we talk about sitting down and talking, it turns into a war. This culture of demanding actions, and verifying compliance and, if it not, someone has to answer, it’s lacking in Brazil. (ET, State)

Among the barriers for the development of monitoring and evaluation, is the **discontinuity of policies**, widely discussed in this study. In addition, **the lack of results-focused vision, with a more process-focused vision**, prevents spreading the benefits of monitoring and evaluating ongoing actions. On the other hand, while there is, among actors working in schools, the expectation that the quality of education improves, there is also **insecurity that the monitoring results of are considered solely the responsibility of their actions**, ignoring other factors contributing to low-learning environments.

In the departments, interviewees express the difficulty of putting in place evaluation processes, due to the lack of a propensity to discuss the theme, while, in the federal government, some report a disregard of evaluation results.

“...In-depth reports, such as those developed by the World Bank, relative to the first phase [of ProUCA], were neglected because they

are considered extremely pessimistic in their interpretation of the results since, within them, the emphasis was given to the problems and failures recorded upon the release of the first draft of the One Laptop per Child Project. (LAVINAS & VEIGA, 2012, p. 10)

Companies and organizations working in the implementation of education projects using technology, with learning improvement objectives, exhibit greater advances on this matter and are heterogeneous in their approaches. Process indicators are the most common: hours of use, content accessed, schools with greater access, etc. Results indicators, focused on student learning, were found in organizations that provide platforms in which there are evaluative tests that permit the systematization of skills and competencies. One organization also mentioned the realization an ongoing external evaluation, considering variation of knowledge over time, with initial testing and follow testing after a control period.

There are criticisms of the currently existing assessments, because they do not target the non-cognitive skills of students and the changes in the teaching-learning environment, resulting from the efficacious use of ICTs in schools. And, as a trend, evaluations via games are mentioned, where students, without realizing it, have their skills measured.

”

Often, municipalities acquire the resources, put them in schools, but don't do the appropriate follow-up; they don't demand it from the teacher, don't allow this teacher to have training, don't demand results, don't track results at the school, don't track what difference technology is really making. For example, that project [of the city] that had a 2.8 on the IDEB, reached 4.7 on the IDEB, in 2011. It is a very poor city, where 70% lives off of the "Bolsa Família". There are researchers in there, with universities doing research. We did a project with everything we needed; the result was very good. (Organizations)

”

Regarding the knowledge assessment, the effectiveness of knowledge, we will assess it through external evaluation, entrance exam, exit exam. We look at the data from the "Prova Brasil" and we look at the efficiency data from our own platform, and all that makes up the evaluation of the project. I know if it they are getting proficient or not, what content they are working on, at what speed, if there are things changing, that is part of the follow-up, but there is no way to cross this data outside of the platform; I do it only with the evaluations. (Organizations)

”

There is a new standardized evaluation module coming out now. So, you will have a module within the application (it should be out in the next two months, at the most), which connects with our server in the cloud, that can generate analyses, generate insights, give answers in real time, feedback in pedagogical terms. That feedback is for the teacher and the administrator. But, above all, for the teacher, because we are focused on the pedagogical part, on pedagogical impact. (Organizations)

”

We don't have such a big obsession for standardized assessments. So, it is like this: what is the school's mission? The school's mission is to bring content, to generate curiosity? Yes. But it also has to do with non-cognitive evaluation, the creation of values, the generating of culture, responsibility in citizens. There are "n" other variables that we recognize that won't be in the standardized evaluations, that the science of standardized assessments doesn't encompass, which are the testimonials... Testimonials on our website, where we have dozens and dozens of students, teachers, parents who say, "Look, this created interest in me", "This generated curiosity in me"... (Organizations)

”

A game, and the student learns playing, and doesn't know that he is learning and goes... and you evaluate whether or not he is learning with the game. So, it's something, a veiled evaluation, and I think it's the next level of evaluation that we will have, which is much better than you just putting a bunch of multiple choice questions, because there is the pressure of you being evaluated. (Administration, Municipal)

Based on the interviews conducted and the scenario found in the studied education departments, processes for monitoring and evaluation of mobile learning policies, such as defined in this report, should have not only students but also teachers as their target audience. This model doesn't ignore other school actors, but prioritizes the monitoring of the structure and of the actors present in the classroom, having in mind the costs of this phase of the project.

Indicators for the school should also be considered in order to consolidate both the results of teachers and students, and allowing for the monitoring of the pillars of infrastructure, digital content and teacher training of a mobile learning policy.

Given that each initiative should have its own design and implementation plan, the monitoring and evaluation plan, a component of a policy from its inception, should accompany the design of the project and be developed in line with its objectives and assumptions. Regardless of the project, in any case, **learning is the central are of focus for measuring the effectiveness of the initiative**. Surrounding it, emerge areas that impact results and that, if monitored, ongoing diagnosis can ensure frequent corrective actions.

In addition to addressing areas that lend themselves to more objective indicators, such as the availability of infrastructure, the monitoring and evaluation process will be more comprehensive if it also encompasses teachers and students satisfaction with the resources available and their self-perception of the teaching-learning process, in a manner that integrates aspects of the effectiveness of policies with the well-being of the target audience.

We list below the discussed areas to be addressed and subsequently present them graphically.

Table 9.1: Possible areas to be addressed in integrating monitoring and evaluation plans in mobile learning policies

Students	Teachers	School
Appropriation of technologies for pedagogical purposes	Appropriation of technologies for pedagogical purposes	Integration of ICTs in school curriculum (pedagogical-policy project)
Learning (curriculum)	Learning (learning process and pedagogical practices)	Availability of adequate infrastructure
Engagement	Engagement	Availability of digital content according to policy plan
Satisfaction with the available digital resources	Satisfaction with the available digital resources	Availability of continuing education according to the policy plan
Satisfaction with the teaching-learning process	Satisfaction with the teaching-learning process	
Self-perception of learning	Self-perception of lesson performance	
	Satisfaction with continuing education	

Source: Authors' creation

Figure 9.3: Areas to be addressed for monitoring and evaluation plans with a focus on students

Source: Authors' creation

Figure 9.4: Areas to be addressed for monitoring and evaluation plans with a focus on teachers

Source: Authors' creation

Figure 9.5: Areas to be addressed for consolidated monitoring and evaluation plans for schools

Source: Authors' creation

The development of **institutional aspects**, such as creating or, in some cases, strengthening the monitoring and evaluation divisions of education departments, is a crucial factor for the consolidation of an effective monitoring plan as part of mobile learning policies. **Continuing education that focuses on administration** based on these data will also be fundamental to generate a virtuous demand cycle for such results and their application.

Creating ways to share methodologies and monitoring and evaluation tools between departments and other actors is also necessary. The exchange of experiences and models can strengthen the quality and utility of evaluation tools and avoid the duplication of efforts.

Finally, privacy and safety aspects of collected data need to be carefully managed (ORTIZ & CRISTIA, 2014). Regulations for pedagogical use of digital technologies, especially in networked and online environments, require the development of legal frameworks at a national level to support progress in that direction at a local level. This is an extremely important factor in the process of consolidating mobile learning policies in the country.

2 TOWARDS MOBILE LEARNING

2.1 Trends

Education imagined by managers working in departments 10 years down the line includes several possibilities and lots of synergies between ideas.

Table 9.2: Educational trends identified by managers who work in departments

Interactive Classroom like in Harry Potter

Only what you need appears, when you need it!
(Curitiba)

Classroom with abundant resources

If you want to teach a class with the simulator, a holographic projection, one 1Gb connectivity to show what my students have done, I will have it. But the curriculum above all.
(Federal Government)
Everything will be so integrated that the teacher will ask for research and the student gets it straight from the phone *(Curitiba)

Ubiquity and administration

All students and teachers will already have equipment, we will already have a pedagogical proposal, and we'll have a system linking all institutions, at a minimum. Including information for parents.
(Goiânia)

Research-based lessons

Circular tables, the students sitting in rotation, and the teacher circulating between tables. The teacher defines the theme the students will research. In a 50-minute lesson, 30 are research and 20 debate. Students will be self-taught and the teacher will be in the classroom. (São Paulo)

Social networks to integrate parents

I have the idea of a social network that we can solve the problem of school and family. For example , if the student did his homework and he brings it the next day and it's on time, he gets points and his father receives them too!(Salvador)

Government as a support for innovation

The government has to act as a support platform for innovation to happen, it needs to be a fertilizer , supporting and being at our side all the time.
(Rio de Janeiro)

Consultation of the Federal Government to guide their actions

Before buying the equipment, the departments would give suggestions and the Ministry would take up the three most highly rated. It would be a dream world ! (Rio de Janeiro)

Network administration

Education Departments, independent of being party A or B , sharing experiences , exchanging good practices , with investments having an effect on learning
(São Paulo)

Source: Authors' creation

The ideas merge with expectations and desires that policies reach a level of maturity allowing for achieving the fluidity pointed out in the tables above. Interviewees show a conviction in substantial changes towards this direction and, thus, suggesting that there are fertile grounds for reforms.

2.2**Ways to reform**

To change it is necessary that we know where we are and where we want to go. Diagnosing with an eye to detail and building an action plan, with goals that cover the dimensions that you want to focus on, are key actions. This research aims to be a detailed diagnosis, after nearly three decades of educational technology policies

in Brazil, which offers a future-oriented gaze that expresses the requirements for developing context-appropriate mobile learning policies. And there are long steps ahead.

So that changes in public policy may occur, sometimes it is necessary to reconsider certain trajectories. Disruptions or adjustments, although with varying degrees of changes, require initiatives based upon well-formulated strategies. There are no formulas. But you can have networked learning, with states and municipalities that are already on the way and be inspired with actions from other contexts: whether from other areas of public policies that have developed rapidly, such as mobile health, or with experiences of other countries, seeking to adapt the curriculum to the new skills and competencies that have emerged as a priority due to technologies.

Jane David and Larry Cuban, academics and experts on the subject of educational reform (DAVID & CUBAN, 2010) and Joel Klein, Secretary of Education in the City of New York for eight years, who implemented large-scale reforms with notable results on the improvement of learning and graduation rates (KLEIN, 2014), converge in many of their recommendations for those aiming to implement educational reforms and draw attention to different aspects that can yield more context-appropriate, and, thus, more successful actions:

- » It is necessary to change the environment for a reform, acting broadly in order to prevent the educational system itself, consolidated for years, from limit initiatives.
- » The assumptions underlying the reforms and steps to achieve the expected results should be well established and shared publicly
- » The implementation must be well done, otherwise, regardless of whether the idea is good or not, it will not become effective.

"... how well a program is implemented can matter more than what the program is" (DAVID & CUBAN, 2010, p. 186).

- » The engagement of the community and of those involved in the reform is essential, as these will provide necessary support during implementation, and a factor that favors continuity.
- » The implementer of the reform must connect with teachers and focus on their needs, improve their working conditions and recognition.
- » Reforms should provide a mix of incentives, direction, and also be adaptable and flexible to some degree in order to adapt to differences between schools.
- » The school context and individual commitment matter, as teachers and actors in schools do not *adopt* reforms, they *adapt* them (DAVID & CUBAN, 2010)

“Any reform aimed at improving student learning depends wholly on how much teachers understand the reform, believe that it will help students learn more and better, and can tailor the reform to their classrooms. If the teachers perspective is ignored, reforms are less likely to be embraced where it matters the most.” (DAVID & CUBAN, 2010, p. 186)

- » Curricula reforms should be accompanied by resources that enable teachers to respond to the challenges that will arise in the face to new scenarios, and include training and appropriate digital resources.
- » Well-trained teachers are needed to implement reforms. And professional development requires investments that need to be considered, including training, mentoring, etc.

“Teachers can do more or less of what they already do, but they cannot start doing something they do not know.” (DAVID & CUBAN, 2010, p. 183)

- » Teachers tend to reject extreme positions in favor of a balance between different solutions.

- » Negative reactions and problems are not necessarily indicators that reforms should be abandoned, and may point to the need for adjustments.

“Neither abandoning a reform prematurely nor steadfastly sticking with something that isn’t working, even if it is politically popular, will contribute to improving schools.” (DAVID & CUBAN, 2010, p. 189)

- » Monitoring and evaluation should be part of reform policies and their design should encompass more than standardized tests, including the results expected based on planning.

In addition to a focus on planning and the need for strategic vision highlighted by the authors, it is crucial that attention be paid to the implementation stage, as it is decisive in the success of public policies. The recommendation to act contextually, seeking the commitment and engagement of educators who are, in fact, the implementers of the actions, also stands out. Primarily, to ensure the continuity of any reform, the actions must be understood by those upon which it will focus. Consultation of parents and students, in this context, can also be excellent strategies for engagement and support.

It is beneficial to establish a commitment to the proposed agenda and be aware of the maturation time for the policy to develop. Discontinuities may bring more losses than inaction would bring.

Below, we list possible areas to be addressed for the formulation and implementation of mobile learning policies based on research results presented in the previous chapters.

Knowing

- » What is the current situation of the school system in terms of infrastructure, digital content and continuing education of teachers? Detailing numbers, scope, and challenges.

- » What is the profile of the teaching staff and their relationships with digital technologies?
- » Those that already make pedagogical uses of ICTs, how do they do it?
- » What are the expectations to improve their performance conditions?
- » Which departments and representatives of the school system should be part of the formulation, planning and policy implementation committee?

Planning

- » What are the goals of the school system?
- » What is the design of the mobile learning policies?
 - » What are the stages of the project?
 - » What are the expectations for results from its implementation?
- » How to realize the integration of ICTs within the curriculum of the school system?
- » What should be the role of digital resources in the daily routine of schools?
- » What are the necessary actions in terms of the three pillars of policies? Below, we list some fundamental questions.

Table 9.3: Planning and diagnosis questions for the pillars of mobile learning

Infrastructure

- » What is needed to realize the project?
 - » Electrical network
 - » What reforms are needed?
- » Connectivity
 - » What are the most appropriate solutions?
 - » Consult operators, compare possibilities in terms of availability, stability, speed, cost, etc.
- » Hardware
 - » What are the most appropriate?
- » What are the implementation time frames, considering existing resources?
- » What are the indicators to monitor and assess efficacy in the classroom

Digital content

- » What are the existing experiences
- » What are the contents available from the MEC and other departments as open educational resources that can be used ?
- » What are the options available in the market ?
- » What are the local production of alternatives and the structure necessary for this?
- » Which options are most suitable in terms of:
 - » Policies and their objectives
 - » Adaptation to the school system
 - » Structure required in terms of costs and human resources
- » What are the indicators to monitor and evaluate effectiveness in the classroom

Teacher training

- » What do the teachers in my school system need to know to implement the policy formulated?
 - » Be instrumentalized for the use of technologies in the context of curriculum subjects?
 - » Be sensitized to the regular and frequent use of available resources?
 - » Enhanced skills to handle the use of some tools? Which one? To use in what way?
- » What strategies and resources are needed to reach the universe of teachers considering their differences:
 - » In-person courses
 - » Courses with adaptive platforms
 - » Mentoring (pedagogical assistance)
- » What strategies to engage them?
- » Which indicators to monitor and evaluate effectiveness in the classroom

Source: Authors' creation

Implementing

With proper planning, implementation tends to be more predictable, although it requires attentiveness to new demands. For instance, adaptations in the staffing and the structure of the departments to accommodate the functions of mentors and educational advisors, committees for decision-making, monitoring and evaluation, in addition to infrastructure requirements, may require more time to implement than other aspects.

The establishment of committees that dissolve the prevailing model of technological segregation in departments, as well as the establishment of guided use technology programs in schools, can involve conflicts and new administrative needs.

Monitoring and evaluation, through becoming structuring elements of implementation, become the basic input of administrators and educators to adjust and redirect policy trajectories, requiring new administrative skills.

Network governance (GOLDSMITH & EGGERS, 2011) tends to be an excellent administrative instrument, considering that several municipal and state education departments can, based on their stages of policy development, share their efforts and trajectories, while the Ministry of Education can utilize such information to create forums for the design and implementation of policies that enhance new results.

Obviously, the contextual adaptations that public administrators will make in the questions raised here, will promote modifications and will link policy planning to other dimensions. The expectation we authors, have is that the work presented here will serve as an instrument that will help in building innovative and context-appropriate trajectories for local mobile learning policies. A contribution for Brazilian public education to attain the levels of excellence that we all hope it reaches.

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