Learning with Mobile Technologies at Public Primary Schools in Costa Rica: The case of

the National Program of Educational Informatics of the Ministry of Public Education and

the Omar Dengo Foundation

Fundación Omar Dengo

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Abstract

This article presents the experience of the National Program of Educational Informatics of the Ministry of Public Education and the Omar Dengo Foundation of Costa Rica designing and executing a national project to encourage and develop learning experiences for teachers and students using mobile technologies at public schools. To describe this experience, first, the Omar Dengo Foundation and their National Educational Program is introduced. This program works under certain conceptual and methodological ideas regarding teamwork, collaboration, ubiquitous learning environments with digital technologies, among others. The Learning with Mobile Technologies Area (ATM for its acronym in Spanish) includes more than 2,400 schools, and has benefited 206,096 students (based on September 2018 data). The paper examines a description of this model, the main results with primary teachers and students, as well its coverage all throughout the country. This analysis includes the essential pedagogical principles of the program, their main outcomes, and challenges ahead. In general, the contribution of technologies has the potential to increases motivation, interest and improvement in the student´s learning.

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The Omar Dengo Foundation (FOD)

The Omar Dengo Foundation, FOD for its acronym in Spanish, was founded in 1987

as a non-profit organization, located in Costa Rica, Central America. Its mission is to

contribute to improve the quality and equity of learning opportunities to enhance human

development through innovative projects and educational models focused on people and the

use of digital technologies (FOD, 2019).

To achieve this mission, the organization has created different national and regional

projects to innovate the use of technology for human development. In the case of public

formal education, thanks to a public private partnership with the Ministry of Public Education

(MEP), the foundation was able to introduce digital technologies into the public education

system starting in 1988. This effort continues today through the National Program of

Educational Informatics of MEP-FOD. This paper explore the origin of this program and its

current impact on public schools of the country through the pedagogical use of mobile

technology. This has been fundamental to promote technological appropriation and reduces

the digital gap in teachers and students at kindergarden, primary and secondary school.

The National Program of Educational Informatics of the Ministry of Public Education

and the Omar Dengo Foundation (PRONIE MEP-FOD)

The alliance between the MEP and FOD started by focusing on the public schools with more students´ enrollment in the country. By then, in 1988, the program used only the model of Educational Informatics, with the goal of contributing to the development in students´ strategic capabilities for the modern world, such as creativity, logical-mathematical thinking, problem solving, and collaboration. These experiences took place using educational informatics´ lessons with specialized teachers guiding the students in their learning outcomes (FOD, 2018).

The development of this model helped the program to develop other initiatives for regular teachers. These experiences helped the program to establish their general objective: to foster the appropriation of digital technologies by Costa Rican student population, and to allow them develop the competencies required to learn and fully participate in the 21st century (Fonseca and Bujanda, 2010). The main beneficiaries are students and teachers of kindergarten, primary and secondary public schools (K-9).

Today, these initiatives are part of two models in the program: Educational Informatics and the Area of Learning with Mobile Technologies (ATM). Both models are inspired by conceptual and methodological principles (next section). Educational Informatics has beneficiated 503,906 students, and 1,256 schools; meanwhile ATM has focused in covering more schools, with a total of 2,484 educational centers, and 206,096 students beneficiaries (FOD, 2018). The data presented in this article is based on FOD´s statistics to September 30th 2019.

Conceptual and Methodological Principles

Based on FOD´s history, there has been six key conceptual and methodological guiding principles for the work of the different initiatives focusing education perspectives in constructivism, collaboration, development strategies, among other themes (FOD, 2018). To provide a description of these principles, following, there is a summary presented on page 57 of the book "Digital Technologies and Capabilities for Building the Future: Contributions from the National Program of Educational Informatics MEP-FOD":

1. Learning is more effective when knowledge is built by doing things together with other people.

2. Digital technologies enable the creation of more effective, profound, and ubiquitous learning environments, as well as the development of strategic competencies for the modern world.

3. Students carry out and lead their own learning process, based on their interests, needs and talents.

4. The capability of teachers to take on the new roles assigned to them by modern education is strengthened with effective professional development strategies.

5. Schools should develop a shared vision on how to promote the educational use of the available technological resources, as well as incentivize collaboration among its members, to achieve such goals and become a space for innovation.

6. The Program's interventions are based on the knowledge available on how to favor educational change and on development paths that allow for the progressive construction of such change.

These principles are implemented in the different initiatives of PRONIE MEP-FOD considering administrative, technical and pedagogical issues of the public school system in

Costa Rica. The ATM model is one example of how these principles are applied in schools with 10 or less student enrollment; to schools with approximately 400-student enrollment (FOD, 2019). The ATM model will be further discussed in the next sections, focusing on ATM Primary, the ATM initiative with more students and educational centers beneficiated today. This discussion includes a description of the model, their pedagogical principles, the main outcomes, and other results, encouraging other people and educational institutions to benefit from these ideas in the implementation of similar models in their own countries.

Learning with Mobile Technologies in Primary (ATM Primary)

The Learning with Mobile Technologies, ATM, was born in 1998 with the first initiative focused in rural schools with a small enrollment, less than 10 students per school (FOD, 2019). The learning strategy used several desktop computers in the regular classroom. The learning outcomes were used by different education experts, including Dr. Claudia Urrea. She did observations and collect data in El Silencio Primary school, in 2003, to identify relevant aspects for the intensive incorporation of digital technologies in rural educational environments (2004). Her doctoral dissertation, analyzed the implementation of pedagogical ideas of constructivism of Seymour Papert. The conclusion of this study indicated the potential benefits of these educational contexts to include more technology for students (Urrea, 2004).

This idea was applied in several pilot studies to use of technology to improve the learning outcomes in students. In 2010, the program used these data to launch an initiative with multi-grade teachers, with the purpose of promoting the development of problem-solving and research skills, productivity and citizenship, and communication of students from multi-grade schools through an educational offer with mobile technologies (FOD, 2019).

This initiative currently provides one laptop per child (1:1) along with other technical equipment such as printers and audio devices, among others.

To include other primary schools with a bigger student enrollment, the Program started to develop in 2013 Mobile Labs as their equipment deployment. This type of deployment included several laptop computers with the possibility to be transported together in a single cart between different classrooms. This initiative benefits schools between 90 and 400 student´s enrollment. The pedagogical objective pursued is to develop scientific skills using inquiry-based learning strategies in sciences lessons (FOD, 2019).

Today, these initiatives (Multi-grade and Mobile Labs) are part of the ATM model. They merged into a single pedagogical project with two types of equipment deployment in 2018 today known as ATM Primary. This project (ATM Primary) is present in 2,066 schools and benefits 81,697 students in kindergarten and primary levels of Costa Rica. The objective of ATM is to develop competencies associated with the use of digital technologies, such as managing information obtained from digital media, technology-supported research, digital expression, and online communication (FOD, 2019).

To develop the project, ATM works under three key approaches (FOD, 2018):

- Equity and adaptation to the evolving needs and expectations of society in its different contexts. ATM has contributed to reach most schools in rural and very difficult access routes of the country, including indigenous educational centers.

- Focused on the promotion of new educational models made possible by mobile technologies, and on fostering in students the competencies considered strategic for the modern world: communication, collaboration, creativity, self-regulated learning, ethical and safe use of technologies. The project takes advantage of mobile

technology to promote use of technology inside and outside the classroom to develop

skills associated with the national curriculum.

- Gradual construction of change. ATM renews periodically their program trainings

    based on technology changes but conserving the same pedagogical approach, which

    will be explore next.

Pedagogical Approach and Technology Used in ATM Primary

The work of ATM has been done using five pedagogical approaches to guide, train,

support and monitor how teachers and students can potentially use the technology (Bujanda,

2017). These uses explore the implementation of 21 century skills using technology

(Ananiadou and Claro, 2009) . The laptops are loaded with open source programs and/or uses

the programs that are included in the operational system. Another requirement of these

computers is to work under online and offline environments. Following, the pedagogical

approaches of ATM and some examples of how primary teachers and students use them are

presented (Bujanda, 2017):

1. Discover and understand new knowledge. This is done in primary schools using

    digital didactic resources off line such as Kiwix, YouTube, among others, which

    provide open sourced information with contents in Sciences, Math, Social Studies,

    Spanish, English and others. In some schools, with connectivity, teachers can use

    Explorer, Google, etc.

2. Create new knowledge. The user takes advantage of office automation tools and other

    software to create communication products based on the official curricular programs.

    In primary schools, teachers and students often use Power Point to represent ideas

    based on the exploration of didactic materials given by the teacher.

3. Learn collaboratively in connection with others. The program installed an internal network (Intranet) on each school to provide an internal digital environment of communication in which students and teachers can exchange data for teaching and creating purposes. The students can review the digital work of their teammates and provide feedback not limited by Internet access.

4. Apply new knowledge with authentic audiences for real purposes. There are a number of examples in the curricular programs focused on providing real situations based on the environment, economy, social causes, among others. These situations are used by the teachers to explore the topics and motivate their students to create communication products and research real world problems. The technology is used to facilitate this process.

5. Gain more control and autonomy over the learning process. Digital resources can provide support to help students become independent learners by making this learning more visible for their teacher and other companions in the classroom. The teacher can moderate this process so it can become a great feedback for the students. For example using concept maps, learning logs, digital portafolios, etc. With software like CmapTools, students are able to make thinking visible to others. In that sense, they can compare their initial learning at any time and feedback the ideas behind the big learning theme. The digital creation (i.e. mental map) can be edited at any time depending on the activities develop in the classroom.

There are many more programs installed to choose, depending on the level, subject, needs and interests of the educators and students. Therefore, these pedagogical uses depend on the teacher´s creativity and the programs installed in the computer. These software are periodically updated with the demands of the guiding principles of ATM.

The pedagogical approach reaches the school staff and their students through a teacher professional development work, based on training activities and follow up in their progress using technology for the school staff (FOD, 2019).

Teacher Professional Development

This process begins with an analysis of theory based on constructivism approach for the development of teacher competencies with technology (figure 1). The learning objectives, activities and contents are designed applying andragogy principles and teaching practices. This creates four main stages of action: Teacher Training Plan (PAD); Advisors Training Plan (PAA); Coaching and support and other complementary actions. Through the Teacher Training Plan the teachers and a selection of students are trained in the school with the necessary skills to use the technological deployment model, considering the administrative and pedagogic aspects of its use (FOD, 2018). The first phase of PAD is done at the schools, while the second phase of this training is done in a virtual learning environment.

Advisors in technology and pedagogy carry out these training activities and provides coaching and support after the schools staff has been trained. The Teacher Professional Development is possible thanks to a large multidisciplinary group of specialized staff in pedagogy, education, technology.
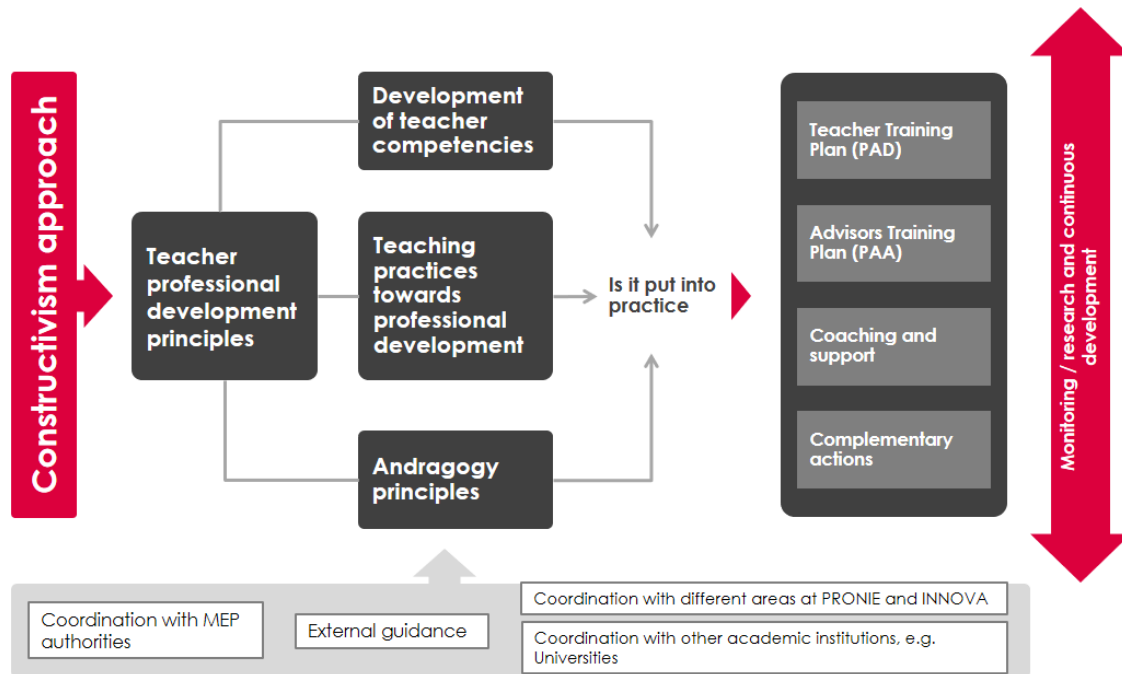
Figure 1. Teacher Professional Development of PRONIE MEP-FOD. Source: FOD,

2018.

Results

The program has contributed to the reduction of the digital gap within the country and in relation to Latin American countries (Zúñiga, 2018). At the end of September, 2019, this program has benefited 91.3% of the students in the public school system of Costa Rica (figure 2). Learning with Mobile Technologies in Primary (ATM Primary) covers 67% of the public schools with technological deployment. The social impact of these results translates into having more equity to favor access to technology in students with low-income families and hence, less probability of using computers in their homes and communities (Zúñiga, 2018). With 1:1 deployment model, students can take their laptop computers into their homes all through the year.
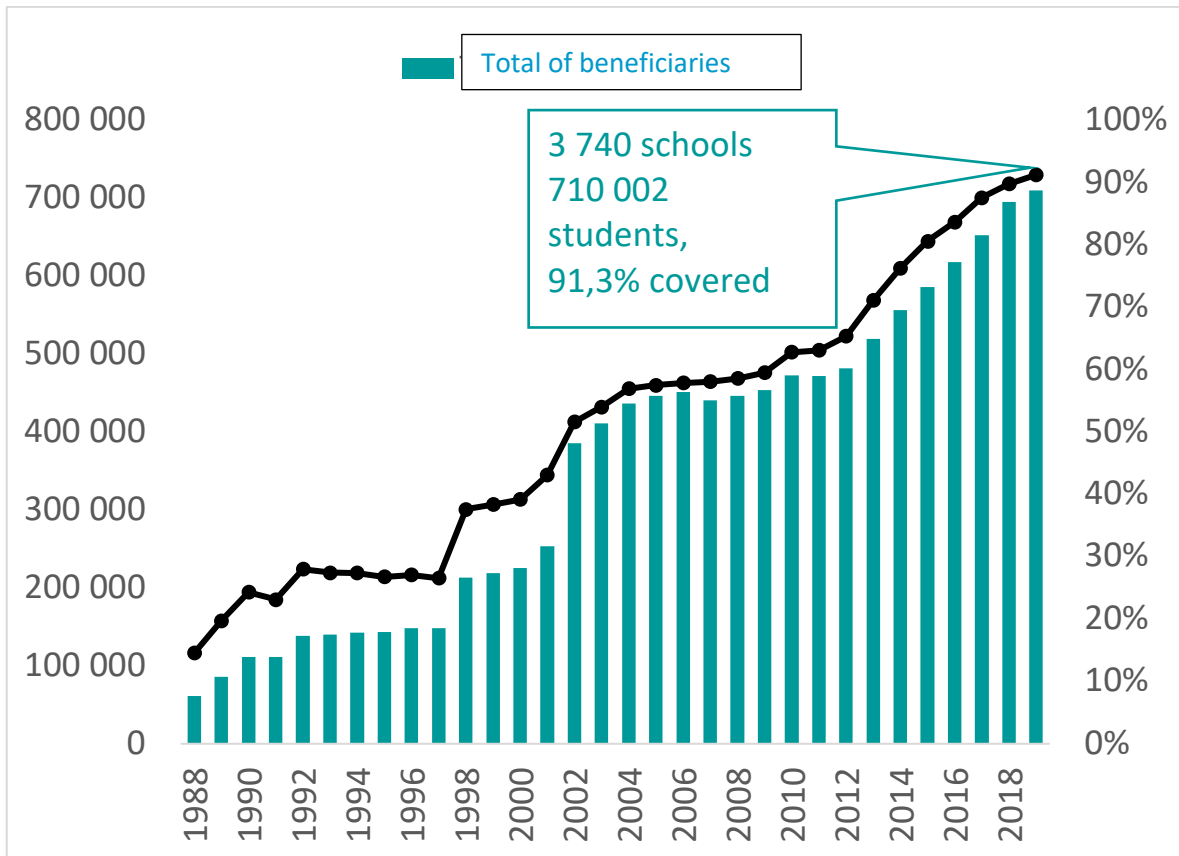
Figure 2. Teacher Professional Development of PRONIE MEP-FOD. Source: FOD, 2018.

The implementation of the Teacher Professional Development plan has been very important to renew pedagogical practices in teachers in the public education system; at the same time providing more possibilities for technological appropriation in students. Of the five pedagogical approaches of ATM, the most common observed in teaching practices are related to discovering, understanding and creating new knowledge. These approaches has been important to implement the technology access in public schools as a means of promoting learning in students. However, much remains to be learned about using technology's potential and more importantly, how teachers are using the technology to promote new learning in their students (Bransford et al., 2000).

The digital uses of technology in the classroom on average usually takes place between once or twice a week. At the same time, the development of research, communication and collaboration skills is promoted to the extent that teachers promote the use of technology, both inside and outside the classroom (FOD, 2016).

In general, based on Zúñiga (2018) the contribution of technologies has the potential to increases motivation, interest and improvement in the student´s learning. From the teacher´s point of view, the use of digital technologies for educational purposes provides progress in students´ autonomy and confidence. The role of the teacher or the principal is key to overcome fears and prevail attitudes of support and trust towards the educational process through digital technologies.

Conclusions and Recommendations

The experience of implementing the PRONIE MEP FOD can provide a number of lessons learned. Next, a few are highlighted considering their importance for the possible implementation in other countries:

- The public-private partnership between the Ministry of Education and Omar Dengo Foundation has been fundamental to provide the creation of a national program the promotes technological appropriation and reduces the digital gap in public schools.

- The program has envisioned and strengthened the need to create a well-documented pedagogical approach to use the technology in education, which has been essential to develop teacher capacities to use technology in the classroom.

- Due to the lack of broadband connectivity in the country, it is important to find open source software capable to work under offline conditions, which covers most of the schools at ATM Primary.

- It is essential to provide a monitoring and assessment system for the schools that are part of the program.

Challenges ahead for the Program and the country:

- One of the main challenges of the program is to promote more professional teacher development in regular classrooms. The practice of teacher technological appropriation needs to balance the demands of the curricular programs to have meaningful, practical and everlasting learnings in their students. The use of the technology in the classroom has greater potential to promote active pedagogical methodologies and to attend student's particular needs.

- Is important to implement pedagogical uses of technology focused on learning through connection and collaboration with others. The program is currently doing pilots studies to explore possibilities considering the quality of the broadband connection in the country.

- At present there is a pilot study using a virtual coaching and support model, it will be implemented for the rest of the schools in 2020.

- Costa Rica still has a challenge ahead providing a national broadband network to expand the possibilities of educational projects.

- In primary schools using technology, there is work ahead by practicing with students other capabilities less explored such as problem solving, research, citizenship and communication as necessary skills for the XXI century.

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