

TABLETS IN EDUCATION

Opportunities and challenges in one-to-one programs

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April 2012

This study has been possible thanks to the contribution made by the OEI, Organization of Ibero-American States, Buenos Aires Regional Office.

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1. Introduction¹

The incorporation of digital devices for students and teachers at different education levels is becoming a major trend of current government policies driving digital inclusion, social inclusion and enhanced educational opportunities across education systems in Ibero-America.

The recent appearance and early adoption by young people of tablets² because of the benefits to using them in terms of portability, touchscreen and long life battery, among others, has raised expectations among those responsible for public policy implementation in the education sector; especially in those countries that are distributing electronic devices to their teachers and students, generally known as “1-to-1 models”.

So much so that the quick acceptance of tablets by specialists and users (the most optimistic forecasts even talk of the disappearance of desktop computers) was followed in no time by a boom in a group of projects to bring these devices into the classroom³, which, in turn, have been broadly advertised in the mass media and presented as the “next step” or the “natural evolution in the wave of future education”. These projects – almost all of them of the “pilot” type- are recent and, therefore, many are still in a design and implementation phase. In these phases, the social and educational impacts of programs are still potential promises that should be evaluated in the near future.

On the other hand, the technological development that comes with the digital world moves at its own pace and offers, on a daily basis, new services, tools and devices that create potential opportunities, making decision-making more difficult. Some of the new appearances are trivial and irrelevant. Others transcend the novelty status and become benchmarks in the technological market.

Some questions arise that we need to address more in depth and with more scientific rigor than articles or advertisements in newspapers o magazines.

Is this the natural evolution of 1:1 programs?

Is it only another option in the menu of available devices?

What are the necessary baseline conditions for an enriching and differential experience?

¹ The author thanks Hugo Martínez and Betina Lippenholtz for their collaboration during this study.

² For the purposes of this study, we will use the English term “tablet” to refer to all devices in the form of a tablet that are bigger than an intelligent phone, without keyboard, and with touchscreen.

³ See, for example: <http://www.onlineuniversities.com/18-enlightening-ipad-experiments-in-education>

Definitely, tablets bring a new format to consume and produce content, and a new way to experience interactivity, interaction and entertainment. But their implementation seems to present a mixed picture that should not be disregarded when assessing whether to implement these devices.

The purpose of this document is to offer education public policy managers input for decision making. It attempts to evaluate the potential use of tables in search of inclusive and quality education, analyzing to this end existing initiatives, as well as the scarce documentation available.

2. What is a tablet?

In this study we will make reference to digital devices with information processing capability and Internet browsing features that are similar or slightly inferior to those offered by a portable computer of the netbook type. Their main characteristics are long life battery (around 8 hours), touch screen, light weight (around 500 grams) and a size (up to 10") which enhances portability.

They have specific operating systems, more in line with the platforms used by intelligent telephones or smartphone (Blackberry, Iphone, Android). The applications that give them functionality are closely associated to the user`s profile, and in most cases, they include wifi and 3G connectivity.

For the purposes of this study we have not included the devices known as Tablet PCs or e-readers. We have excluded the former because it is a generation older than the device under study, and does not have the same portability and battery life features. In the latter case, the e-reader does not have the processing power described above.

2.1 Technical characteristics:

There follows a comparative chart with the best known models:⁴

	Samsung Galaxy 10.1"	Motorola XOOM	Ipad2	Asus Eee Slate	New Ipad
Processor	dual core	dual core	dual core	dual core	quad core
RAM memory (in GB)	1	1	1	2/4	1
Storage (in GB)	16/32/64	16/32	16/32/64	32/64	16/32/64
Operating system	Android	Android	OS	Windows 7	OS
Screen	10.1"	10.1"	9.7"	12.1"	9.7"
Resolution	1280*800	1280*800	1024*768	1280*800	2048*1536
Battery life (in h)	9	10	10	4.5	10
Camera	Double ⁵	Yes	Double	Yes	Double
Connectivity	3G/WiFi	3G/WiFi	3G/ WiFi	3G/WiFi	4G/WiFi
GPS capability	Yes	Yes	Yes	Yes	Yes
Weight (in g)	565	708	601	1160	652
Height (in mm)	175.3	249.1	241.2	207.2	241.2
Length (in mm)	256.7	167.8	185.7	312	185.7
Depth (in mm)	8.6	12.9	8.8	16.98	9.4
Cost⁶	450	500	400	500	500

⁴ The models selected and their prices are only meant to serve as a reference for comparison purposes since the referenced prices tend to go down as new models reach the market.

⁵ Front and rear

⁶ Basic model, in US dollars

3. Properties of use

3.1 *Benefits and contributions*

Given their recent appearance in the market and incorporation in educational settings, the pros and cons of using tablets in learning and teaching can only be guessed and should be assessed by more structured short and medium-term evaluation instruments.

However, it is possible to draw some preliminary considerations based on initial usage reports, as well as on the configurations and applications available.

The first reports indicate that the use of tablets motivates students and favorably influences their willingness to learn. However, this may be very much because they see tablets as their new technology toy.

The technical characteristics of the tablets make them especially useful tools to distribute and consume educational contents in different formats and with different features: read, play, watch videos. Their operating systems make it possible to quickly disseminate texts that can be modified or in which images, videos and audio can be inserted. These texts can be broken down in specific content units, organized by education level or topical subjects. At the same time, tablets may be used as e-readers, thus facilitating the access of students to children's and juvenile book collections available online free of charge or through new subscription models or commercial download of collections of specific titles.

The benefits of interactivity with the contents thanks to the tablet touchscreen allows us to offer a new and rich experience for all students, when accessing school contents.

These are intuitive products; and using them is a very pleasant experience that does not require prior training and that taps into the skills that young people have developed thanks to other similar devices. They also allow exploring contextual learning instances, when visiting a museum, for example, or during lab work "The whole world becomes a 2.0 classroom"⁷

At present there is a set of specific applications, designed for educational purposes in several fields such as visual arts and music, initial development of motor and spatial competences, development of logical thinking, interactive and initial language learning, second language learning, among others. It is also possible to have systems for self-assessment and diagnosis of skills and specific knowledge. However, most of these applications have been designed for contexts that do not require the intervention of teachers, making it necessary to adapt their design to the classroom setting so that they are in line with the pedagogical plan.

⁷ PLAZA Marina, Beatriz; PÉREZ PLAZA, Miguel (2012). Las tabletas en la educación: ¿implica un cambio en la metodología la introducción de un nuevo dispositivo? In Revista Didáctica, Innovación y Multimedia, number 22<<http://www.pangea.org/dim/revista22>>

There are positive initial reports of the use of tablets at initial learning levels and in the education of children with special needs⁸⁹, that should be further explored to determine the potential, eventual limitations and additional requirements to evaluate their impact on education.

Along the same lines, it seems to be that the portability and connectivity offered by tablets encourage collaboration and interaction among students in the classroom.

As to school management, the possibility of having a tablet permanently connected and available without any battery life constraints, together with the address book, calendar, e-mail and instant messaging applications would improve the communication and coordination systems in schools, and the access to centralized platforms of education information.

It is worthwhile mentioning that carrying a tablet instead of several books everyday to school in the backpacks can help prevent health problems in students.

3.2 Drawbacks and limitations

Tablets have limited capacity to store content and applications. Although this may be solved through the feature of Internet connectivity, this also requires consistent access to robust and stable access points. This may be a big limiting factor in many schools and other education centers.

Reality tells us that having wireless Internet connectivity at school, with enough broadband to connect the tablets of all students is a utopia in any of the countries under analysis.

Tablets are not specially suitable to produce content with considerable amount of text or precision drawing. Although it is possible to create and edit texts, like one does with a word processing application in mobile or desktop computers, typing on touchscreen can be time consuming and frustrating. This holds also true when trying to create or edit spreadsheets or presentations. They are not efficient either to edit video multimedia or manage images, despite the existence of specific applications to this end.

Tablets are fragile, and their touchscreen can easily become damaged. Also, their small size and portability mean that the tablets are handled more, further increasing the risk of an accident. In some cases, a tablet's screen hinge is designed to rotate around two axes, which can easily break, if handled incorrectly.

The tablet configurations currently available in the market do not include hardware update or enhancement options. Therefore, their obsolescence rate might be higher compared to devices which critical components can be updated on a regular basis.

⁸ <http://www.foxnews.com/scitech/2011/03/09/can-apple-ipad-cure-autism/>

⁹ <http://www.reviewatlas.com/archive/x13294143/Interactive-iPads-help-special-ed-students>

There are no recycling or final disposal programs for electronic components of damaged or discarded tablets.

Although some models are more flexible than others at the time of installing open applications, their architectures are limited. For example, it is necessary to have a user authenticated and registered in platforms outside of the school system to have privileges to install and update applications and contents.

Finally, being new to the market, tablets cost more than a lot of conventional netbooks and their longer battery life requires that students make a habit of connecting their tablets to the power supply at home every day. This may eventually lead to a significant increase in the student's household energy consumption, although this is not seen as a major drawback

3.3 Educational resources

There are dozens of thousands of educational resources that have been developed for tablets for educational purposes, as well as guidelines for use and proposals for teachers, based on various platforms, but in particular for the Ipad format. Anyway, the offer is significantly smaller than what is available on Internet, and even than the one existing in offline formats, such as CD, DVD, etc.

There are many, though isolated, proposals generated by individuals or companies. These proposals lack the official cataloguing and validation support that many digital educational resources enjoy nowadays, such as those offered by RELPE¹⁰ member portals. In most of the cases observed, the success of the project will depend on the skills of the teacher to find, adapt and implement these resources.

3.4 Basic assumptions to include tablets in school settings

As previously indicated, some of the main benefits over other devices are easier access to content, school management, portability, autonomy and communication. It was also indicated that given their limited storage capacity, a tablet distribution project will require continuous connectivity, a condition that, in the case of PC computer rooms or netbooks under the 1:1 model, is desirable, but not an indispensable complement.

¹⁰ <http://www.relpe.org/buscador/>

On the other hand, we should think of a strategy to migrate, develop and/or adapt contents and applications to these platforms, working towards the development of multi-platform content. The development of contents is a complex issue, requiring multi-disciplinary work. If the process implies only reading current content on the tablet, the benefits provided by the touchscreen, interactivity, hypermedia and high resolution will not be fully utilized. That is why it is of the essence to engage developers that are at the vanguard of innovation, in a position to exploit these features. Besides, it is necessary to open up the discussion on whether the classroom model will change and if so how; to, then, think of the resources to be developed and their characteristics.

Finally, it is indispensable to develop safety protocols, and theft-deterrent features (similar to those available for most 1:1 models).

4. The use of tablets at school vis-à-vis traditional models

It is clear that it is not possible to give all students a netbook, a tablet and the traditional PC computer room (except perhaps in the case of private schools, and even so, it is difficult to image that such an investment will be made). It is then required that we discuss the expected results or impact on the learning process, the possibilities of use associated to the devices, the use that is desired of ICTs, and the situation in a particular school. An additional issue appears here: the results of the studies that allow drawing a clear correlation between the use of ICTs in the classroom (or any school establishment, for that matter) and the enhancement of the learning process, are still preliminary. And those that try to present them as valid argument are quickly challenged by opposing arguments.

That is why it can be observed that in several of the countries involved in comprehensive electronic devices distribution programs, the main objective is access and inclusion, targets that are easily demonstrable (an benefit that is not minor for any government).

But other consequences can be observed in what Magdalena Claro calls in her study on assessing the impact of ICTs on students` learning for ECLAC¹¹ “other types of learning”.

Claro states that: “As mentioned before, ICTs are not a homogenous instrument and, depending on how they are used, they have proved to be more, or less, useful to teach some subjects or concepts.”

For example, the use of simulation software and models has facilitated the learning process in the case of hard sciences, while the use of word processors and communication software (e-mail) has proven to be of help to develop language and communication skills (Condie & Munro, 2007; Trucano, 2005; Kulik, 2003). Given the many applications and functions offered by ICTs, the clearest effects are found in studies that have considered the specific nature of ICT-based tasks and the types of concepts, skills and processes that can be affected (Cox & Marshall, 2007; Cox et.al. 2003).”

¹¹ CLARO, Magdalena. “Impacto de las TIC en los aprendizajes de los estudiantes. Estado del arte”. Santiago De Chile: ECLAC, 2010

A possible classification and ordering criterion, based on this study could be the following:

	PC	Netbook	Tablet
Motivation	C	B	A
Digital literacy	A	B	C
Cross-cutting skills and superior order cognitive skills¹²	C	B	A

Being “A” the device that best meets the learning goal.

¹² Communication, collaboration, independent learning and team work.

5. Experiences

Of the survey conducted it resulted that to date there are more than 200 initiatives around the world experiencing the use of tablets in the classroom, with different deployment models (one per student, batches per classroom, some grades, all the school, etc.). The immense majority of these examples are from private sector schools. We include below three examples selected from those with the longest duration (1 year) in settings with varying levels of use and access to ICTs, and various socioeconomic conditions.

5.1 *Gran Canaria*

Institution: CEIP Centre “Europe” Jinamar Valley, Las Palmas de Gran Canaria. Spain

Characteristics: Kindergarten and grade school

Person interviewed: Headmaster

The project was selected for the study despite the fact that it included Tablet PCs, because it met the formalization and duration criteria (2 years).

The school is located in a marginal suburb, of medium-low socioeconomic and cultural background. Teachers are trained in the use of technology in the classroom and work with ICT resources.

The school had been equipped with ICTs and connectivity, and had a history of participation in collaborative projects between students and teachers. The proposal of the use of Tablet PCs came from teachers and the framework of the proposal was the “Proyecto Medusa”, a project implemented by the Education, Culture and Sports Council of the Canary Islands Government to integrate ICTs in schools. The lines of action of the project were:

- a) Provision of infrastructure and equipment
- b) Training of the teaching staff in the use and “leverage” of ICTs in education.
- c) Training of students to benefit from the use of ICTs in the learning process.
- d) Promotion of innovation, research and content production initiatives.
- e) Communications and networks to support the dissemination of educational content.
- f) Academic and administrative management of education establishments.

The pilot project that included a group of 5° grade students raised expectations and was highly motivational for students and teachers alike. The devices were used in a limited number of subjects (mathematics, English and environmental studies).

At the end of the project, students with more learning difficulties were seen as more motivated and as having worked harder. Teachers highlighted the interaction with their students, access to resources, the possibility to design self-assessable assignments and the change in methodology, with a stronger focus on collaborative work. There was no suggestion to replace the desktop computer room, or to extend the project to include all students and teachers in the school. It was considered to be a focal experience.

5.2 Madrid

Institution: Colegio SEK-Ciudalcampo, Madrid. Spain

Characteristics: Kindergarten and grade school

Persons interviewed: Teachers and coordinators

The school is located in a high-income community. All students have a computer at home. Students and teachers are accustomed to using technology. Every classroom has an electronic board and they have mobile computer carts to provide the classrooms with computers when needed.

The school had always favored the inclusion of technology in the classroom. So, we cannot say that in this case the introduction of tablets was a breakthrough, but rather, that it was rather a natural evolution process.

The institution chose the iPad model with 3G. They started with the youngest students and worked their way up other levels. In grade school they are currently using e-learning platforms. Whether to include the iPads in the classroom is up to the teacher. They are used to learn graphomotricity, reading and writing, English, math and to encourage creativity. The content used is produced by different companies; they also avail themselves of free software and content developed by teachers. Technology is included and allowed at different times. No indiscriminate use. Filming cameras are disabled and browsing filters are installed.

The experience is ongoing and is not considered to be a pilot project. So, there was no baseline, measurement indicators or goals. In the long term, they imagine that tablets will replace netbooks, but there is no decision yet made in this regard. The benefits reported are: motivation, access to information, time saving, collaborative work and concentration.

5.3 *Kentucky*

Institution: Several visits were made because the state of Kentucky has a very broad technology inclusion plan.

Characteristics: grade and high schools

Persons interviewed: Secretary of Education of Kentucky, headmasters and teachers.

Schools, ultimately, are the ones that decide whether to introduce tablets or iPads, and request funds from the Education Bureau of the County, which will decide about the allocation of these funds after evaluating the project submitted. (Although the funds come from the State, it is the County that will decide the final destination of those funds).

The first visit was paid to a school specialized in science, math and technology, of the “advanced student program” type. The school has electronic boards and multimedia. Technology is built in the traditional practice in a systematic manner. It has its own content repository.

The second visit was to a public school where the use is free. Every student has their own iPad and they can take it home. The iPad is considered to be a tool to access information, rather than a tool meant to enhance the learning process. Parents pay a monthly insurance fee for the device.

As benefits they report more communication, access to information and motivation of students.

The state of Kentucky has a strong education quality improvement program in place, with a 20 year horizon (implemented in 1990) to reduce the gap in training between high school and college. They are working on reforms at different levels. Among these, the inclusion of ICTs at schools is an important pillar. The decision to support the project of getting tablets into schools is meant to encourage self-learning and student accountability, since they miss many schools days for climatic reasons. E-learning is encouraged.

There are differences worth noting between the United States and Latin American or Spain. In 2010, 88% of Americans used a tablet PC. By the end of 2011, it is estimated that 28 million were using an iPad.

6. New tables developed for education purposes

6.1 OLPC: XO.3

OLPC (*One laptop per child*), the Project set up by Nicholas Negroponte to oversee the production of affordable educational devices for use by the poorest children around the globe, presented in January this year, in Vegas, during the CES 2012 (Consumer Electronic Show, the world's most important technology exhibition) its tablet model: XO-3¹³.

It is still a prototype to be developed jointly with Marvell Semiconductor Group and offered at a low price, with energy efficiency features and a rugged design. Some of the soft cover designs proposed so far include a built-in solar panel.

One can choose between Android or Linux OS and the price is expected to be around USD 100, although the actual price will not be known until the tablet hits the market. The XO-3 is still planned to enter production at the end of this year, and manufacturing will not occur until an order is placed.



¹³ <http://blog.laptop.org/2012/01/07/the-xo-3-100-tablet-debuts-at-ces/>

6.2 Intel: Studybook

Intel, that reacted to the appearance of OLPC with the introduction of its Classmate (2007), a rugged netbook with preloaded education software, with around 7 million distributed, is launching a new tablet reference design geared specifically for K-12 education. The "studybook," as it's called, is capable of running both Google's Android (Honeycomb) operating system and Microsoft Windows 7¹⁴.

The new studybook features a 7-inch capacitive multitouch display with a resolution of 1,024 x 600. The ruggedized design includes unibody construction, shock resistance, dust resistance, and water resistance. It has an ingress protection rating of 41 (IP41) and is designed to survive a drop of up to 70 cm. And it comes at a low cost.

The device also offers a security feature common to other Intel Learning Series devices, a Trusted Platform Module (TPM)-based system that can brick a device that's lost or stolen. Software includes e-reading solutions and laboratory simulators and microscopy.

The first models are expected to be available by the second semester in 2012.



¹⁴ <http://thejournal.com/articles/2012/04/10/intel-reveals-multi-os-studybook-tablet-for-education.aspx>

7. Preliminary conclusions

It is still early to say that digital tablets are the next steps in the process of bringing technology to the classroom.

Any mobile device –the more portable the better- that allows the student to move freely with a 24/7 access has a benefit over fixed technology, with headroom and time limitations. It not only changes the headroom ratio, but also the user’s behavior patterns. The screen is small; however, it offers pedagogical possibilities that cellular phones do not.

At first sight we may venture that tablets are very good tools for content consumption, not creation, which may seem like a contradiction for the education model that is encouraged. (Students and teachers create their teaching and learning experiences) and there are still many limitations regarding extensive deployment of tablets (lack of appropriate connectivity, availability of content and applications and development of related solutions-recycle policies, theft deterrence features, etc).

“Sometime in 1882, Friedrich Nietzsche bought a typewriter. His vision was failing, and keeping his eyes focused on a page had become exhausting and painful, often bringing on crushing headaches. He had been forced to curtail his writing, and he feared that he would soon have to give it up. The typewriter rescued him, at least for a time. Once he had mastered touch-typing, he was able to write with his eyes closed, using only the tips of his fingers. Words could once again flow from his mind to the page.”

“But the machine had a subtler effect on his work. One of Nietzsche’s friends, a composer, noticed a change in the style of his writing. His already terse prose had become even tighter, more telegraphic. “Perhaps you will through this instrument even take to a new idiom,” the friend wrote in a letter, noting that, in his own work, his “‘thoughts’ in music and language often depend on the quality of pen and paper.”

“You are right,” Nietzsche replied, “our writing equipment takes part in the forming of our thoughts.” Under the sway of the machine, writes the German media scholar Friedrich A. Kittler, Nietzsche’s prose “changed from arguments to aphorisms, from thoughts to puns, from rhetoric to telegram style.”¹⁵

Along these lines we can take our own experience as the basis to analyze the relation established with these devices.

When e-mailing was first introduced we followed the letter format structure. In the last few years, with the dissemination of networks and mobile devices, our writing evolved to what we called message format.

¹⁵ YALOM, Irvin G. “When Nietzsche Wept” Spanish version, Emecé Buenos Aires, 2002.

Communications became briefer but not less rich or strict, if necessary. Summaries resulting from the organization and prioritization of ideas are very much in handy to communicate in our times. The power of synthesis (which means construction) is no longer an assignment but a necessary skill that appeared together with Technology.

We could contribute more examples but we would always be conditioned by our own judgment, by the inherent limitation to translate previous cognitive models into new realities.

This transition moment, however, allows us to make interpretations that will prove their degree of certainty as reasoning and significance coincide, in the context of new instrumental modalities that Lipman explains as follows:

“Translation involves carrying meaning from one language or symbolic scheme or sense modality to another and yet retaining them intact. Interpretation becomes necessary when the translated meanings fail to make adequate sense in the new context in which they have been placed. Thus, reasoning is truth preserving and translation is meaning-preservative.¹⁶”

It is yet to be seen whether the new uses are creating by themselves new content or laying the groundwork to produce them.

It will be interesting to see how children and young people react; and the first results of the initiatives already under way, where best practices will necessarily be related to the gradual approach method and to the production of increasingly better informed responses so as to reach new conclusions about the degree of ownership by students and teachers, pedagogical pertinence and results obtained.

¹⁶ LIPMAN, Mathew. “Pensamiento Complejo y Educación”. Ed. De la Torre. Madrid, 1997.

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