Effects of the use of the BAKE mobile application as an Educative instrument for teaching content for preschool education to Shipibo people in the community of Cantagallo, Lima, Peru

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Abstract— **This document includes the experience in the design, development and validation of a mobile application conceptualized as an instrument for basic teaching and self-learning of the Shipibo - Konibo language. It was created to be used in Bilingual Educative Institutions of preschool level, located in the Peruvian native communities.**

This App is intended to support the different education gaps in Shipibo-Konibo communities. The App name is BAKE that means child in Shipibo-Konibo language. It works offline and it has been developed for mobile devices with android operative system, considering they would be used in the remote Shipibo-Konibo communities.

As part of the validation processes, a comparison test between the use of the application and the use of traditional education in Cantagallo community in Lima (the only Shipibo-Konibo community in Lima) has been developed. The results have been favorable and capabilities have even been identified in the reduction of gaps and overcoming existing limitations in traditional education in Bilingual Educative Institutions.

Keywords— Native People, Mobile Technology, Cantagallo, Shipibo-Konibo language, child.

I. INTRODUCTION

One of the serious problems currently affecting the native population of the continental Amazon, is the disappearance of languages, along with the loss of ancestral cultural manifestations practiced by each of the native people for hundreds of years, representing irreparable loss of the living heritage of humanity.

When a native language dies, a whole cultural legacy dies out with it. Many native languages are in serious danger of becoming completely extinct; that is why linguistic revitalization processes are necessary [1].

It is important to state that is a worldwide problem spread across all continents, according to data from the UNESCO General Conference in 2016, at least 40% of the existing languages were in danger of extinction that year, which covered at least 2680 languages from a total of 6700 languages registered in the world at that time [2] [3].

Likewise, in recent years, activities aimed at promoting the preservation and survival of native languages have become important in various countries. In this way the General Assembly of the United Nations Organization has declared the year 2019 as the "International Year of Native Language" [4].

Although it is true all the native languages of the Peruvian Amazon are transmitted orally, considering the family the main transmission and learning space from generation to generation, for decades, some state educative programs have become useful mechanisms to strengthen the preservation of native languages, as well as to reduce social inclusion gaps. Peru is one of the countries that has been using these programs for more than half a century, although with few encouraging results [5].

In recent years and worldwide, information technologies have been used as support mechanisms for learning at all levels of education. However, there are few specific experiences in the creation and use of information technologies aimed at teaching and / or revitalizing native languages. This paper aims to introduce the use of mobile applications of easy massification, as instruments for the transmission and learning of native languages for children, having as advantage, over other types of instruments, its easy interactivity, visualization and learning through audios and videos, and its easy accessibility given the massive use of smartphones.

In Peru, there is a program naned Intercultural Bilingual Education (EBI) promoted by the Ministry of Education [6] [7] , which covers at least 30 of the 48 native towns that are located throughout the Peruvian Amazon territory. The high geographical dispersion of these towns is a limiting factor to offer a quality service. Generally, the educative authorities justify the poor quality of their report results due to the geographical remoteness of the communities, indicating that transporting teachers, educative materials and good service is something complex due to geographical difficulties.

In this way, we made a search of any Amazon native communities with better access to basic services and physical proximity to the large logistics centers of the Ministry of Education in Lima city, in this way the community of Cantagallo was identified that its inhabitants belong to the Shipibo-Konibo people, and was originated after the displacement of some 14 families in 2000, and currently consists of about 2000 people. Cantagallo is located on the banks of the Rímac River, less than 2 km from the Government Palace [8] [9] [10] .

The Shipibo-Konibo people is one of the most influential communities of the Peruvian Amazon. They call themselves "jonikon", meaning "real people"; they also adopted the exonym "shipibo". Their own language or "joikon", 'true language' is now known as Shipibo-Konibo. This language belongs to the *pano* linguistic family which includes about thirty languages, in active and extinct in Peru, Brazil and Bolivia. According to INEI (2008), the population Shipibo-Konibo by far exceeds the official figures (22.517). The majority of the population is bilingual. It means they talk in Shipibo-Konibo and Spanish. Although the Shipibo-Konibo is still transmitted to children, there is a growing number of people who speak Spanish as the dominant language and reaches only a partial or passive proficiency of their native language. In addition, the degree of impact of the Spanish speech and structure in the Shipibo-Konibo is considerable. For these reasons, the language is considered to be in a vulnerable situation.

In Cantagallo there is only one Educative Institution: preschool and primary level, belonging to the Intercultural Bilingual Education (EBI) program. Although it is true that better conditions have been identified than in most schools located in the Peruvian Amazon in aspects such as: Presence of educative materials, access to basic services, greater supervision of educative authorities, however, it still has limitations related to learning language and culture, based on:

- Insufficient number of teachers who speak or know the Shipibo-Konibo language.

- Curricular plan not adapted to the cultural Shipibo-Konibo context.

- Inexistent use of technological instruments to support the learning processes of native languages and other learning.

- Shortage of investment of the Peruvian state in the educative service oriented to native people.

Finally, it is important to enhance, as a fundamental part of working with native populations, the differentiation of each town from the others. Precisely, the attempts to cultural and linguistic homogenization, carried out mainly after the arrival of the Spanish people in America, generated the early loss of dozens of Latin American cultures. There are great similarities occurring at the linguistic family level, however, each town represents hundreds of years of survival and development. All these entails to incorporate in the design of information technologies various elements and considerations of the culture of each people, in order to achieve their acceptance.

II. METHODOLOGY

A. Computer development of the BAKE app.

A series of activities aimed at the participatory construction of a mobile application oriented to serve as an instrument for basic learning of the Shipibo-Konibo language was established, which was called "BAKE", that in Shipibo-Konibo language means "Child". As part of the process of identifying the requirements for this App, we contacted teachers of kindergarden and primary level in bilingual Intercultural educative institutions in Pucallpa, a city where the most Shipibo inhabitants are settled. We reviewed the curriculum with these teachers used by these educative institutions at the kindergarden and primary level. In the same way, we inquired specialists from the General Direction for the Rights of native people of the Ministry of Culture, with whom we worked on the establishment of the information architecture and the production of the contents to included in the mobile application.

Considering these inputs, the following requirements were identified:

Functional Requirements:

- The mobile application, when it is downloaded, should work off line.

- The organizational structure of the application content must follow basic learning categories.

- The application content should be displayed in two languages: Shipibo as a main language and Spanish as a second one, and the sound needed to be only in Shipibo.

- The navigation between categories of the application must be through interactive, friendly and intuitive buttons, so that it is for easy navigation and interaction for a child.

- Audio reproduced in the application must be understood and with a good pronunciation.

Nonfunctional Requirements

- The mobile application run on mobile devices of different types (Tablets, Smartphone, etc.), which have

an Android Operative System with a minimum version of Android 4.0 OS and API 14.

- The images used in the application to graph the content must represent it.

- The package size of the application must not exceed 20 MB.

- The content must be prioritized according to the Educative curriculum of the Shipibo-Konibo Communities.

- The application content must be produced with the participation of people who master the Shipibo-Konibo language.

B. Information Architecture Design

a) Production of content

As a result of the interviews with teachers of the Shipibo Bilingual communities, based on the review of the educative material, and other experiences in the development of mobile language learning applications, carried out by the development team, the following main contents were established:

TABLE 1: CATEGORIES OF APPLICATION CONTENT.

CATEGORY		
MATHEMATICS	LANGUAGE	SCIENCE AND ENVIRONMENT
The Numbers	The Alphabet	The plants
The Colors	The family	The animals
	Expressions	The Human Body
	The Things	The weather

Likewise, in the main contents of the mobile application we have the four existing vowels in the Shipibo-Konibo alphabet and the alphabet itself composed by 19 letters, in both cases the content is different from that used in Spanish and Portuguese, all this is attached in table 2.

TABLE 2: SHIPIBO-KONIBO ALPHABETH.

Vowels Shipibo-Konibo				
A		E		I
		O		
Consonants Shipibo-Konibo				
A	B	CH	E	I
J	K	M	N	O
P	R	S	SH	T
TS	W	X	Y	

On the other hand, most Amazonian languages have historically used a small quantity of numbers, in case of the Shipibo-Konibo they basically use 10 own numbers, in case they need larger numbers they make loans to other languages as Quechua for example. Table 3 shows the numbers and other contents included in the BAKE app.

TABLE 3: FORMAT OF THE APPLICATION CONTENTS.

N°	Category	In Spanish	Translation Shipibo-Konibo
01	The Numbers	One	Westiora
02	The Numbers	Two	Rabe
03	The Numbers	Three	Kimisha
04	The Numbers	Four	Chosko
05	The Numbers	Five	Pichika
06	The Colors	Yellow	Panshin
07	The Colors	Blue	Yankon
08	The Colors	White	Joxo
09	The Colors	Black	Wiso
10	The Colors	Red	Joshin
11	The family	Grandmother	Yoxan
12	The family	Grandfather	Yosi
13	The family	Sister	Wetsa
14	The family	Brother	Poi
15	The family	Daughter	Ainbo bake
16	The Fauna	Achuni	Shishi
17	The Fauna	Afaninga	Piska
18	The Fauna	Scorpion	Nibo
19	The Fauna	Cat	Mishito
20	The Fauna	Dog	Ochiti
21	The Flora	Aguaje	Binon
22	The Flora	Cacao	Toranpi
23	The Flora	Caimito	Caimito
24	The Flora	Camote	Kari
25	The Flora	Granadilla	Kaxawaro
26	The Human Body	Hair	Bo
27	The Human Body	Eye	Bero
28	The Human Body	Nose	Rekin
29	The Human Body	Mouth	Kera
30	The Human Body	Ear	Pabiki
31	Expressions	Welcome	Bekanwe
32	Expressions	Good morning	Jakon yameki
33	Expressions	Good afternoon,	Jakon yantan
34	Expressions	Good night	Jakon yame
35	The climate	Water	Onpax
36	The climate	Forest	Nii
37	The climate	Heaven	Nai
38	The climate	Hills	Shanka
39	The climate	Rain	Oi
40	The Things	Needle	Xomox
41	The Things	Raft	Tapan
42	The Things	Shirt	Koton
43	The Things	Canoe	Nonti
44	The Things	House	Xobo

When finishing the list with the application content classified by category on the format content, the appropriate translation was made into the mother tongue, with support from community members, in which each word described in the file was translated and written by the same member of the community in the mother tongue and with the alphabet corresponding to their language, thus obtaining a reliable translation.

b) Digitization of Contents.

The Ministry of Culture of Peru facilitated the participation of a Bilingual Shipibo-Konibo teacher, who

made the recording of the selected words in Shipibo-Konibo language. It should be noticed that involving the native speaker was extremely important, considering the complexity in the pronunciation of the words in that language.

There were digitalized 282 words to constitute the database of the terminology contained in this first version of the BAKE app, to be learned and eventually we achieved an average of 8 Megabytes storage in the mobile application.

c) Application Interface Design.

For the development of the application design, we took into account the experience of the community members regarding the use of mobile devices (tablets, Smartphone), the interaction with the applications they had, the number of actions necessary to enter to the desired content, and especially the graphic interface. The application should be simple and the content easily accessible, in Fig. 1 we can see the distribution of content for the main graphic interface in the application, to make the user have available at first sight the categories of the application and in second sight the content by each category.

For the development of the mobile application, the team worked under the XP Methodology (Extreme Programming), considered as an agile methodology that adjusts to the limitations of time and human and financial resources that characterizes this type of development, according to the needs identified in the requirements.
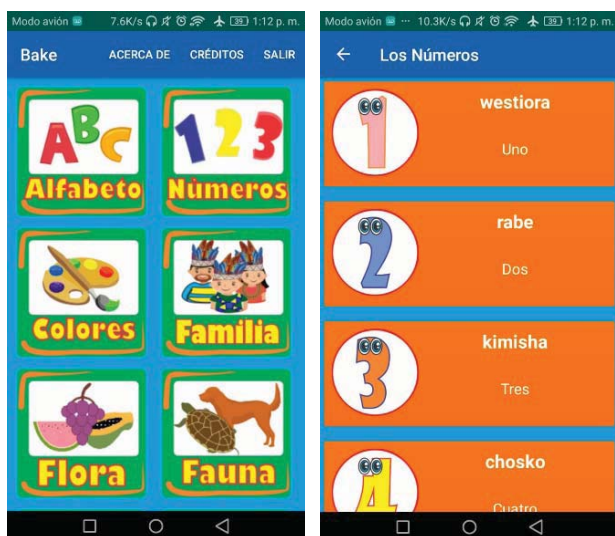

FIG. 1: INTERFACE BETA OF THE APPLICATION.

d) Computer Configuration

The development of the mobile application was carried out under the Android Studio platform, this was made in order for the application to run on mobile devices that have the Android operative system in a minimum version 4.0, which is the operative system for mobile devices with more expansion.
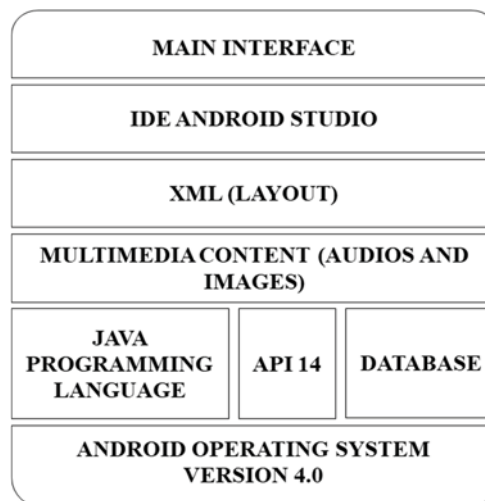

FIG. 2: LOGICAL ARQUITECTURE OF THE APPLICATION.

e) Validation and feedback of the BAKE app.

When the development of the mobile application was completed, it was necessary to carry out the validation with children of a Shipibo-Konibo bilingual intercultural school, so, we established contact with the Cantagallo Community located in Lima, which has more than 200 Shipibo-Konibo migrant families.

The process of the application validation consisted on testing the prototypes of the application, consequently, first meetings were held with members of the community and the teachers, who reviewed the content of the application and made feedback based on the community needs.

The application tests were carried out in the IB school "Community Shipiba" of the district El Rímac, in Lima. Two types of tests were used, the Utility test and the Usability test.

The utility test focuses on the use of the mobile application as a basic content teaching tool for Language, Mathematics, Culture, Natural Sciences, among others, regarding the Traditional Methodology applied in the EIB schools of the native communities. As a first step, two groups of students were established randomly, a control group that uses the traditional methodology and the experimental group using the mobile application. In this way the utility of the mobile application could be measured as a learning and teaching tool.

At the beginning, a brief evaluation of the knowledge and skills of the participants was made, after this, the traditional method was used and next we used the mobile application. When the lessons were completed, the assessment of the learning was carried out.

The Test Usability was performed to measure how understandable is the application for the user. For this, a metric opinion was applied as proposed in mGQM (mobile Goal Question Metric) model described by Enriquez J. and Casas S. in their article on usability of mobile applications [11], as they mention that the usability framework considers 3 main elements: the elements that make up the user, the Technology, the Task / Activity and the Environment. The elements that make up the usability dimensions and the elements that make up the consequences of usability, all framed in the use of the application.

f) Publication of the App in Play Store

The final version of the application was published for free on the digital distribution platform for mobile applications with Android operative system, Play Store, and it can be found with the name BAKE [12], meaning child in Spanish.

III. RESULTS

The result of this work allowed to test the usefulness of the mobile BAKE app in the teaching of the content of the subjects in language, mathematics and science and environment, in the kindergarden and primary level, comparing it to the use of the traditional teaching methodology applied in the Bilingual schools.

These tests were based on performance, content and usability, which allowed to validate the mobile application within the classrooms of kindergarten and primary level, involving a total of 20 students at primary level (12 girls and 8 boys) and 18 students of kindergarten (10 girls and 8 boys), who showed that more than 90% acquired knowledge about the use and manipulation of a mobile device (Smartphone).

The test consisted of 02 academic workdays, for which 2 groups were established at kindergarten and at primary level. The first group received the mobile application as a teaching instrument and the second group received classes with the traditional method, which consisted in the use of printed material (in both cases they had the support of a counselor who was not necessarily the teacher of the course). In both cases, the use of the mobile application as an instrument for teaching, achieved better learning results than using the traditional teaching. These results were obtained based on statistical data of students, showing that the first students had higher satisfactory results and achieved improvement from those who used the traditional method. It is also pertinent to evidence the emergence of a strong interest, motivation and acceptance over the 85 % of children of both sexes for using the cell technology.

In Graph 1 we can see the utility resulting from the tool compared to the traditional method applied in teaching and learning in the classrooms of the "Shipibo Community" school. There is a difference of 8% and 26 % respectively favorable for the use of the BAKE app as a teaching and learning tool, overtaking the traditional methodology. In this context we can say that the application fulfills the role of serving as a tool in the process of learning.
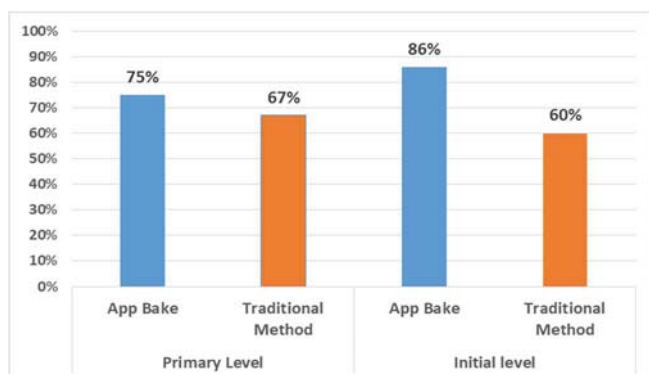
GRAPH: 1: PERCENTAGE OF LEARNING IN STUDENTS.

With regard to the usability of the application, following the proposed model mGQM and considering that measuring usability includes the context where the application is used, it was taken as appropriate to add a usability metric attribute of "satisfaction" of the quality attribute "Effectiveness" that served to measure the ease of access to content taking into account that the application is a tool for learning. The evaluation was done through direct observation (objective metrics) and interview (subjective metrics).

The results of the evaluation of the mobile application usability made to the 38 children who participated in the test, include the following:

Objective measures: for the measurement of these aspects, some metrics were not taken into account, such as the ease of entering the data, information on system resources, support through voice assistant, because the application does not have these functionalities. We can say that the mobile application has a structure that allows ease of learning, because according to test, children took an average of 14 to 20 seconds to learn the application use, so its access to the content is in only 4 steps. This demonstrated ease of access, being ideal for children. To conclude, the application obtained good results both in simplicity, precision and efficiency, and proved to be very attractive to children

Subjective measures: we can say that using this mobile application was good for children. In the test only 4 comments of non-acceptance were obtained, related to the size of the screen, menu button and text and part of the graph. So the satisfaction when using the application is very good.

As a final point, this research allowed us to analyze the extent to which the BAKE mobile application can be useful to complement or support the learning processes with respect to the traditional or current method, taking into account the main problems and limitations currently facing native schools

TABLE 4: ANALYSIS OF THE USE OF THE MOBILE APP.

N°	Problematic	With the Traditional method	With the Mobile App
1.	Insufficient number of teachers who speak or know the Shipibo-Konibo language.	The number of teachers who speak the Shipibo-Konibo language is reduced, since two out of three of the teachers assigned to the school are not speakers of the Shipibo-Konibo language, which limits the quality of the Educative service in that Institution.	The BAKE mobile App facilitates teaching and self-learning in children, being able to become a complement to improve the educative service in the community of Cantagallo
2	Educative curriculum not adapted to the cultural context of Shipibo-Konibo.	The curricular plan used in the Shipibo-Konibo school is based on the Spanish curriculum plan used in the whole country.	The content of the mobile application is interactive and available in the Shipibo-Konibo language (menus and thematic contents) and its contents are contextualized for the Shipibo-Konibo culture, which makes it a good complementary tool that could reduce the gaps in the curricular plan
3.	Inexistent use of technological instruments to support the learning processes of native languages and other learnings	The school does not have technological instruments to use in its academic learning activities.	The BAKE mobile application is a technological instrument aimed at language learning for children with easy access for this and any other school interested in basic learning of the Shipibo-Konibo language.
4	Shortages of investment of the Peruvian state in the educative service oriented to native people.	The school does not have connectivity (Internet) or computer equipment for children's learning tasks.	The Mobile App is easily accessible and downloadable online (although a mobile device is required, currently more frequent in native communities)

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