PACo: An Educative Instrument to Transform Society

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Abstract

Historically, Mexican education has been a low point in every international assessment made. Mexican primary schooling has been stalled for decades, with low-income families on the last link of the chain, thus creating an ever-lasting vicious cycle: poverty – ill education – inequalities. With PACo we aim to break that cycle with a useful gadget for teacher's college students as well as for children from rural schools in the Southern Mexican State of Oaxaca. Even with this simple device, we cover the most urgent needs for learning and teaching in rural, impoverished classrooms. Every user group heighten exciting new ways to use it, becoming a source for inspiration, a first approach to challenge inequalities.

Author Keywords

Normalistas; Hacking, Mr Potato Head; Oaxaca; Rural, Mexican School; Design Thinking; UN 2030 goals.

ACM Classification Keywords

H.5.1 Multimedia Information Systems: Audio input/output, Video (e.g., tape, disk, DVI). H.5.2 User Interfaces: Prototyping.

Introduction

Mexico's continuous pathway into the XXI Century is undeniable. A great deal of social, economic

development has been reached, although several issues remain painfully unsolved or delayed. Poverty, inequality and illiteracy are just a few of them.

Education is still on everybody's pending list. On the last OECD PISA test (2015), 70 countries were evaluated. Mexico ranked 58th, placed below other Latin American countries. PISA's overall average score was 493 points; Mexico scored only 416 [5].

The Southern Mexican State of Oaxaca has the largest indigenous population in the country, most of them living in small, rural areas. Illiteracy, along with another socioeconomic data, places Oaxaca as one of the states identified by its great degree of poverty and, in turn, Mexico as one of the countries with greater inequality [1].

Rural Teachers' Colleges, known in Mexico as "*Normales Rurales*" are schools specialised in training teachers for basic, primary education in rural areas. All *Normales* are boarding schools, open only to men or women from low-income, rural families. Among them, the *Normal Rural de Ayotzinapa* is the most known.

The *Escuela Rural Normal Vanguardia* is located in the Mixtec region of Oaxaca, one of the poorest rural areas in the state. A female only *Normal* school, it was the centre of our research study (see Figure 1).

Rural schools are basic education (elementary) institutions located in small agricultural towns; some of them have got less than a 100 inhabitants. They share similar backwards conditions, such as lacking proper furniture, bathrooms, libraries, audio-visual equipment, computers and with no internet access at all.

Figure 1: A *Normalista* student at the *Escuela Rural Normal Vanguardia*, in Tamazulapam del Progreso, Mixtec region of Oaxaca. Two thousand female students are studying there to become rural teachers.

On September 2015, many countries, including Mexico, adopted a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of the 17 United Nations Sustainable Development Goals for 2030. Each goal has specific targets to be achieved over the next 15 years [6].

Considering this glum scenario, nevertheless, we were decided to help to level the playing field for them. Also, we also learnt that in underprivileged areas technology is just another barrier that separates those whom have and have not. Hence, we grounded our project on three UN sustainable goals. See Figure 2, below:

Figure 2: We selected three UN goals: quality education for rural schools in Oaxaca; gender equality, especially for girls and *Normalistas*; and finally, reduced inequities for indigenous, unprivileged populations.

We assuredly believe that, changing the conditions for rural *Normalistas* and students of rural primary schools in Oaxaca would bring countless of denied opportunities to them, and to leapfrog into a more equal, modern Mexican society.

Related Work

Plenty of previous work presents the way in which technology finds a way into the classroom. It is definitely undeniable that technology intervention is the way to go for us, but in a friendly, easy to use way, a non-obstructing multi propose device which could useful in rural areas.

A thoughtful literature review revealed the different ways in which similar problems have been solved. Interesting proposals, like [2,4] tells about the use of technology in the classroom looking to improve the chances of success of children elsewhere.

On those case studies, technology is but a medium to achieve higher goals, not the final target. With that in mind we continued our journey.

Methodology Used

According to our objectives, and looking for a fun and easy to use solution which would motivate and inspire both *Normalistas* and rural school children, we chose the Design Thinking methodology, as it is an interactive, self-directed process. Besides all the known advantages to use it, as watching the product grow into a reality, it clearly became our right choice. Figure 3, below, shows the Design Thinking steps.
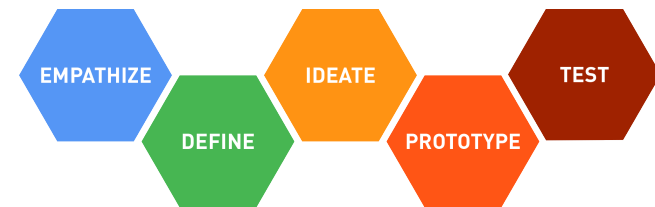

Figure 3: Design Thinking methodology explained (Stanford Institute of Design).

Empathise
The harsh reality of the *Escuela Rural Normal Vanguardia* came into our attention by chance. A quick first visit resolved us to work together on this very project.

With permission of the school authorities, we organised a Focus Group with senior *Normalistas.* We listened to their stories about their learning ways as well as their tech requirements in the classroom. They told us about the practices they make on rural primary schools and the difficulties they face on almost bare classrooms. User Journeys and observation revealed their needs, their desires and wishes.

Figure 4: Focus Group at the *Escuela Normal* with senior *Normalistas*.

Define
Then we defined the needs for both users, as described in the Table 1, bellow:

Normalistas	6-12 years old students
• Internet access in their classrooms • Projector to present academic materials	• Something to interest them, to motivate them, to arouse curiosity and to entertain in rural schools

Table 1: Requirements defined through the Empathise stage of the Design Thinking methodology.

Ideate
Through Brainstorms, and Out Of The Box Thinking, we came out with a wide range of ideas for the project. We envisioned large and small screens, Virtual Reality goggles, Augmented Reality cards, and even our own version of a Google Home assistant. All those ideas came along with pros and cons. Finally, we settled up with a familiar toy, hacked to fulfil all our needs: Mr Potato Head.

Mr Potato Head has the ideal size to become a learning companion as well as a teaching tool to help the *Normalistas* in their practices at rural schools. Besides, all kids love the character. Hacking a Mr Potato Head and turning it into an educative instrument was feasible. And fun.

Prototype
We named our project PACo after its Spanish initials for Projector and Knowledge Assistant. Paco is a very common and dearly nickname in Mexico. We considered several versions of the character and, after showing it to kids, and teachers alike, we settled down to the classic character.

We hacked Mr Potato Head (PACo) with the following off-the-shelf technologies:

• Pocket projector (200 lumens)
• Internet access point (Ethernet connection)
• 128 Gb SSS storage
• Stereo speakers
• USB port
• Basic GUI on the back for easy operation

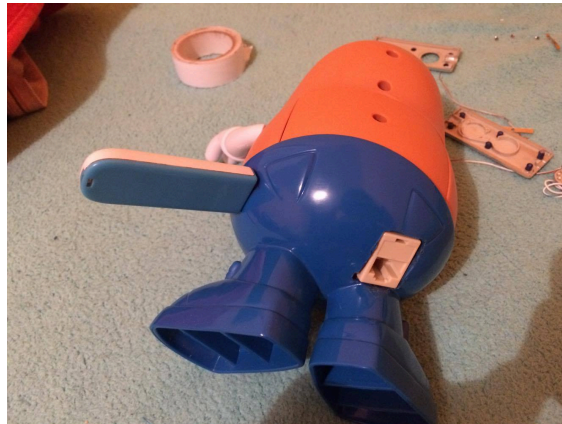Figure 5, below, shows the hacking process of PACo.

Figure 5: Hacking Mr Potato Head into PACo with cheap components.

Test
We conducted two series of Wizard of Oz testing using a prototype. The first one was carried on with *Normalistas* at the *Escuela Normal Rural Vanguardia*, in which a senior student used PACo to work an assignment. Her fellow students watched a slide presentation, used the WiFi provided and even listened to music while collaborating, as shown in Figure 6.

The second test took place in a rural school near the Yosocuta dam, also in the Oaxacan Mixtec region, as portrayed on the video. Firstly, we observed a normal class day in which the children and teacher used their normal, traditional appliances. On the second day, they all experienced PACo. Children were excited to have the gadget in class, as they participated more; they looked motivated and happy. The teacher gladly accepted the device and gave us interesting feedback.

Figure 6: A senior *Normalista* showing her presentation while advancing slides with PACo.

Results
In general, all users (90% of them) accepted PACo as a useful and interesting inclusion to their learning/teaching process. Users kept discovering new functionalities to it (as storytelling during History classes [3]) according to their particular needs. Some of the most relevant feedback we received was:

- PACo felt fragile on the hands of the less tech oriented *Normalistas*
- Teachers asked us to include greetings and farewell messages in the Mixtec language for their students, as they might be bilingual or just because they want to learn phrases in other languages
- No one questioned the price of the device, as it look useful but not costly (around $220 USD)
- Teachers were worried that PACo ought to be a joyful distraction, but that didn't happen

Discussion

We certainly believe that PACo is really the result of an interesting process, as defined by the conference motto: explore, innovate, inspire.

With PACo, we covered the lack of educative tech tools in the *Normalistas* classroom. We don't offer them a solution, but instead a tool for them to explore and to create innovative forms of education. In rural schools, PACo creates a new learning environment, which facilitates, motivates, inspires and delights children.

Our project fully supports the growth and academic development of female *Normalistas* students. As we mentioned earlier, they all came from rural backgrounds, traditionally characterised by machismo, few opportunities for development and mistaken stereotypes.

Finally, we are eager to break the vicious cycle. PACo is but a first approach to offer opportunities to revert the technology barrier in rural areas in Oaxaca, and ideally, to transform society.

Acknowledgements

Figure 6: PACo in full gear at a *Normalista's* practice classroom.

References

1. Coneval. Informe de resultados de medición de la pobreza. 2014. Retrieved October 24, 2014 from http://www.coneval.org.mx/medicion/Paginas/PobrezaInicio.aspx

2. Dae gun Jang, Yi-Kyung Kim, and Seunghun Kim. 2015. Flex-Beam: A Versatile Video Projection Interface for Digital Performance. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems* (CHI EA '15). ACM, New York, NY, USA, 1639-1644. DOI: https://doi.org/10.1145/2702613.2732799

3. Henriette Cramer, Paloma de Juan, and Joel Tetreault. 2016. Sender-intended functions of emojis in US messaging. In *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services* (MobileHCI '16). ACM, New York, NY, USA, 504-509. DOI: http://dx.doi.org/10.1145/2935334.2935370

4. Jaime Sánchez. 2010. Digital inclusion in Chilean in rural schools. In *Proceedings of the 9th International Conference on Interaction Design and Children* (IDC '10). ACM, New York, NY, USA, 364-367. DOI=http://dx.doi.org/10.1145/1810543.1810615

5. OECD. PISA Results report. 2015 Retrieved October 18, 2016 from https://www.oecd.org/pisa/PISA-2015-Mexico-ESP.pdf

6. UN. Sustainable Development Goals 17 Goals to Transform Our World. 2015. Retrieved November 14, 2016 from http://www.un.org/sustainabledevelopment/sustainable-development-goals/