Microworld-type Ethnoeducational Computer Materials to Support the Teaching of Nasa-Yuwe

Recommendations from a Software Engineering Disciplines Viewpoint for Constructing Microworld-type Ethnoeducational Materials Aimed at Supporting Nasa Yuwe Language Teaching

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Abstract: The Nasa indigenous community has been promoting processes for the recovery and revitalization of the Nasa Yuwe language. The language is at risk because the vast majority of the young people in the *resguardos* use Castilian spanish. To address this problem, several IT-backed initiatives have been put in place with the aim of developing strategies to restore and revitalize Nasa Yuwe. Among these is a combined piece of research, innovation and technological development that seeks to propose a series of recommendations for the construction of microworld educational software to support Nasa Yuwe teaching. The recommendations come from a software engineering disciplines viewpoint. They take account both of specific aspects of educational software development and of characteristics pertaining to the culture and language of the Nasa community, and are expected to contribute significantly to the preparation of ethnoeducational software with the Nasa community. This paper is an important contribution, because it presents a way of use IT in linguistic heritage recovery, since an educational point of view with a high scientific rigor and supports it in the disciplines of software engineering, from which specific guidelines have been generated for the construction of educational software for indigenous communities, contextualized to the worldview and the significant scenarios of nasa culture.

1 INTRODUCTION

It is estimated that the population of indigenous Nasa totals 186,178 people, representing 13.37% of the indigenous population of Colombia (Social Action; European Union; CORDEPAZ, 2010). This populace is primarily agricultural, with an economy based on consumption and production for the market. Most of its territory is comprised of *resguardos* run by *cabildes*. The lands enjoy inalienable rights and are not subject to land seizure. This is fully recognized in the Colombian Constitution. The indigenous laws draw on beliefs and cultural traditions in addition to the recent legal rulings (Uricoechea, 1968). Ever since their origins

these people have consolidated themselves as a culturally rich people, securing their own identity. The Nasa Yuwe tongue is one of 65 indigenous languages that still survive in Colombia, and despite the language being spoken by a significant part of the Nasa population, a process of weakening has been observed in both its valuation and social use. Among the events that have brought it under attack, three stand out: the process of evangelization in which the use of Spanish was obligatory; the setting up of official schools in which the Spanish language was the hub for the dissemination of knowledge (Colombian Institute of Hispanic Culture, 2000); and the market economy, making the use of Castilian inevitable. Another phenomenon that threatens Nasa

Yuwe and other vernacular languages is globalization. According to the sociolinguistic study carried out by the Regional Indigenous Council of Cauca CRIC, the University of Cauca and the Ministry of Culture (CRIC-Program-Intercultural Bilingual Education General Language Commission, 2008) less than 40 percent of respondents say that they speak Nasa Yuwe on a daily basis. This situation varies from one area to another within the Nasa territories, but it shows the need to create and support processes that facilitate the teaching and learning of this language among the children and young people of the community, who will be responsible for continuing the oral tradition (Ibarra, Mosquera and Zuniga, 2004).

The indigenous educational institutions in Cauca have acquired for themselves a computer infrastructure, which although fragile and far from sufficient, is constantly improving thanks to the support of projects and programs focused on benefiting indigenous peoples (Ministry of Information Technologies and Communications, 2013). The growing interest in the use of Information Technology (IT) in these communities is made explicit in its use as a tool to strengthen and promote cultural identity (Ministry of Information Technologies and Communications of Colombia, 2010), and suggests its use in education, presenting the learning of indigenous languages in a way that is innovative and attractive to the younger generation.

The incorporation of IT in education offers a number of advantages and possibilities, as in the case of educational software, which represents a powerful medium that allows the combined use of such elements as images, text, animations and sound (Sanchez, 1995) to promote the teaching and learning processes, to stoke interest, maintaining a continuous intellectual activity, allowing individual as well as group work (Marques, 2010).

Against this background and in an effort to support the strengthening and revitalization of the Nasa Yuwe language, the research question arises of how to develop microworld-type ethnoeducational computer materials that would present different scenarios meaningful to the Nasa worldview and support the acquisition of reading and listening skills in Nasa Yuwe?

To provide an answer to this question, a series of recommendations is put forward from the disciplines of software engineering to build microworld-type ethnoeducational computer materials designed to support Nasa Yuwe teaching and that incorporates aspects of the Nasa worldview. Through this article, more will be learned about the different stages that

are being carried out in this research project, among which are: establishing the methodology, constructing the state of the art and the theoretical framework, comparative analysis, recommendations, construction of the ethnoeducational computer material, future work, conclusions and contributions.

2 PROJECT DEVELOPMENT

For this project of research and technological innovation, information was collected and graded towards identifying the most important aspects taking account of educational software methodologies, software engineering disciplines, the contributions of the state of the art, interviews with the Linguistic, Pedagogical and Socio-Cultural Studies group of the University of Cauca, and exploratory visits to a number of communities. Aspects to be considered in preparing educational software with the Nasa community were identified and the recommendations intended to supplement or help in the teaching of Nasa Yuwe by means of a microworld that takes into consideration relevant aspects of that community were put in place. This approach allowed technical and pedagogical aspects to be taken into account to suit the cultural characteristics and needs of the Nasa indigenous community.

2.1 Methodology

To carry out the recommendations that would allow the construction of microworld-type ethno-educational computer materials aimed at supporting reading and listening comprehension in Nasa Yuwe while including aspects of the Nasa worldview, a comparative study was necessary of methodologies, in which common criteria were identified and classified in the various software engineering disciplines. After classifying the criteria, assessment was made of their importance and how to implement them. They were then complemented with the cosmological features identified in the state of the art analysis, in interviews with anthropologists and from visits to the community, so that they could be used in this context.

Through the development of the microworld, it is sought to shape the use of the recommendations so that they contain features identified from the contexts, such as interfaces and symbols, important features of daily life and the environment, etc. These allow concrete and abstract concepts from the real world to be represented, such as landscapes,

ecosystems, natural, social or cultural areas, and interact with the community, actively participating in an experience that allows them to create and reorganize previously possessed knowledge through multimedia components, dialogues between characters, videos and animations (Galvis, 1992) (Valencia, Z. Riascos and Child, 2011).

Given the above features, we can see that the microworlds are similar in a number of features to educational video games, which are a good option for improving outcomes in teaching and learning (Valencia, Z. Riascos and Child, 2011). Such a scenario indicates a need to select a game development tool for the implementation of the ethno-educational microworld for teaching Nasa Yuwe, suited to the limited computing resources that the community currently possesses.

With the microworld that results from this project, testing will be conducted with members of the community, involving them in their specific teaching process, allowing feedback on the recommendations made and to identify errors, ambiguities or omissions and make necessary adjustments to ensure that the objective of the project is fully realized.

2.2 State of the Art and Theoretical Framework

In order to carry out the recommendations, the following work done with indigenous communities has been used as reference: Teaching and Revitalization of the Nasa Yuwe Language (Unicauca & UNICEF, 2002) which takes up the experience in teaching and revitalization of the Nasa Yuwe language using Western games adapted to the Nasa culture in the Canoas indigenous resguardo. Ethnic Education Centers for Strengthening the Nasa Life Plan: Weaving Resistance from Identity (Llano, 2010) where important aspects of ethnic identity are identified, as are the collective actions of the community and the construction of social subjects.

Zuy Luuçxkwe *Kwe'kwe'sx Ipx Kwetuy Piyaaka*. Learning Workbook for Nasa Yuwe as a Second Language (Rojas and Farfan, 2010) in which tasks and cultural practices of the Nasa community are identified. Süchiki Walekerü: An example of the use of IT in Indigenous Schools. Wayuu Case Study (Quero and Madueño, 2006), which sets out how information technology and communication can be used in support of bilingual intercultural education projects. Yaak: Online System for Teaching and Dissemination of the Otomí language of Querétaro (Cardona, Ortega and Gutierrez, 2010) where the

reactions are seen of an indigenous community to the use of computational tools to foster, restore and teach their language, including the process carried out in order to achieve this. Virtual Community of Support for Ethnoeducation Processes for the Nasa Community of the Corinto López Adentro *resguardo* (Sierra, Rojas and Naranjo, 2007) which makes use of prior studies, inputs collected over time, and the experience of the staff who have been involved for a long time in assisting the ethnoeducacional support processes in this community.

2.3 Comparative Analysis

Below is shown an example of the tables constructed to identify common criteria in educational software methodologies. The ellipses indicate the existence of other methodologies that were reviewed before the recommendations were proposed.

Table 1: Example of comparative table for educational software methodologies.

Aspect under Revision	Educational software development (DESED) (Peláez and López, 2006)	Educational software development (Arias, López and Rosario, 2010)	...	Recommendation proposed
Aspects of everyday life are identified to implement them in the educational material.	A foundation is put in place to find metaphors that help the student understand the knowledge to be imparted.	Metaphors, guiding principles, icons, buttons, backgrounds, text, drawings, etc. are specified.	...	*. Identify the particular life situation to be represented in the microworld. *. Collection of Information. *. Arrange work dynamics for meetings and tasks delegated for the following.
Anaysis of educational needs	The need is determined covering fundamental aspects of the area or field of study and teaching techniques to be used in the course.	Each need requires to be specific to a particular learning situation	...	*. Develop a profile of the student's educational needs. *. Identification of problems or situations in order to support the material to be developed.
Carry out a technologic al approach strategy.	Does not consider this aspect.	If end users have had little contact with computers, a way to train them should be formulated.	...	*. Develop strategy of technological approach
...	...	...	...	...

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2.4 Recommendations

The word recommendation means advice, suggestion or warning in performing one or more activities (Royal Spanish Academy, 2001). Each recommendation lists the steps to be considered in each of the phases of software construction (engineering of requirements, modeling, design, implementation, and testing), and when applied these support the development of microworld-type ethnoeducational computer materials.

The recommendations were constructed from the comparative analysis of the most important aspects of the educational software methodologies (see Table 1) and software engineering disciplines, while taking into consideration the characteristics of the Nasa educational and pedagogical context and the help of anthropologists and linguists who have worked with members of the community. At the time of preparing this article 31 recommendations have been proposed, an example of which are presented below:

RECOMMENDATION Nº 1: Identify the specific situation to be represented in the microworld.

What it relates to: This concerns identifying the *resguardo* with which the work will be done, highlighting its cultural and geographical particularities in relation to the others.

Steps to be carried out:

- Arrange a visit to the community where the microworld is to be used, to get to know the details of the target community.
- Inquire about especially significant or representative landscapes; identify elements of cultural value that can be translated into the microworld-type ethnoeducational computer material; take pictures of landscapes, houses, significant places, classrooms and inhabitants of the region.

Why this is recommended: To represent significant elements of the context of the community and identify what is required and the important objectives thereof, through images and contact with the community.

2.5 Construction of Microworld-Type Ethnoeducational Materials.

Beginning with the proposed recommendations, the selection of a videogame development tool with which to implement the microworld is made. The recommendations considered are: Recommendation

Nº 0: "Identify the physical and logical features of the community's computer equipment" and Recommendation Nº 27: "Select the appropriate development environment to implement the microworld-type ethnoeducational computer material". The most important steps for this task are: The technical specifications of the computer equipment of the Nasa community into which the micro is to be implemented must be taken into account, so as not to exceed the limits of these when using the application.

- Choose a development environment that allows the microworld a good graphic quality, attractive, innovative and in line with the performance of the equipment the end users have at their disposal. The price of the development environment (preferably choosing free tools to keep costs low and avoid licensing problems).
- Performance and scalability.

Based on criteria such as the minimum cost of getting a license, prior knowledge of the tool, and scalability portability, it emerges that the tool that combines all of the conditions for use in the microworld-type ethnoeducational computer material is Unity 3D (Unity Technologies, 2013). Unity is a game engine that allows the integration of sounds, images, character interaction, animation and dialogue.

Having as the game engine Unity3D and the recommendations for applying the software engineering processes, we proceed to the construction of the microworld for the Nasa indigenous community. Below is a screenshot of the microworld that is being developed, which takes into account the specific characteristics of the Nasa life and which is still in the process of being implemented.

Figure 1: Screenshot of microworld-type ethnoeducational computer material.

Figure 2: A house in the microworld; and one in the Nasa community.

Figure 3: A microworld character; and a child of the Nasa community (Oviedo, 2012).

Figure 1 is a screenshot of the microworld that contains, among other items, a home with features found on a visit to the Nasa community in Munchique in Cauca Department, Colombia (Figure 2), and a character with whom to explore the microworld, whose features are close to the characteristics of the children of the Nasa community (figure 3). Other elements that can be seen in the image of the microworld are the context in which the daily activities of Nasa community members are carried out, characterized by trees, plants, mountains and the typical ambient sounds of a Nasa *resguardo*. On the left side of the screen shot is one of the activities of the microworld, which was designed with elements known to the children of the indigenous community and which features Nasa Yuwe sounds and writing based on activities suggested in the workbook *Zuy Luuçxkwe Kwe'kwe'sx Ipx Kwetuy Piyaaka* (Rojas and Farfan, 2010).

2.6 Future Work

- Complete some additional levels of the ethnoeducational microworld.
- Design and implement a pilot project involving the use of the constructed microworld and that allows its usefulness in the teaching of Nasa Yuwe to be evaluated.
- Deployment of the ethnoeducational microworld in the Nasa community education centers.

3 CONCLUSIONS

3.1 Final Conclusions

The comparative analysis of educational software methodologies and software engineering disciplines set against the cultural, pedagogical and educational characteristics of the Nasa community, allow the creation of a set of recommendations that are complemented and strengthened taking into account the cosmology and processes that pertain to the Nasa

community, towards a situation where in the development of educational software in the Nasa context is more relevant and designed from working together with the respective Nasa community.

The development of this project demonstrates the need to continue building educational materials and go on supporting the processes of Ethnoeducation of the Nasa Indigenous People and recovery of the culture of the Paez community. For this revitalization process every possible tool should be used, in particular that of technology - not only to contribute to the revitalization of the language and its ancestral customs, but to close the technology gap, taking action that will support teachers for their teaching-learning and in a continuous process of training in the management of resources and motivation strategies to include them in the teaching practice either inside or outside the classroom.

Finally, it can be concluded that it is possible to develop a microworld-type ethnoeducational computer material that presents different scenarios that are meaningful to the Nasa worldview and that support the acquisition of reading and listening skills in the Nasa Yuwe language, in addition to having an adequate methodological support (favoring the pedagogical and didactic aspects and a formal software development).

3.2 Contributions

The contributions of this project are:

- The development of microworld-type ethnoeducational software, paying attention to aspects of the Nasa context and applying them to future software development processes, thus aiding designers and developers.
- Specific recommendations for the development of software that can be used and adapted in the construction of other types of software for this community.
- A continued strengthening of the use of ICT as a support for the processes of culture recovery in the indigenous communities.
- A teaching tool that supports the realization of the teaching-learning processes by facilitating access to information, encouraging the student and enabling both the possibility of individual and group work.

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