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Léxico de expresiones técnicas hidrológicas idiomáticas, sistematización Web para América Latina y el Caribe

Idiomatic hydrological technical expression lexicon, Web systematization for Latin America and the Caribbean

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Resumen

La publicación de documentos científicos en distintas lenguas es uno de los principales medios de comprensión y difusión de la ciencia. Sin embargo, la labor de escribir ciencia se ve dificultada por los modismos de cada región, incluso en un mismo idioma. Tal es el caso del idioma español en los diferentes países de América Latina y el Caribe, donde existen diferentes modismos para una misma palabra técnica. Se presenta una plataforma Web que permite manipular y relacionar diferentes palabras y términos técnicos que definen una misma expresión técnica en español en el ámbito de los recursos hídricos. La implementación de esta plataforma es un proyecto de la Iniciativa Internacional sobre Inundaciones IFI Oficina Regional para América Latina y el Caribe LAC-PHI UNESCO. Fue desarrollada en JavaScript y permite una discusión interactiva por parte de los más reconocidos especialistas de la región LAC. El sitio Web permite el ingreso de una nueva palabra, su discusión, su evaluación, y su posible aceptación y promoción para su uso. La estructura del léxico permite la mejora continua y la inclusión de fotografías especializadas para cada palabra dentro de la plataforma. La evolución de este proyecto tiene como objetivo apoyar los diversos programas de Ciencia Ciudadana del PHI-UNESCO; ya que también intenta incluir términos técnicos en los dialectos indígenas más importantes de la región de ALC como el quechua, el náhuatl y el guaraní.

Abstract

The publication of scientific documents in different languages is one of the principal means of understanding and disseminating science. However, the work of writing science is made difficult by the idioms of each region, even in the same language. Such is the case of the Spanish language in the different countries of Latin America and the Caribbean, where different idioms exist for the same technical word. A web platform is presented that allows manipulating and relating different technical words and terms that define the same technical expression in Spanish in the field of water resources. The implementation of this platform is a project of the International Flood Initiative IFI Regional office for Latin America and the Caribbean LAC-IHP UNESCO. It was developed in JavaScript and allows an interactive discussion by the most recognized specialists in the LAC region. The website allows the input of a new word, its discussion, its evaluation, and possible acceptance and its promotion for use. The structure of the lexicon allows for continuous improvement and the inclusion of specialized photographs for each word within the platform. The evolution of this project is aimed at supporting the various Citizen Science programmes of IHP-UNESCO; as it also attempts to include technical terms in the most important indigenous dialects of the LAC region such as Quechua, Nahuatl, and Guarani.

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1. INTRODUCTION

1.1 The Intergovernmental Hydrological Programme (IHP/IHP)

The United Nations Educational, Scientific and Cultural Organization (UNESCO), as the United Nations Office for Science and Education, is active in five international scientific programs: the Intergovernmental Oceanographic Commission (COI); the Intergovernmental Hydrological Programme (IHP/PHI); the Man and Biodiversity Programme (MAB); the International Geoscience Programme (PICG); and the International Basic Sciences Programme (IBSP).

IHP works from its regional offices in Africa; Arab States; Asia and the Pacific; Europe and North America; and Latin America and the Caribbean (LAC region). Within each region, in addition, IHP works through Programmes and Initiatives. The most important of these include: Hydrology for the Environment, Life and Policy (HELP); Flow Regimes from International Experimental and Network Data (FRIEND); Ecohydrology; Groundwater Resources Assessment under the Pressures of Humanity and Climate Change (GRAPHIC); Water and Development Information for Arid Lands (G-WADI); International Flood Initiative (IFI); Internationally Shared Aquifer Resources Management (ISARM); International Sediment Initiative (ISI); Joint International Isotopes in Hydrology Programme (JIIHP); From Potential Conflict to Cooperation Potential (PCCP); Water Education and Training (WET), and World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP).

Most UNESCO member countries have one representative for each of these programmes. For example, there is a representative for Ecohydrology in Argentina, or a representative for HELP in Italy, or a representative for GRAPHIC in Senegal. They are called national representatives (focus point). These representatives in each country work under the direction of a Regional Coordinator of each Programme.

For example, for the region of Latin America and the Caribbean, the national representatives of the FRIEND Program work directly under the orders of the Regional Coordinator FRIEND-LAC and this one in turn reports his activities with the Regional Hydrologist, who is responsible for the LAC region from the Regional Office of Sciences for Latin America and the Caribbean, in Montevideo, Uruguay.

The UNESCO Office in Montevideo was established shortly after the birth of the Organization at the global level (1949), under the name of the UNESCO Center for Scientific Cooperation in Latin America and the Caribbean. It was the first UNESCO centre for scientific cooperation in the world. It arose in response to a request from the Second General Conference of UNESCO held in 1947 in Rio de Janeiro, Brazil, to convene leading experts to advise the Organization on how best to help advance science in Latin America. In 1949, the world's first UNESCO Centre for Scientific Co-operation was established: the Regional Bureau for Science and Technology for Latin America and the Caribbean based in Montevideo. With seven decades of existence, the office has seen its functions and challenges increase and today its action is revealed through a large number of projects involving governments, social organizations and the citizens of 33 countries and 4 associate members from Latin America and the Caribbean.

Within this framework of international cooperation and promotion of science, it is important to consolidate capacities in the LAC region through scientific collaboration with knowledge and technology centers. In this way, the sharing of knowledge, projects, and expertise in the field of water resources become a vital activity in a region that has three of the poorest countries in the world. Mainly the written scientific expression, as well as all scientific work in the field of water resources, it is supported by the Intergovernmental Hydrological Programme of UNESCO (IHP).

1.2 Vulnerability and scientific knowledge in the LAC region

The LAC region is by nature an area exposed to extreme events. Floods, earthquakes, landslides, tropical storms, hurricanes, contamination of water sources, and others, occur more and more near communities that are located in areas exposed to these natural phenomena. These phenomena have become hazards, and when it happens, damage and loss of human and economic life are inevitable. The most serious thing is that it produces a significant backward effect on the development of the countries of the LAC region (Molpeceres 2012). Over the past two decades, precise risk management actions have made it possible to combat this backwardness.

Remarkable conceptual advances support these management actions. Scientific communication is certainly one of the most important components of risk management.

The scientific vocabulary used in the area of risk and vulnerability is one of the great challenges for the LAC region. Good communication will allow for precise and direct actions. Many attempts to standardize the terminology in water topics have been made by the IHP; this becomes a great challenge since the technical terms are written in a Spanish regional language. Additionally, technical terminology is affected by the geographical, political, cultural, economic, and social framework of the LAC region (Smith 2007). Technical documents, scientific papers, glossaries, and online dictionaries are examples of documents that support communication and written language (Russell et al. 2007). In all cases and in any place of the world, access to science has overcome geographical borders thanks to the Internet (Russell and Liberman 2002). It is important to emphasize that the production of the scientific community through their manuscripts always attends to high-quality standards. Although the English language is universally used for scientific papers; obviously the Spanish language is preferable in this region (Navas-Fernandez et al. 2018). However, technical words in Spanish that have the same meaning are written differently in some LAC countries. It seems hard to believe, but Latin countries often use "local idiomatic expressions" to modify technical words (Jung and Ruiz-León 2018). This bad practice of language can be an obstacle to scientific work since it complicates the interpretation of knowledge. In particular, confusion has been detected in the terminology used in geography, demography, hydraulics, and hydrology.

A good and clear terminology, decided by consensus in each country, would allow a correct understanding in the clear and universal language of each of the terms used in technical and scientific documents (Giménez-Toledo et al. 2018). The most common example is the word "runoff" (in English) which in Spanish can be said as "escurrimiento" (used mainly in the countries of North America and some of Central America); "escorrentía" (used in the countries of South America and Spain); and "vertido" (used in Central America and the Caribbean). However, in Chile and Mexico, the word "vertido" refers to the discharge of water from a spillway; and here is the confusion begins.

Another dramatic example can be reached when we talk about the different parts of a hydrograph. The physiographic characteristics of a watershed transform rain into runoff; this hydrological process is represented by a hydrograph. In other words, a hydrograph is the graphical representation of the flow of water over the surface, as a function of time. The maximum value in a hydrograph provides us the volume of water per unit of time, when the whole basin has transformed rain into the runoff. This maximum value is called "peak flow"; however, as can be intuited, in Spanish it is known as *caudal máximo*, *caudal de punta*, *gasto máximo*, *caudal pico* and *gasto pico*.

The latter word *gasto pico* turns out to be a "bad word" in Chile, and however incredible it may seem, it should not be used. A researcher who gives a lecture in Chile, mentioning the word *gasto pico* could make most of the audience feel embarrassed. Thus, it is clear that a lexicon, a guide, a glossary or a dictionary of technical equivalents is required to have a correct interpretation of the most important technical terms used in the LAC region. In particular, focused on the topics of water use, water management, disasters, hydraulics, and hydrology.

This paper aims to analyze the problems of using local language expressions. So to describe some of the computer tools used in the scientific diffusion and to propose a hydro-informatics tool, which allows the interaction between several researchers to define the correct technical terminology. This paper also details the procedure that was carried out to implement the tool on the Web and how it has allowed the enrichment of the Spanish language and is even evolving to include local dialects and languages to contribute to the Citizen Science project of the International Flood Initiative of UNESCO-IHP.

2. METHODS

2.1 Informatics tools in education

The advanced information and communication technology allows new platforms for remote collaboration between engineers in the search for new technical solutions. The application of web-based platforms requires new types of skills, knowledge, and experience to obtain successful training and competitive education; in the field of engineering and especially in hydro-informatics training (Molkenthin et al. 2001). So important is the water issue associated with computer science to UNESCO that it

has an International Center for Hydro-informatics, based at the Itaipu dam, between Brazil and Paraguay. This binational center represents an innovative and technological approach to optimize the relationship between users and information technology, thus providing efficient and effective processes in the context of sustainable development of water resources in Latin America and the Caribbean.

Educational software development processes are by nature complex and require the collaboration and cooperation of teams of experts. For appropriate learning, it is important to design a customized online training environment. This platform, or environment, should facilitate communication at any time and in any place. Providing adequate virtual space for the transfer of information is essential for the success of any effort to work on online educational programs (Diaz Redondo 2012). An excellent example of good international cooperation in the field of education and engineering is the course presented by Bothe (2015). This course (a short crash-course on "Software Engineering") was created as part of an international educational project, which covers nine countries and fifteen universities. More significantly, it helped to improve communication between people and countries and to create a multicultural environment for engineering graduate students. With this evidence, it is not difficult to think that, as proposed by Molkenthin et al. (2001), "web-based collaborative engineering" (HydroWeb: based collaborative engineering in hydroscience) is now a reality.

Regarding computer applications in engineering, many can be mentioned. For example, tools for estimation of soil erosion (Jimenez-Hornero et al. 2009). To design drinking water supply networks (Türkkan et al. 2019), and to monitoring the potabilization and maintenance of supply sources (Robinson and Carmical 2005). Even to solve complex engineering problems with the help of mathematics and advanced statistics. Such is the case of the STEVE (Stochastic Theory Education through Visualization Environment) tool that uses autoregressive models to solve environmental problems (Florence et al. 2011).

The use of stochastic models in water resource engineering is of particular importance, so a study of the civil engineering curricula of U.S. universities was done. Online questionnaires were applied to teachers who teach this subject at the undergraduate and graduate levels. It was found that 84% of the universities responding to the questionnaire offered the subject of Stochastic Theory in their curriculum. Forty universities were found to have full (integrated) programs dedicated to the teaching of Stochastic Theory (or a closely related discipline). The teachers questioned were unanimous in their intention to integrate this subject into the teaching of water resources engineering (Schwenk et al. 2009). This is just one example of how an online questionnaire can consolidate criteria and make decisions regarding the content of a curriculum.

One of the innovative technologies to improve the performance of the teaching-learning process of web engineering is certainly Wikis. Wikis are becoming an important element for lecturers, academics, and educators in general as a tool for teaching and collaboration (Nejkovic and Tosic 2012). Following this idea of taking advantage of the flexibility, efficiency, and innovations of a series of technologies to produce tools that improve the process of gaining new knowledge (Aminmansour 1996); this is when we propose an interactive Web tool for a regional consensus of technical terminology in the field of water. The aim of this project is just to use technology in the diffusion of science to bring about important advances in methods, techniques, and virtual learning environments; this technology in itself provides a high level of interaction within specialists (Nunes et al. 2017).

It is remarkable how fast-moving computer tools have become. They currently are easily adapted to all engineering studies (Hernandez-Abad et al. 2009). From tools for the creation of technical signs for science, technology, and engineering in sign languages for the hearing impaired (Souza et al. 2018). The development of applications for mobile phones to handle information on the quality of water in the town (Jonoski et al. 2012) or real-time weather warning systems (Ibarra-Corona et al. 2018). Including applications in aerodynamics and aerospace engineering (Higuchi and Henning 1996). A very important field is computer applications used for direct use in the classroom. An application with an open and modular structure supports the tutorial work of teachers (Ramos et al. 2007). Thus, group work, similar to that in the classroom, will allow for discussion and debate regarding highly specialized technical items.

2.2 Computerized structure of lexicon of hydrological terms

Based on UNESCO's official glossary of technical terms, a technological platform was designed and programmed to function as a hydro-information tool. Based on the problems mentioned above, and considering the lifetime and flexibility of the tool's implementation, the decision was made to design a service-oriented architecture. The base programming language chosen was JavaScript, making use of the open code library React for the development of the Front-End which consists of the user interface. In the case of the Back-End which consists of the functionality, the execution environment Node.js was used and for the storage of the information a database on the MySQL engine is used.

The fundamental principle of the design of this architecture is to have a core that allows the construction of the platform in a modular way so that new functionalities can be incorporated and that these can be adapted to what is currently in working use. The core is composed as an API application programming interface in representational state transfer (REST) architecture, thus allowing effective communication between the current components and with the possibility of interaction with other external applications.

The architecture that provides the functionality is made up of five components, each component with its own functionality elements as can be seen in figure 1. These components are:

- The configuration components
- Controller components
- The components of interactions
- The public components
- The route components

Figure 1. Overview of the platform's source components

The data model of the platform was designed with a structure of eight tables for the storage of information and establishes the relationships between them as you can see in figure 2.

2.3 Systemization of the process of analysis of hydrological terms.

The lexicon of technical terms is tried and evaluated in a continuous manner by the group of specialists of the International Flood Initiative (IFI-LAC). Table 1 lists the institutions to which the specialists involved in the evaluation of the technical terms discussed belong to be shown in the IFI-LAC glossary. The systematization of the process of analysis and publication of words is done in four stages that are detailed in Table 2 and Figure 3. Once the words/technical terms are published on the site, users are asked to provide feedback and comments. Future updates will incorporate the necessary changes and features communicated by users. It is also important to emphasize that the work of the group of experts who decide on each word, are highly specialized and well recognized in the LAC region.

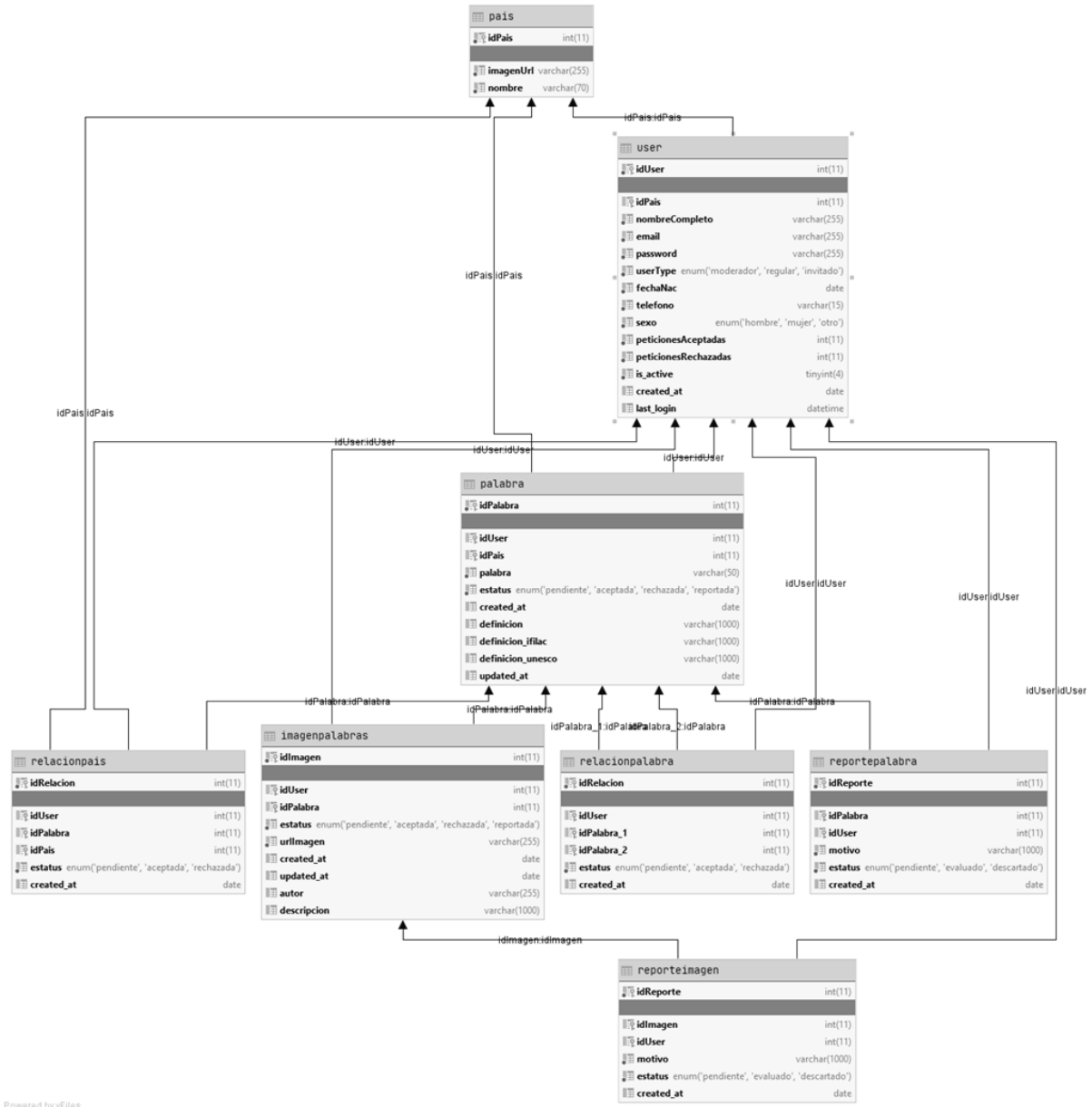

Figure 2 View of the data model

Table 1. List of the institutions of the experts involved in the revision of the technical terms to be considered

Institution	Country
Instituto Nacional del Agua Santa Fe	Argentina
Instituto de Hidráulica e Hidrología, UMSA La Paz	Bolivia
Centro Internacional de Hidroinformática, CIH	Brazil
Departamento de Ingeniería Civil, Universidad de Concepción	Chile
Instituto de Hidrología, Meteorología y Estudios Ambientales, IDEAM, Bogotá	Colombia
Instituto Nacional de Recursos Hidráulicos, INRH La Habana	Cuba
Centro de Investigaciones del Agua, CIAQ. Universidad Autónoma de Querétaro	Mexico
Instituto Nicaragüense de Estudios Territoriales, INETER, Managua	Nicaragua
Universidad de Panamá	Panama
Servicio Nacional de Meteorología e Hidrología, SENAMHI, Lima	Peru
Centro para Gestión Sostenible de los Recursos Hídricos en los Estados Insulares del Caribe (CEHICA). Instituto de Recursos Hídricos, INDRHI.	Dominican Republic
Instituto de Meteorología (INSMET), La Habana	Cuba

Table 2. Main section and contents of the module

Main section	Contents
Introduction	This section discusses the background and purpose of the lexicon. As well as specifying its operation and the operating instructions.
Enter a new word	The specialist group evaluates the inclusion of a new word.
Process description	This section describes the processes involved in process for discussion if a technical term should be included in the lexicon.
	It is checked if the word exists in the Spanish Language Dictionary.
	Prospective evidence of use is provided by recognized technical documents.
	If the word is valued as a term that can be confused within the LAC region, it is added to the platform for discussion (90 days).
Accepted word	The word becomes visible on the website.
	The section contains interactive procedures for the promotion and dissemination of the new word.
The technical word is used in the region	The section presents the approaches used in the in the LAC region for the use of this new word.

3. RESULTS

A web platform was developed that can be used in both mobile phones and desktop computers that adapts to the resolution of the device from which it is consulted without losing functionality. It was built with an architecture design that allows for easy maintenance, future updates and interaction with third parties' applications. The platform handles three different types of users: guest, registered user and administrator.

The guest is a profile where words, their meaning and their relationship to other words can be consulted; the registered user can perform the same activities as a guest but with the characteristic that it can suggest the relationship between one word and another or its relationship between a word and a country. He can also suggest a picture associated with a word by

uploading it to the platform and report either a relationship considered incorrect or a picture that does not correspond. The administrator, besides having the functionality described for the previous profiles, has the functionality to register new administrators who can help him in the revision of the reports. The administrator attends to the user reports and makes the required corrections if necessary, can accept or reject the suggestions made, and can also register new words on the platform.

Considering the importance and the experience of the user, the design of the interface was built looking for the user to have fast access to all the functionalities. On the left side of the platform window there is a menu that shows the different options available as shown in figure 4. This menu is hidden in order to have more space in the visualization of the words. As the figure 5 shows, in the main screen the words contained in the platform are displayed as index cards, ordered alphabetically, and with the flag of the country where the word was added. In the same way, in the top part of this interface there is a search field and in the upper right part, a country filtering element. It should be noted that each image that is uploaded to the platform must have a detailed description and the corresponding credits for the photograph.

When you access a word in the interface, you can see on the left side the definitions of the words in three categories, in the center of the interface the images or the option to suggest a picture. Also in the center we are able to see the words that are related and the country. On the right side of the interface there are options to relate the word displayed or to make a report of that word. The main screen of the platform is very similar to that of a registered user when logged in as an administrator. It has a menu with more options and with the particularity of displaying the words with a band that changes color with regard to the status of a word, being able to be accepted words in blue, reported words in red, and words awaiting approval in yellow. All this to provide the administrator with the actions that must be performed, likewise, as an additional part; there is a word status filter in the upper right of the screen.

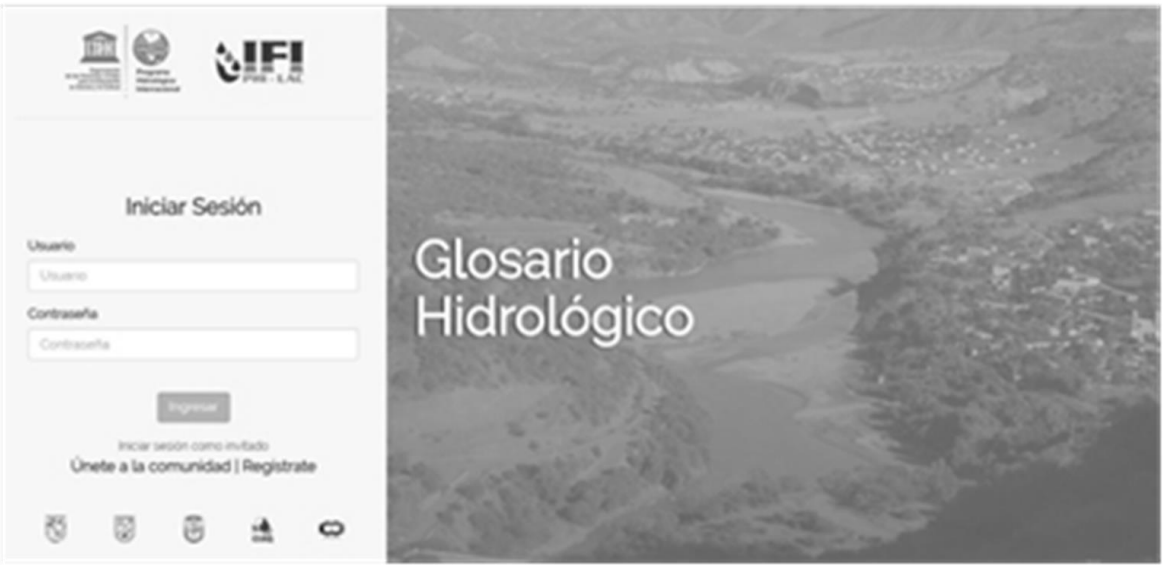

Figure 3. Add a word function screen interface in main screen

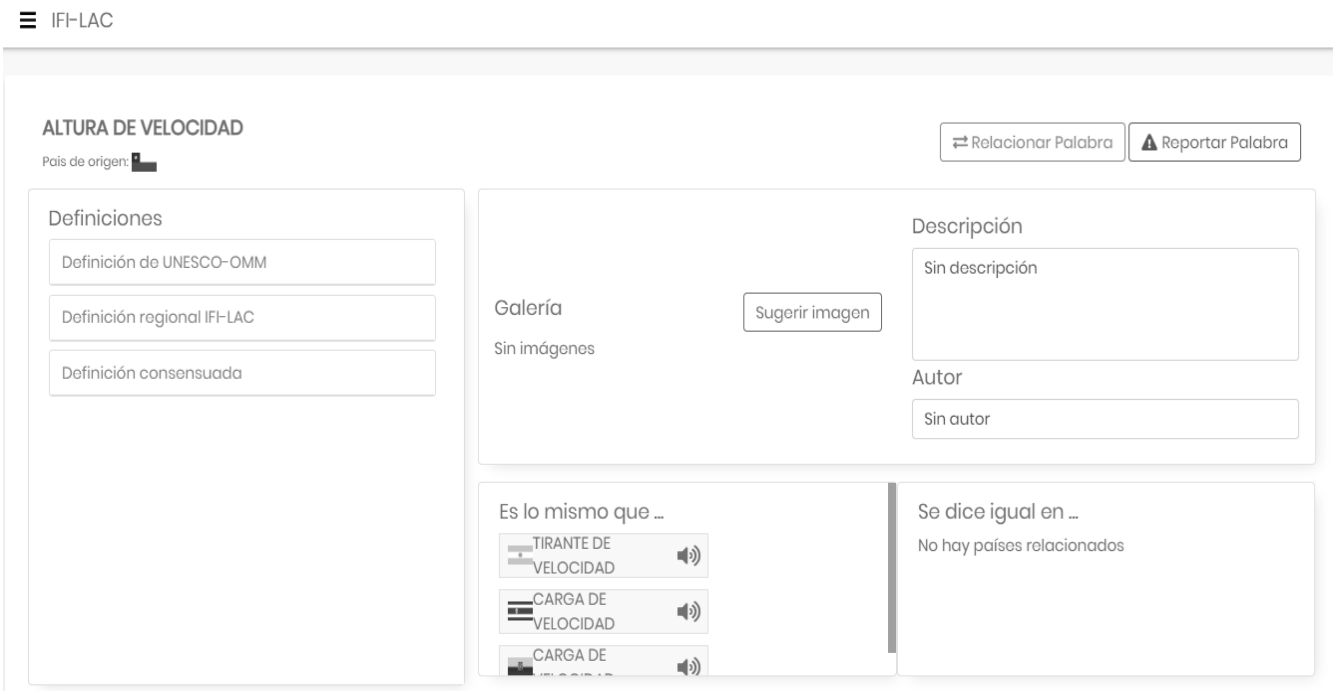

Figure 4. Interface of the screen of the suggest relationship function

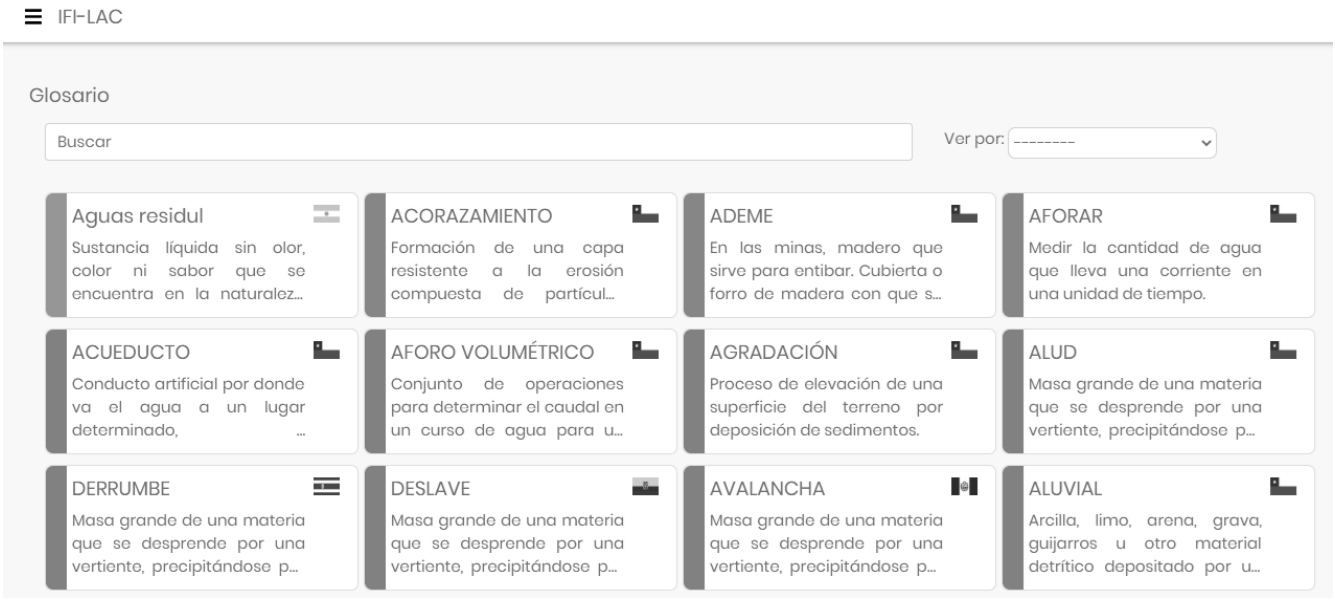

Figure 5. Screen interface including an image related to the word

4. TESTING AND EVALUATION

4.1 The hydroinformatics tool in the regional context

The implementation of the Web platform of the lexicon of technical terms in hydrology, as already commented, was born from the requirement to know and specify the use of the different technical expressions that are used for the same concept in our LAC region. Now that the lexicon is online, it has been proven that it promotes scientific research in highly specialized institutional and professional fields. Since it was launched online, six scientific articles received by Aqua-LAC, the scientific journal on water resources of UNESCO's Intergovernmental Hydrological Programme, have cited the lexicon's web page. Likewise, opinions have been received from regional experts who emphasize that the precision of some technical terms discussed in this

lexicon within the Web have allowed the creation and consolidation of networks for the exchange of scientific, technical and normative information from institutions and individuals in our LAC region (Alcazar-Farías and Lozano-Guzmán 2009). In this way, the joint effort of the researchers and associates of this project will allow us to verify in the short term the increase in the quality of technical publications and scientific divulgation material.

5. CONCLUSIONS: FUTURE WORK

The creation of the Lexicon of Technical Terms platform is an innovative and unique project in the LAC region. Although it only focuses on water resources, it opens a way to apply the idea in other engineering disciplines. Within this framework of regional cooperation, the objectives of promoting science, culture, and education in the field of water resources are fulfilled, since the platform will allow having a detailed and accurate knowledge of the technical expressions used in the LAC region. It is expected that in the future this type of regional initiatives will promote good practices, as well as reinforce the capacities of research groups and communities, all with a strict rigor of good writing, for the benefit of scientific learning in a simple and daily manner within the framework of citizen science.

With the first UNESCO science office in the world, it is clear that the Latin American and Caribbean region must be at the top of the science agenda. The promotion of science is not the exception, which is why this lexicon has made it possible to have precision in the terminology used in the LAC region.

A first printed version of the lexicon is expected to be published in the first months of 2021. It is also intended to provide a common lexicon for water resources specialists within the task for talking and writing about project management for the disaster management.

5.1 The evolution of languages and dialects

Latin American Spanish covers a diverse range of Spanish spoken dialects used in Latin America. Latin American Spanish varies according to the region where it is spoken. These differences are called regional variants or dialects. In Latin America, this variation in dialect is almost always due to the size of the country and its population. Depending on the geographical area, it is possible to detect the rise of the several variants of Latin American Spanish: Amazonian Spanish, Bolivian Spanish, Caribbean Spanish, Central American Spanish, Andean Spanish, Colombian-Ecuadorian Spanish, Mexican Spanish, Paraguayan Spanish, Peruvian Spanish, Chilean Spanish, Puerto Rican Spanish and Argentinean Spanish. This great variety of dialects is the frame where this project moves.

A significant advance has been made in recent months. The Latin American Faculty of Social Sciences (FLACSO), promotes the inclusion of basic terms on climate change in the Lexicon. This initiative joins the IFI-LAC Citizen Science Program to promote knowledge of basic terms in indigenous languages of the LAC region. Work is being done in Ecuador with Quechua and Aymara. In Mexico with Nahuatl and in Paraguay with Guarani.

5.2 Implementation of participation indicators and identification of opportunity areas

As part of a second stage, we want to create a module of indicators, taking advantage of the architecture with which the platform was designed. The indicator module will make it possible to take advantage of the information generated by the platform and apply network science to identify patterns and areas of opportunity between platform users. The nationalities of the participants, the words and the existing relations between all these variables. Taking into account this information, a series of statistical models can be applied which, through computational algorithms, provide information to design new modules for the improvement of the platform.

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