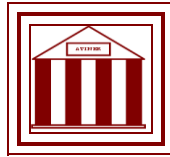# Athens Institute for Education and Research
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Mobile Technology:
Brazilian Case Study from the Perspective of Educational and Socio-digital Inclusion

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Dr. Gregory T. Papanikos
President
Athens Institute for Education and Research

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Abstract

This article presents the results of the investigation that analyzed the interactions triggered by the educational laptops in the inclusive process of people with diverse needs. These interactions were produced by the National Policy of Inclusive Education associated with the One Computer per Student Project (PROUCA). The study is methodologically designed as a qualitative research performed in Inclusive Schools/UCA (RS) and in Tiradentes (MG). The research was guided by two questions: 1) Do the educational laptops used at PROUCA present an accessible interface to the people with diverse needs? 2) Which movements are triggered by the educational laptops mediation in order to increase the socio-digital inclusion of the person with diverse needs? The technological uniformity have caused some problems regarding aspects of accessibility and usability of the laptops to the students with diverse needs. The educators' lack of digital fluency and the incipient teachers' training in digital and school inclusion are aspects that make school inclusion difficult. The positive aspects of the technological configuration established by PROUCA can be seen in actions such as the boost of educational processes which are concerned about the specifics of the students with diverse needs. Also in the design of educational procedures that are more heterogeneous, and the increase of the customization of the technical and pedagogical mediation, which acknowledges and values the sensor, physical and cognitive diversity of the students in Brazilian public schools
Keywords: Mobile Technology – Socio-digital Inclusion – PROUCA

Introduction

The Brazilian educational scenery has been constructed under the impact of government actions which operate with two inclusive interfaces: the first one **in the school**, by ensuring the students with diverse needs the enrollment in regular schools; the second one is **digital,** by reconfiguring the computing technology with the insertion of mobile devices.

The school inclusion interface has been developed in Brazil through the implementation of The National Policy on Special Education from the Perspective of Inclusive Education. Professionals with a different education became part of the new school structure, aiming to serve to the specificities of people who behave, as Burbules (2003, p.161) analyses, differently from the orientations and work and life aspirations which are socially accepted and valued. The discourses and practices of the Inclusive Education proposal have been based on learning conceptions and models which consider that students and teachers are different. The difference, an inherently human characteristic, has gradually started to lose its pejorative attribute.

The digital inclusion interface started to be developed with the offer of training for teachers and the creation of Computer Laboratories in public schools. The analysis of the Brazilian experience regarding Information Technology in schools has revealed a hybrid model between the digital mediation, strongly centered in practices that reinforce the instrucionism, and some actions where the technology is used to mediate processes of knowledge construction.

While the pedagogical hybridism characterized the insertion of the technology in the schools, the data provided by CETIC.br[1] showed the results of the government actions to give access to digital technology in a universal and democratic way. The research reveals that, on average, each school of the country has 18 pieces of equipment working in the computer laboratory. The computer and its technologies are no longer alien elements in the school context, which allows the construction of a school digital culture and the beginning of discourses and practices related to Information Technology in schools.

With the arrival of the mobile devices, the technological configuration model that was adopted by the Computer Laboratory started to be questioned. The concepts of mobility and connectivity which are associated to the laptops and tablets allow the Brazilian school to experience the Convergence Principle, a contemporary trend which enables various technologies - printed, analogic and digital – to operate through the interface of one single device. There is no doubt that the mobility and connectivity of the mobile devices provides more diverse forms of learning and teaching, even though in a still incipient way. These different forms lead to the organization of a new technological configuration which promotes the decentralization of the production and

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[1]T he access to the complete research data is available at <http://cetic.br/>.

management of knowledge and impels a more active and flexible learning process which is mainly focused on the pace of each learning agent.

The inclusive and technological interfaces of the Brazilian Education raises the need to discuss the educational resources which are now available for the educational institutions. Students with diverse needs enrolled in public schools are entitled to utilize all the resources that the government makes available for the learning process mediation. In opposition to the technicist approach used to discuss the insertion of mobile devices in the school space, the research carried out by the Nucleus of Informatics in Special Education (NIEE) team, of the Federal University of Rio Grande do Sul (UFRGS), followed an investigative path that took into consideration public policies that focused on school and digital inclusions. Policies such as the National Policy on Special Education from the Perspective of Inclusive Education (BRASIL, 2008) and the One Computer per Student Program (PROUCA).

Educational Laptops in the Brazilian Reality

The insertion of education laptops in the world context did not originate from official policies, but came from a group of intellectuals, which had Nicolas Negroponte as its most referential member. Negroponte's ideas of democratizing and universalizing the access to digital technologies of information and communication gave structure to the One Laptop per Child Program (OLPC). Moreover, these ideas motivated rulers of Third World countries to participate in the project, which assured that every child at school age had access to their own computer. In the Brazilian reality, the implementation of PROUCA was accompanied by an inter-ministerial group called GT-UCA, which was formed by experts in Information Technology and communication.

The Brazilian experience in public schools for the 1:1 configuration started with a pilot project in five schools, which, in a second phase, was extended to 300 schools. All the public schools of six Brazilian cities received laptops for the students. These cities started to be called Total UCA (One Computer per Student) Cities. The interaction of the computers with the schools was then developed and updated by the PROUCA, which provided them a new configuration and extension.

Respecting Diversity in the Technological Context

The researches on Informatics in Special Education highlight the importance of the work with technologies in order to overcome the obstacles and barriers for the development of people with diverse needs. Accessible digital technologies can operate as a lever to citizenship by reducing social discrimination and socio-cultural segregation. Learning processes for the target public of Special Education are empowered when the technological interfaces

allow them to overcome the limits imposed by sensory, physical, and cognitive fragilities.

The actions of the Ministry of Education and the Ministry of Science and Technology to achieve the education and services for students with diverse needs in regular schools responded to the dimensions of the inclusive and technological school. These actions included the creation of Multifunctional Resource Rooms (SRM) and the establishment of the Specialized Educational Service (AEE) by the Ministry of Education, and the distribution of the educational laptops by the Ministry of Science and Technology. The inclusive aspect needs the technological aspect to make the resources available so that they impel the development and learning processes. Discussions about the need for complementary government actions support the relevance of the research proposed by the NIEE/UFRGS team.

Educational Laptop and Human Diversity: The Scenario and the Research Methodology

The investigation conducted by NIEE/UFRGS outlined as the research object the technological accessibility and the socio-digital inclusion and it was structured in two axis of discussion: 1) Do the educational laptops used at PROUCA present an accessible interface to the people with diverse needs? 2) Which movements are triggered by the educational laptops mediation in order to increase the socio-digital inclusion of the person with diverse needs?

The research was methodologically set up as qualitative with an exploratory and explicative approach, and it was carried out in two phases. The first one was performed in the Total UCA city of Tiradentes/MG and the second phase was in UCA/inclusive schools of Rio Grande do Sul state. The data collection techniques used were the direct observation, document analysis, semi-structured interviews, and Focus Group dynamics (Picture 1).

Picture 1. *Research Methodology Organogram*
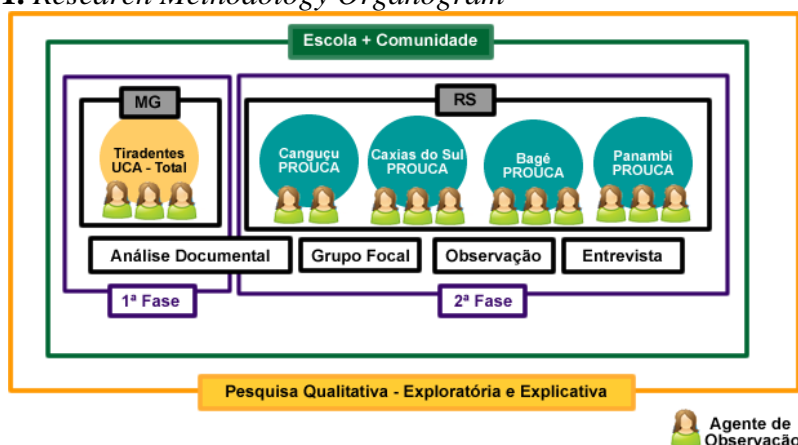
The innovation perspectives associated to the 1:1 technological configuration pointed by MEC- mobility, media integration, wireless connectivity, and immersion in the pedagogical digital culture – designed the construction of the analysis criteria, which guided the investigation performed by the NIEE/UFRGS. In order to analyze the limits and possibilities of the government actions which caused the inclusive and technological school to happen, the researchers were guided by these categories: accessibility, mobility, connectivity, belonging, customization and equity. From these criteria, it was possible to observe the approximation of the student with diverse needs to the mobile and individualized technologies.

Analysis and Discussion of the Research Results

The results of the research carried out by the NIEE/UFRGS team are discussed here in a linear way by categories. However, in order to take into consideration the density of the concepts associated to these categories, the reading of these reflections should be performed in a transversal complementary way

For the discussion of the **Accessibility**, the category which more obviously answers the first research object – **Do the educational laptops used at PROUCA present an accessible interface to people with diverse needs?**, we understand this analysis object as:

> **Accessibility:** The guaranty of access to the educational laptop in its technical and pedagogical dimension. The mobile technology that is available to the student should allow the interaction not only with the hardware, but also with the software. These interactions should respond to the sensory, physical and cognitive specificities of the students with diverse needs.

The NIEE/UFRGS team performed accessibility and usability verification tests on the educational laptop provided by PROUCA. The equipment consists of a 1.6 GHz Intel Atom processor, 4GB flash memory for storage, 512 MB of DDR-2 memory, two USB entrances, one RJ-45 entrance, one audio inlet and one audio outlet, wireless connection and webcam. It presents the size of a netbook (1.3 kg) and it was designed for the school public, fulfilling the requirements established by the PROUCA experts, that is, a technology that offers high resistance to falls and presents a portable design.

According to the tests performed by the NIEE/UFRGS team and observations from the researches of the UCA-Accessible Project (2012), the installation of the accessibility tools was impossible due the restrictive characteristics of the operational system Metasys. The absence of an accessibility package is one of the weak points of the educational laptop, which prevents it from being an educational resource for students with diverse needs.

The accessibility and usability verification processes of the educational laptops showed some weak points which endanger the accomplishment of the school and socio-digital inclusion for the Special Education public.

(1) The reduced size of the screen makes it impossible, or difficult, for the users with visual and motor limitations to use the laptops.
(2) The keyboard without spaces between the keys does not consider age specificities, which makes it difficult for the Primary School students and the ones with motor limitations to use it.
(3) The prolonged use of the touchpad may cause muscular fatigue and discourage the use of the laptop
(4) The flash memory of only 4GB limits the installation of an operational system plus personal files, as well as the inclusion of any other needed software.
(5) There is no VGA outlet, which makes it impossible to connect a larger monitor or a multimedia projector that would provide different dynamic constructions for the Special Education public.
(6) The operational system Metasys does not present a consistent accessibility package or support for the installation of technical help. It does not allow the installation of a screen reader, which makes it difficult for blind or low vision students to use it.

The tests of technical analysis of the educational laptop show as positive aspect the KDE graphical environment, which is a simple interface that makes the access to tools easier through a tool bar on the screen. The instability of the system was considered a weak point of the equipment, as the machine froze several times during the analysis process.

However, despite the fragilities regarding the technological accessibility, the attachment of assistive technologies was possible to minimize the difficulties the students with diverse needs had when interacting with the equipment. The USB entrance allows the integration of assistive technologies that are present in the SRM of the schools that were analyzed, as it was verified in the tests performed by the NIEE/UFRGS team (Table 1).

Table 1. *Integration: ClassMate and Assistive Technologies*

Adapted Mouse	PlugMouse, RCT-Barban, and TrackBall were tested and responded positively to the verification protocols.
Activators	Pressure Activators AbleNet, TASH, and PuxeClik were tested and responded positively to the verification protocols.
Keyboards	External keyboards could be used with different keys for children (Carvola). The typing mask colmeia was also used.

The usability and accessibility analysis revealed that the technological universalization of the laptop was built under the same principles that characterize the Brazilian Education process, the homogeneity. A group of experts defined one single technological configuration for everybody, which is

perfectly coherent with a school process also designed based on the same false idea of equality.

The encounter of the student with diverse needs and the educational laptop, which in many cases revealed an impossibility of a technological mediation, reaffirmed the conclusions found by Skliar (2009) when analyzing the movements that project an Inclusive Education: " the inclusion which is ours and the difference which is of others" (own translation). The legislation guarantees school inclusion, but the problems originated from the participation of students with diverse needs in the school process are under the category of **different**. As it is the student with diverse needs who is different from the homogenous pattern, it falls on them the burden of the change and the disadvantages they suffer due to the exclusion from the possibilities offered to the other students.

Trying not to reduce the investigations to a merely technological analysis of the insertion of the mobile devices – which presents the most obvious answer to the updating movement of the technology in the school, almost as a "computing Darwinism" - we ratify the importance of the second question of the research: **2) Which movements are triggered by the educational laptops mediation in order to increase the socio-digital inclusion of the person with diverse needs?**

In order to move the focus off the technology, it was necessary to look at the technical/methodological mediation of the educational laptop with the student with diverse needs. Each of the categories presented next were analyzed from the empiric data collected in the research sites of Tiradentes (MG) and in the UCA inclusive institutions (RS).

> **Mobility:** A concept that allows to rupture with the Computer Laboratory configuration as the place of technology in the school institution, and it also gives the opportunity for the learning process to happen out of the school walls. When PROUCA gives the possibility of taking the educational laptops to the students' homes, the process of digital inclusion in the family and community context is empowered. When the students with sensory and motor specificities have the opportunity to continue to use the information and communication technologies at home, they can accomplish the systematization and consolidation of the practices mediated by the Assistive Technologies in the school.

The main point analyzed in this category lies in the possibility of transporting the laptops from the school to the student's home, increasing the possibility of exploring the functions of the equipment. In the schools of the research, this transport did not occur effectively, and when it happened it was not seen as a right for the student with diverse needs.

When the mobility aspect was accomplished, a discriminatory situation emerged regarding those who were found in a vulnerable social situation, consisting of a situation of double exclusion,. The laptops could not be taken

home with the justification that the parents had not sent the authorization for it. However, the same criterion was not applied to the students without diverse needs, as they could take the laptops home and back to school even without the authorization. These research data illustrate one of the educational obstacles discussed by Touraine (2009): the burden of prejudice which weighs on the peripheries and their inhabitants - a true rejection to part of the population that, despite many failures, lives the process of socio-cultural integration. The right of exploring "their laptops" would ensure a longer contact with educational digital systems and objects to mediate the learning process and the development of students with or without diverse needs.

The mobility, which would be naturally increased by the mobile devices, was not adopted by the teachers of the researched schools. In situations when there was a possibility to use the laptop as a tool to register images of trips to local socio-cultural spaces, the equipment was not recognized as a possible educational resource to be used. The cognitive gain for the students with or without diverse needs, while using images or texts to register significant aspects of the visits, was not considered, in particular for students going through the literacy process.

The teachers in Tiradentes had a different profile – young, recently graduated, more digital fluidity – ,which made the mobility concept more explicit, conceiving the educational laptop as a tool in a set of resources to be used in the school trips of a school project.

However, in the same city, in one of the city public schools, the mobility was seen in a completely reversed way   with the creation of **the Laptop Room**. The establishment of a laptop room shows an overlap of mobility and connectivity. This new place in the school was justified by the delay in the installation of the logic network and wireless connection, which made the school board to decide not to distribute the laptops, but put them in one place where the teachers and students who wanted to use them had to go to. The mobility was then of the students, not of the laptops, and the room was used with the same scheduling system of the Computer Labs.

> **Connectivity:** The educational laptop, as it has a communication interface with a wireless network, accomplishes the mobility principle for its capacity of promoting efficient and broad communication, not only in the school but also in the community. By using vocalizers and digital communication boards, students with language impairment can development mental structures that are fundamental for their cognitive development.

The expected continuity of the educational process beyond the school context was not established, due to the fact that the students with diverse needs were prohibited to take their laptops home. For these students, who do not have a computer at home, the mobile device would not only give them more time to explore its resources, but it would also give them access to the internet. The students who are older and without diverse needs and therefore have more

autonomy and argumentation power to take the laptop home could be seen more frequently using the laptops out of the school. In the few occasions when the equipment was allowed to be taken home, it was possible to spot groups of students looking for the best places to get internet access, even on the weekends.

> **Belonging:** When the student is given the right to have "their own computer" a sense of belonging is created. In the classroom, the educational laptops in the hands of the students establish a common origin which bonds different individuals, allowing them to acknowledge each other and also respect their individual differences.

The problems of accessibility of the educational laptop hindered the participation of students with diverse needs in the pedagogical activity that started an important opening movement of the school to the needs of the local community. Some structure concepts of PROUCA were put into action: the mobility, by overcoming the limits imposed by the school walls, and mainly the sense of belonging, as the "content" of the investigation acquired a larger meaning for the student and their family, emerging from the routine of the farmers:

> [...] Being our community a region where the students are farmers' children, mainly connected to the growth of tobacco, I proposed the creation of a budget for the growth of soy. All the students took their laptops and used the data available on the internet and the spreadsheets to calculate the budget. The laptop will be taken home for the students to present the project to the family and discuss the cost-benefit analysis. [GBH] got frustrated as, due to his impairment, he could not use the laptop to do the research and work with the spreadsheets. He then worked with a group and his classmates did the research and reported the findings and the work with the spreadsheets. As [GBH], most of the students do not have internet access at home, therefore they saved their work so that it could be presented and discussed with the family at home. [GBH] will also take his laptop home, but his little sister was instructed to mediate the use of the device. **[Report – Observation Agent [CKB], 09/28/2012]**

The research data previously presented reveals a rupture in the autonomy and protagonism caused by the absence of accessibility of the educational laptop for the students with diverse needs. The dependency on his classmates to research on the internet prevented the student with visual impairment from the possibility of establishing and validating the criteria for information selection, as well as applying this knowledge in the elaboration of the budget spreadsheet. A screen reader software installed on the laptop would give the blind student more confidence in the interaction, collaborating effectively for

the process of self-learning. This is an important aspect that is evident for the personalization of the technological mediation that a laptop can produce if the students have sensory, physical or cognitive fragilities.

Together with the search for more respect and equity in the learning process through the use of learning objects which are accessible to students with diverse needs, we can add the work of two teachers who customized the educational laptop. Colored glue for the Braille codes and sticker labels for sign language made the hardware more accessible (Picture 2).

Picture 2. *Customization of the educational laptop keyboard with colored glue for a student with 5% of vision and with labels in sign language for a deaf student*

The aspect the effectively accomplishes the belonging sense is related to the possibility to move an education process centered in the homogeneity to the heterogeneity. The conclusion that the students are different with sensory, physical and cognitive specificities demonstrates that it is not possible to promote a qualified education process without a plan which is adjusted to the diversity of stories and learning styles. The development of the belonging feeling is directly related to the actual participation of the student with diverse needs in the school dynamics, involving customized learning actions that are much more complex than placing a tag with the student's name on the educational laptop.

> **Customization:** By making the customization process possible with the name tagging, the colorful stickers glued on the external surfaces of the laptops, but specially with the attention to the sensory and motor specificities, the sense of belonging develops. It is the opportunity for customization that assures the student with diverse needs the respect to their specificities, allowing the heterogeneity which forms the human diversity to be seen as an advantage, not a disadvantage. This change happens when the technology produces an interface which permits the mediation and interaction of all students, even with the homogeneity of the educational strategies developed in the classroom.

The possibility of proposing different actions adjusted to the specificities of the students with diverse needs explains one of the aspects which was considered by the NIEE/UFRGS team, the customization. It can be illustrated

by the teachers' actions of mapping the pedagogical possibilities mediated by the mobile technology as a support for the inclusion process of students with diverse needs. The learning objects available in repositories and on educational websites allow the teachers to serve the physical and sensory specificities, as well as to plan strategies that respect the pace and the development stage of each student, thus benefiting students with or without diverse needs.

For the student with hearing impairment it was fundamental that the pedagogical actions that were proposed were in the context of the deaf culture. By associating the sign language with the written words in Portuguese, the learning object that was used configures a significant strategy for the consolidation of the literacy process in both languages (Picture 3). In the observations that were sent by the teacher/observation agent [SCS] about the interaction of the student/research subject [BRS], the ludic aspect of the activity and how easily the student interacted with the educational laptop certified the positive results of the proposal:

**Picture 3**. *Learning Objects customized for the Deaf Culture*

> **Equity:** The principle that emerges from the disposition of the socio-cultural contexts to acknowledge the human specificities, not to make them closer to the normal patterns, but to ensure the right of everybody's participation in these different socio-cultural contexts. Equity functions for the human diversity by compensating the disadvantages that the impairment imposes through the access to cultural tools produced by human kind along its History.

By choosing as scope the dialogue between inclusive public policies-technological and educational - the research conducted by the NIEE/UFRGS team discusses an important criterion for the choice of the interface of the educational laptop, hardware and software: to provide equity in the mediation and utilization of the technology for all the potential users, including in this universe the students who are blind, deaf and have physical and cognitive limitations. It is a duty of the Brazilian public institutions to ensure the right of the students with diverse needs to have their specificities taken into consideration. Otherwise, the accomplishment of public policies will continue to rely on the good will of the teachers and the people in charge of educational

service rooms, so that all the students have the same possibilities to use the educational resources in the school, even if it is in a rudimentary way.

The logic of scarcity that characterizes the configuration of the Computer Laboratory – few computers to many students, and an interaction with reduced time exposure (average of 50 minutes) once or twice a week -, has not been ruptured with the presence of the mobile technology. One of the objectives of PROUCA, which is to extend the contact of the students with the computers, as represented in chart 1, did not reveal a significant change.

Chart 1. *Frequency of the computer use in the Computer Laboratory and mobile technology 1:1 Configuration*
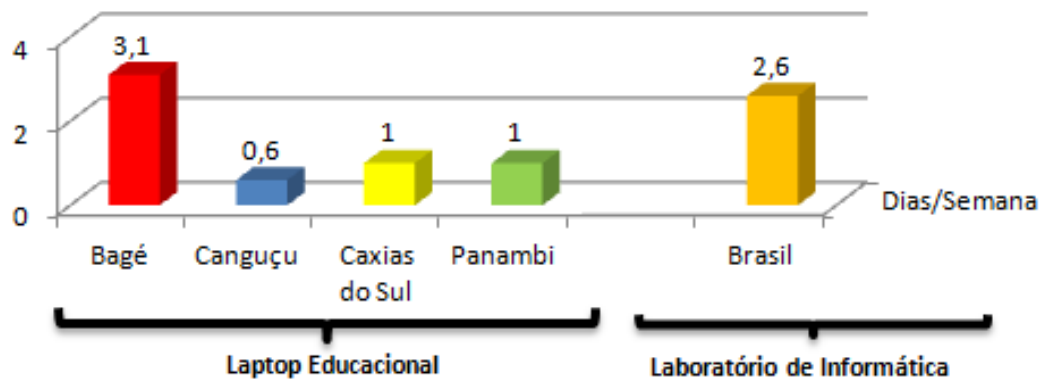
However, it is necessary to point out that the negative side of the logic of scarcity is not an exclusivity of the special education students. Regarding this aspect, PROUCA follows the concept of equity by denying ideal conditions for the accomplishment of digital fluidity for all students, with or without diverse needs.

Final Considerations

The data collected and analyzed by the NIEE/UFRGS team, taking into consideration the inclusive and technological aspects, showed that the insertion of the laptops, with all the fragilities in the structure and implementation of PROUCA, was not enough to overcome the exclusion. On one side we have students with cultural means and a reading and writing practice that creates a feeling of legitimacy and competence in relation to the decisions made; on the other side there is a population with no subjects, almost civilization remains living the abandonment of the order of things and the maximization of the alienation of the computer-media world.

The government actions proposed a significant amplification of access possibilities to the liberating potential of the educational laptop. These actions were encapsulated by the dominant discourse that regulated the type and the way of the computer insertion in the school dynamics. The possibility of minimizing the hiatus that emerged with the density of computer and

informatics networks, with a visible polarization of the human condition, was once more delayed. Certain human groups had their emancipation ratified, which gave them an unprecedented freedom with the ability to move and act at a distance, while other groups watch powerlessly the few chances of freedom disappear and are forced to pay the heavy cultural, psychological, and political price of their new isolation.

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