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# ESPACIO I+D, INNOVACIÓN MÁS DESARROLLO

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## Articles

# EDITOR'S LETTER

Dear reading community, continuing our periodicity, the Journal Espacio I+D, *Innovación más Desarrollo* makes available its number 33, volume 12. This number is composed of materials that analyze contemporary regional and international phenomena from various perspectives and disciplines, among these are the articles: Development Analysis in the Ch'ol Community from a sustainable approach; Use of Information and Communication Technologies (ICT) in teaching-learning English, a literature review; Life story of a ritual musician, Chuño production derived from potatoes grown in the community of Pucará and its link with gastronomy; Hydrological simulation of the Teapa river basin; and Influence of cultural references on the distance between the original humorous message and the one translated in the dubbing of the film Finding Dory. Likewise, we include audiovisual materials: *Software development at UNACH: Softec Expo and Biodiversity, a work for humanity*.

In March we compilated the *Dossier 8M-2023*, a document that gathers experiences of women who make up the UNACH's University Community and from our different roles: researchers, administrators, teachers, and students, we narrated our contributions and experiences from a very valuable perspective to the institution. Although this material is indexed in the previous publication, it is available for consultation at: https://espacioimasd.unach.mx/index.php/Inicio/dossier_8M_2023 With this action, as an editorial team and together with the UNACH Foundation and the Coordination for Gender Equality, we contribute to the mainstreaming of the gender perspective that is so necessary in all areas to achieve epistemic justice, especially in the publishing world, which preserves and communicates the ideas of humanity.

We also take advantage of this space to recognize the work of Gabriel Velázquez Toledo who, as of this issue, ceases to be the executive editor of this publication and is now in charge of other institutional assignments. At *Espacio I+D, Innovación más Desarrollo*, we appreciate his valuable participation since the foundation and implementation of this project and his professional commitment in the first decade in which he was part of the editorial team of this publication. Today, we wish a long life to the UNACH's body of scientific dissemination, which, like these first ten years, is going through changes, restructuring, and the urgent updates that the digital publishing world and scientific production demand. Already on the path of its second decade, Espacio I+D, today is a benchmark in terms of communication of science, knowledge, and art.

Enjoy this Space of Innovation!

"*Por la conciencia de la necesidad de servir*"
Universidad Autonoma de Chiapas

Silvia Álvarez-Arana
**Editor**

# ARTICLES

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# Development analysis in the Ch'ol community from a sustainable approach

—

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*— Abstract—*

Evaluating the development of an indigenous community from a sustainable perspective, whose culture, productivity, and relationships with their natural environment are usually associated with their pre-Hispanic roots, is a complex issue, but one that needs to be addressed. This study was done using the method of hierarchical levels, sustainability indicators, and the General Sustainability Index. The results indicate a critical level of the GSI, that is, there is a negative relationship in the balance of the triad of sustainability, which puts at risk the environmental and cultural heritage that are reserved for future generations and points to the urgent need to reverse this imbalance.

**Keywords:**

*Sustainability, indigenous, community, General Sustainability Index, man-nature relationship.*

At present, the global scale on which environmental, economic, and social problems have transcended has exposed the fragility of man and the relationship he has with the environment around him; this situation has forced him to seek mechanisms that allow him to better understand the systems operating in a world that is ecologically, economically, and culturally rich and complex, as well as to perceive the interactions that arise in the structures of those systems, whose complexity requires a multidimensional analysis.

In this sense, it is necessary to understand the systems that human kind has developed to benefit from the elements that the environment offers, from a perspective of Sustainable Development (SD), from its social-cultural, economic-productive, and ecological-environmental dimensions (Gutiérrez *et al*., 2008a: 54), a study that starts from a community level that allows recognizing the consequences of the imbalance in the relationship of the dimensional triad of sustainability: economic-social-ecological.

This premise leads us, first, to an approach to the concepts that support the present study, we refer to that of development, community, sustainability, and nature. It is possible to observe in the multiple proposals made by different authors that the common elements that have given conceptual support to these terms come, without a doubt, from the orientalist-paternalist paradigm, on the one hand, and the communalist, on the other, from the anthropomorphic or the radical environmentalism vision and economic rationalism (Palsson, 2001:80), which have had a fundamental weight in its construction.

From this, in the context of the relationship of human societies with the environment, these concepts are placed in a well-known dichotomy: either as separate entities or as something impossible to see separately. This dichotomy has resulted in various proposals to understand development, community, sustainability, and nature according to the context where they are located and who they serve, because they are also the support of the civilizational discourse that has been imposed and dominated in the world through what in our country is called "modernization", together with the public policies that have promoted it.

From the perspective of this article, it is a question of analyzing the orientation of the study community towards a type of development that derives from these concepts of "modernity" or the other, which places a different way or vision of understanding these concepts and of sustaining a differentiated civilizational discourse that arises from the 80s of the last century with the proposal of the Brundtland Commission for Sustainable Development that, without a doubt, came to stay, which contributes to clarifying that human kind's relations with the environment cannot be defined as the "use as you like (environmental resources), enrich yourself

and then see how we fix the disaster" but also that resources must remain unchanged as proposed by radical environmentalism because such a question could become an obstacle to human well-being (Gutiérrez, 1996: 205).

It should be pointed out then that the term "Development", in the context of this study, is not only a synonym for material progress or monetary enrichment (Martínez & Figueroa, 2014:15; Chirinos, 2010:296), it also means the desire, personal interests, the motivational forces behind them, as well as the mechanisms (both psychological and economic-productive), which are involved in satisfying it (Fromm & MacCoby, 1970: 171), it is, therefore, a term that has much to do with well-being and equality (Bolvinik, 2022), and with the preservation of resources for future generations.

Based on this, talking about development implies a form of progress and well-being that goes beyond the material, it is a development that from the rationally possible material benefit leads to well-being, which has as its recipient those who live in a given territory, therefore, the participation of people is considered essential and leads us to analyze it in the context that the sustainability triad proposes: achieving a balance between social benefits and human well-being with productive needs and care for the environment, applying the principles of sustainability as the opposite vision to the "modernizing" development imposed on our current societies.

On the other hand, talking about Sustainable Development is also talking about community, as an obligatory recipient of the benefit that the other brings to it and therefore we must bear in mind that this is a polysemic and complex term that can be interpreted according to the context in which it is involved, therefore, here it is used linked to the term territory, seen, beyond the geographical limitation, as a place where the diversity of the natural environment and human beings converge, considering the elements of sense of belonging, of interrelationships and common culture (Krauze, 2001:55), as a space occupied by human groups that gives them a sense of belonging or "sense of community", where they interrelate or interact, share a culture and a common history, which has a dynamic and changeable sense (Montero, 2004:100).

In other words, we speak of community in the sense of territory and the capacities of its inhabitants to decide and assume how to use it, as well as the consequences of those decisions, it also implies being clear about the ways how to use it and how to preserve it for future generations.

Another element that underpins the changes observed today, from urbanization, networks of supplies, fashions, and tastes, is the concept of improvement of the quality of life that stands as a reasoning of the "modern" civilizational discourse associated with the term nature, but, under an utilitarian vision instead of a rational and responsible relationship that leads to the progress and well-being of families without destroying the environment

(Ortiz, 2014:63). We see then that the term nature is understood according to the conveniences of the proponent and not as "that which exists and reproduces by itself" and in which the human is linked in one way or another since what happens in one sooner or later has repercussions in the other.

An example of this is that of economic rationalists that transformed the term nature into "resources", understood as goods on which the living being depended for its maintenance or supply, and therefore conveniently "capable of being exploited" which, added to the legal, support the right to privatize it ("submission"), is the conceptual justification of such appropriation and what it means in fact (destruction, looting, irrational use), only possible under a nature remote from the social world, converted into an object that can be managed according to the fluctuations of human interests at precise historical moments (Gudynas, 2014).

These concepts, viewed from the perspective of an orientation towards Sustainable Development (SD) or its inverse, are what lead us in the search for knowledge to better understand the transformations of the territorial space (Macías *et al*., 2006:73) of the community under study, called Amado Nervo, so it involves recognizing the current characteristics of the community, the dynamics of its interactions and its relationship with the environment (Martínez & Figueroa, 2014:15), which allows evaluating the scope of its development under the criteria and principles of the SD (Moller, 2010:103).

In this sense, it is essential to recognize the abilities of its inhabitants to get goods and services from the environment, analyzing the system that it has created through indicators grouped into components placed under the magnifying glass of a scenario analysis scale and a matrix of interactions that review and analyze those goods and services that are useful to it, of its forms of conservation and/or restoration of the resources consumed, together with the fair and equitable distribution of the social-cultural benefit and others that characterize this place, whose virtue lies in the ancestral roots that distinguish it as an indigenous community of Mayan origin.

The community under study is located in the municipality of Yajalón, Chiapas, Mexico, and is composed entirely of indigenous Cho'l, which of course is not exempt from environmental problems and the exhaustion of resources that plague humanity, exposed to "modern" conversions that are very significant, especially in recent years. From this community it is known that in 1892 it was inhabited by indigenous Ch'ol and its population nucleus was expanded when in 1934, its inhabitants acquired the lands of the Colombia estate, by 1973 they were recognized and granted the title of communal assets, data recorded in the Aga file, Exp. 276.1/677 of the Ministry of Agrarian Reform.

## MATERIALS AND METHODS

### *Research area*

Amado Nervo is a community in the municipality of Yajalón, Chiapas, inhabited by speakers of the Ch'ol language and is located in the XIV Tulijá-Tseltal-Ch 'ol region at 17º 13’ 45” north latitude and 92º 14'43" west longitude to the Greenwich meridian (Figure 1). The predominant climate is humid temperate with an average annual temperature of 20 ºC and is located at 920 masl. The community has 1363 inhabitants according to data from the State Committee of Informatics, Statistics and Geography (CEIEG, 2021).

### *Applied methodology*

Considering that the study is based on an evaluation of complex systems from a sustainable perspective, the analysis is then made from the sociocultural, economic-productive, and ecological-environmental dimensions that give us an integral vision of the community, from the use of the resources of the environment, as well as the interactions that occur and give a dynamic to the community system, that is, they produce a behavior.

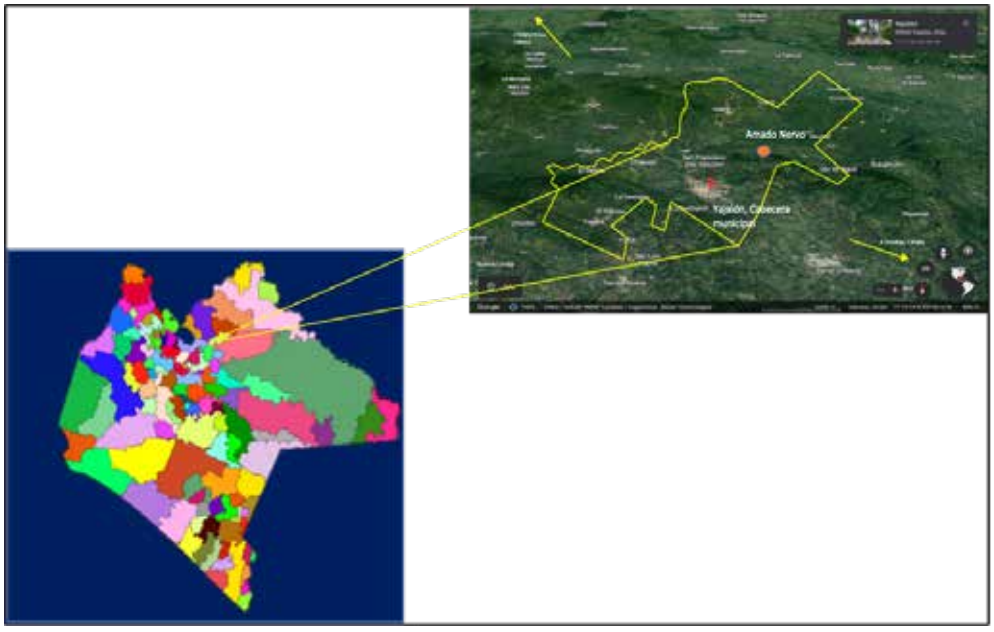


*Figure 1.* Location of the community of Amado Nervo municipality of Yajalón, Chiapas, Mexico

It is important to note that the purpose of this study is to recognize and evaluate the specific location of the system on a scale of values that has two extremes or maximum possible orientations; towards one extreme, an

unsustainable development is oriented, and towards the other, an orientation towards sustainable development, always bearing in mind that the most important criterion is that of the balance that the DS triad must keep. The guidelines refer to the greater or lesser degree of this reasoned balance that must exist in the triad that places human well-being and social benefit "at hand" with economic and productive activities that promote appropriate technologies for the protection of the environment to preserve resources for future generations.

For this purpose, this study used the structure of hierarchical levels (system-subsystem-component) to identify, explore, organize, and systematize information; a quantifier was used employing indicators as a measurement tool, incorporating, in turn, an analysis scale as a complementary instrument to assess the information generated.

The procedure, therefore, considers the Amado Nervo community as a system that is susceptible to disaggregation into three subsystems, and these, in turn, into various components that are combined according to the criteria and principles of sustainability. The subsystems are similar to any of the three dimensions of sustainability that link them in an essential relationship. These subsystems are the following:

(1) Local production systems and their economic efficiency (whose similarity lies in the economic dimension). The capacity of local systems to provide goods and services to the family and community, as well as their capacity to preserve these resources are studied.

(2) Natural resources (NR) and existing natural and induced biodiversity (like that found in the ecological dimension). Here it is proposed to analyze the use of natural resources and biodiversity to generate benefits for the community and, in turn, their efficiency to protect those resources for future generations.

(3) Social services and cultural expressions (similar to the social dimension). The objective is to analyze their contribution to quality goods and services for the well-being and cultural identity of the community.

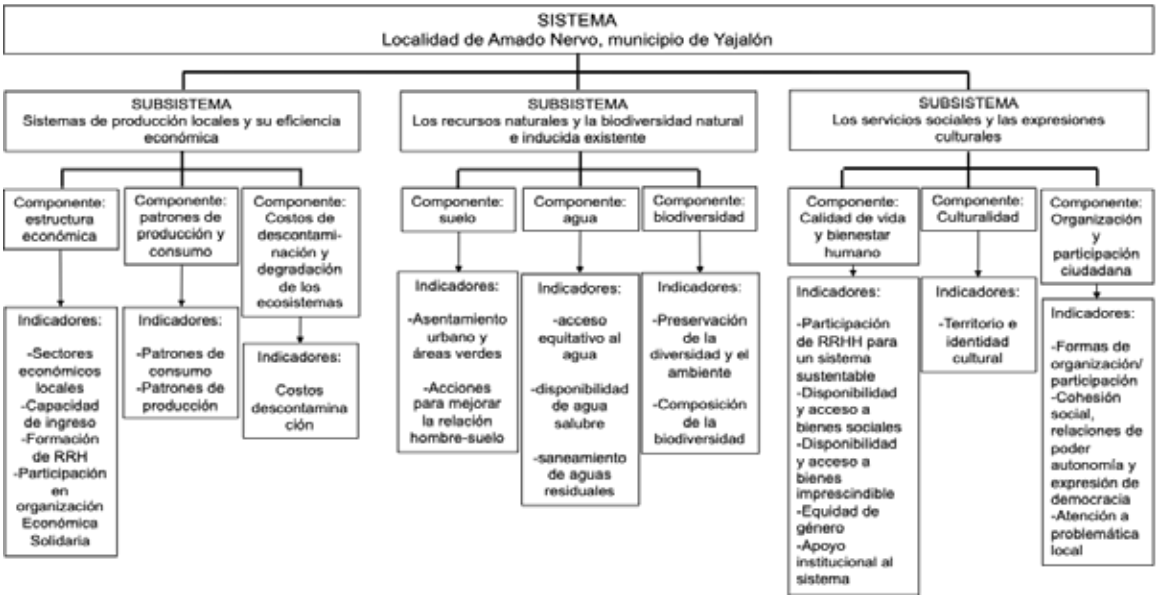


*Figure 2.* General outline of the structure of the hierarchical levels studied. Source: Own elaboration

From these three subsystems are derived components that were selected based on the core thematic indicator platform of the United Nations Organization (Singh *et al*., 2008:197), as well as those proposed by similar studies, permanent observation, and personal experiences in the community under study. Thus, the components that were studied for the first subsystem are the economic structure and the patterns of production and consumption. The second were: soil, water, and biodiversity. The third: is quality of life and human well-being, cultural aspect, organization, and citizen participation. From the components derived 26 indicators that were analyzed by applying a scale of analysis as scenarios to key people in the community (Table 1).

The analysis scale used the concept of Judgment value (*Vj*), which transformed, on the one hand, the original units of measurement of the indicators (percentages, weight units, length, area, etc.) to a scale value and, on the other hand, measured the value that the indicator in question has with an orientation, either towards an unsustainable development or towards a sustainable one, which can also be understood as an "undesirable" or an "ideal" scenario, using a structure of numerical categories in series of minimums and maximums, operating in the amplitude of 1 to 10 in five ranges of values, where 1 represents the "undesirable" category and 10 the "ideal" category, an example is found in Table 1.

**Table 1**
*Indicator: Equitable access to water: (variable 1 Distance and supply capacity)*

| Vj | Scenarios on the scale. |
|---|---|
| 0 a 2 | (1) The water source is more than a kilometer away, and people resort to it. (2) The frequency (and magnitude) of spring water is not permanent. Water is unreliable in purity and cleanliness. |
| 3 a 4 | 1 + 2 + Water is clean and reliable for users (3). Families have artisanal wells to self-supply. (4) |
| 5 a 6 | 3 + 4 + The frequency (and magnitude) of spring water is permanent, but limited. There is a storage tank and distribution pipeline network but in poor condition. Non-participating citizens for water conservation. |
| 7 a 8 | The frequency (and magnitude) of spring water is permanent and unlimited. Storage tank and efficient distribution piping network. Citizens are very interested but not organized in water care committees. |
| 9 a 10 | Efficient distribution network. The spring is permanent and unlimited to supply the entire population. There are citizen committees for water care. |

Source: Own elaboration (2022)

The value of the indicators was obtained following the proposal of Reyes and Ammour (1997:13) but modified and adapted to the interests of this study. The procedure for analyzing the scale information was done using mathematical terms and equations that assigned a value to the indicators (Table 2), and these, in turn, determined the value of the components, of the subsystems and the overall sustainability index (GSI). A weighting factor (*Fp*) was also used to visualize the level of importance of each indicator in the amplitude of 1 to 3, in which 1 is an unimportant level, 2 is moderately important, and three very important.

**Table 2**
*Procedure for calculating indicator values by component*

| Indicator | Weighting factor (FP) (a) | Indicator variables | Judgment Value (b) | Judgment value in multiple variables (c) | Indicator value (d) | Compo-nent value (e) | Subsystem value (dimension) |
|---|---|---|---|---|---|---|---|
| 1 | 1 a 3 | X | 1 a 10 | N/A | (a*b)/a max | | |
| 2 | 1 a 3 | x<br>y<br>z | | 1 a 10<br>1 a 10<br>1 a 10<br>Σ1n (Vv/s) | a*c/a max | Σ1n (d)/S | Average of (e) |
| 3 | 1 a 3 | X | 1 a 10 | N/A | a*b/a max | | |

N/A = not applicable a max= Maximum possible weighting factor

Source: Own elaboration

It is important to note that some indicators were disaggregated into variables and that the scale was also examined by applying the *Vj* and

assigning a numerical value as Variable Value (Vv). The sum and average of the variables assign the judgment value of the indicator in question: VI= Σ1n (Vv) /S (Where: Vv is the value of the variable and S is the number of variables that make up each indicator). The final value of each indicator is given by multiplying the weighting factor by the *Vj* and then dividing by the maximum possible weighting factor, which results in the value of the indicator. Subsequently, the value of the components was calculated by adding and averaging the value of the indicators: VC= Σ1n (*VI)/S* (*VI* is the value of the indicator and *S* the number of indicators), and with these results, it was applied equally in the subsystems.

To recognize the orientation of the system, the General Sustainability Index (GSI) was used, which is very useful to focus attention and often simplifies the problem (Zeballos, 2016:39) since it offers a simple, coherent, and multidimensional way the situation of the study community, showing in the scale its orientation from the perspective of sustainability, clarifying which components of the system are involved and to what extent. It should be clarified that the interpretation of the value of the GSI indicator does not mark a "trend" of orientation towards one or the other end of the scale, but rather specifies where the development of the community is located in terms of balance of the sustainability triad.

The formula applied in this index was: IGS= $\Sigma^{1}_{n}$ (VI) / N (VI is the value of the indicator and N is the number of indicators). The result of the index was interpreted following that recommended by Sepúlveda (2008:27), which estimates that an index below 2 is a state of the system with a total absence of Sustainable Development; levels between 2 and 4 indicate a critical situation in the balances of the sustainability triad; from 4 to 6 is an unstable system, while from 6 to 8 speaks of a stable system and finally from 8 to 10 is considered as the optimal situation of the system, that is, it is a system oriented to maintain a balance between cultural social well-being, with pro-environmental economic activities and the preservation of natural resources for future generations.

To recognize the relationship and interaction between indicators, an indicator interaction matrix (adapted from the Vester matrix) was used as an analysis tool, which seeks to understand the "influence" of some indicators on others with whom it relates, which provided four forms of relationship and interaction: critical, passive, active and indifferent. It should be clarified that to facilitate the study in the matrix, the initially proposed indicators were reduced to 20. Finally, from these results a prospective analysis is built considering three scenarios for the future: possible, probable, and desirable.

### *Approach Techniques and Sample Size*

To collect the information specified in the indicators, exploratory tours, interviews with key informants, and observation of the study site were carried out. For the selection of informants, the "snowball" method was applied (Arias *et al*., 2016:206), while to weight the indicators, a survey was applied to randomly selected community residents (Morales, 2011:13). On the other hand, statistical equations applied in the analysis scale and the General Sustainability Index were used. The study period ranged from January 2019 to March 2020. The sample size followed the criteria mentioned by Morales (2011a: 13), for the construction of scales and that of Ardila and Rueda (2013: 99), with "theoretical saturation" as a criterion to delimit the sample size.

## RESULTS AND DISCUSSION

The data obtained in the results are presented from each subsystem, starting with an overview of the general aspects of the community that are of interest to know.

**a) Generalities**. Amado Nervo is a community made up of indigenous people of the Ch'ol ethnic group, who, since the nineteenth century, are recognized as having inhabited this place. In 1934 they bought an area from the then-owner Natalia Arguello of the estate known as Colombia, which allowed them to add a land of 588 hectares to those they already owned. The recognition and certification of communal property made by the Ministry of Agrarian Reform in favor of Amado Nervo in 1973 totaled 1196 hectares (López, 2015: 91).

The cultural wealth of this community is recognized in those who give rise to it, descendants of the first groups that settled here, probably coming from the area of Tumbalá and Yajalón that over time became part of the group of day laborers who worked the coffee. The main founders were those who made up the servants and waiters of the estate, according to the villagers interviewed.

The biodiversity and productivity of the ecosystem are observed in its agricultural products, mainly coffee and the fruits of the milpa such as corn, beans, squash, cassava, chayote, or herbs such as epazote and rue, in addition to banana, orange, lemon, nanchi, and multiple medicinal plants, but also in the production of birds and criollo pigs that are raised in family backyards and serve to self-supply, with the sale of supplies locally (Ruiz *et al*., 2013:7).

Coffee continues to be the main product with which the community has access to financial resources since its commercialization is done in the regional market-based in the town of Yajalón. Cultural preservation is an

important issue that produces anxiety and restlessness as perceived among its inhabitants, for example, for the conservation of dress or language, gastronomy, and those events linked to planting and water care.

**(2) Local production systems and their economic efficiency**. This subsystem explores the capacity of the system to provide the goods and services that families require for their well-being, considering indicators that record the activities that people carry out to take from nature the resources they need and that can be transformed, but also those that promote their conservation. The indicators studied can be seen in Table 3, as well as the results in the analysis scale. From what can be seen, this is a subsystem with an IGS= 3 that places it oriented to "Unsustainable Development" and expresses a critical situation of the subsystem.

**Table 3**

*Subsystem analysis: Local production systems and their economic efficiency*

| Indicator/ Result | Component/ Results | Subsystem/ Results |
|---|---|---|
| Local economic sectors =2.2<br>Income capacity=2.3<br>Formation of HR=3.1<br>Participation in Solidarity Economic Organization =2.6 | Economic structure =2.4 | 3 |
| Consumption Patterns =3.0 Production Patterns =4.0 | Consumption and production patterns =3.5 | |
| Productivity index =3.7 | System Productivity =3.7 | |
| Decontamination costs =2.5 | Decontamination and degradation costs =2.5 | |

Source: Own elaboration 2022

An approach to the indicators that contribute most to the subsystem GSI better explains the results of the scale, it should be clarified that for reasons of space, only a more detailed explanation of two indicators is made. In the indicator of income capacity (value=2.3), key interviewees perceive it and place it in this value of the scale because, although the inhabitants arrange an economic remuneration per working day according to the law, the average income per person is below the national average, even when they have public programs to support family income, they are perceived as very limited.

The income is mainly based on the primary agricultural sector (under a strategy of self-sufficiency and sale of surpluses, mainly milpa and coffee), complemented by resources that come from other activities such as masonry, public transport, commerce, and employees in education. The income capacity, quantifying only the surpluses that come from the agroecosystem, stands at 6,000 pesos per month on average, well below the national average,

which is 16,537 pesos, while that of Chiapas is 8,836 pesos (National Survey of Household Income and Expenditure, ENIGH 2018). Families who supplement their income with other activities tend to improve by up to 8,000 pesos or more, although this is a minority group.

Another indicator that adds value to the GSI is that it refers to affiliation to social economic organizations (value=2.7), approximately 80% of the members of this community said they are not members of any organization, therefore, the possibilities of promoting economic improvements to the system using this type of associations is narrow and impacts even on the development of skills and knowledge that can well be increased through the training and human resources skills that this type of organizations usually propose to improve the system, although, on the other hand, due to the formal educational level that can be observed, it is assumed that the system has people with greater skills, especially in the new generations.

(3) Natural resources and the existing biodiversity (natural and induced). This subsystem addresses the study of natural resources and biodiversity concerning man, their ability to subtract what is necessary for their benefit, and the efficiency with which it is, in turn, maintained, conserving those resources for future generations. The results of the indicators and components are shown in Table 4. This subsystem has a GSI of 4.7, which places it at scale in an unstable subsystem.

**Table 4**
*Subsystem Analysis: Natural Resources and Biodiversity*

| Indicator/ Result | Component/ Results | Subsystem/ Results |
|---|---|---|
| Urban Settlement and Green Areas = 6.6<br>Actions to improve the man-soil relationship= 3.7 | Soil= 5.2 | 4.7 |
| Even access to water= 7<br>Safe water availability = 3.5<br>Wastewater sanitation = 3 | Water= 4.5 | |
| Preservation of diversity and the environment= 3.5<br>Biodiversity composition= 5.3 | Diversity and environment= 4.4 | |

Source: Own elaboration (2021)

The indicator Urban Settlement and its relationship with green areas (value=6.6) are analyzed as an example due to the use in agroecosystems in human settlement. Of the agroecosystem, we have already said that it is mainly dedicated to crops, which can be classified as an agricultural system with complementary activities such as cattle ranching, under a production model

in a medium with a high presence of indigenous inhabitants (Velazquez & Perezgrovas, 2017:290). As a human settlement, the community is organized into six neighborhoods, whose plots are very large and in which dwellings and large gardens are settled, having urbanized streets, for the most part, in which the action of the "human hands" in their care is also denoted.

Another important indicator is the water supply for the community, to which people assigned a value=7 which maintains a dynamics of supply from the white water stream, located to the southeast five kilometers away from the community, this is brought by pipes to the storage tank, is considered clean and reliable water (monitored every six months by the authorities), able to supply the population permanently with a volume that usually varies in the dry season, (90 liters per capita). There is a network of pipes for an equitable distribution of water. In addition, informants recognize that approximately 75% of families have artisanal wells that favor them in the self-supply. It is observed that many families have concrete tanks or two to three water tanks (capacity of 600 l) for storage. The frequency of the supply is constant except in the dry season when it is done every two or three days.

**(4) Social services and cultural expressions.** The subsystem dedicated to the social-cultural field considers three components: Quality of life and human well-being, the cultural aspect, and the organization and citizen participation component. With these, it is about understanding the generation of quality goods and services for the well-being and cultural identity of the community. The results can be seen in Table 5, where an IGS=3.8 is observed for the subsystem classified as critical.

**Table 5**

*Subsystem Analysis: Social Services and Cultural Expressions*

| Indicator/ Result | Component/ Results | Subsystem/ Results |
|---|---|---|
| HR contribution to a sustainable system =4 Availability and access to social goods =4.5 Availability and access to essential goods =3.9 Gender equity =5 Institutional support to the system=3.6 | Quality of life and human well-being =4.2 | 3.8 |
| Territory and cultural identity =3.3 | Culture=3.3 | |
| Types of organization and participation=4 Social cohesion, power relations, autonomy, and expression of democracy=4.2 Attention to local problems =3.5 | Organization and citizen participation =3.9 | |

Source: Own elaboration (2021)

The indicators that contribute the most to the system are the "contribution of HR for a sustainable system" and "availability and access to social goods". Concerning the first, the value obtained is because the judgment issued by the participants takes into account that they are reforesting with fruit trees, ornamental plants, medicinal plants, and other vegetables, but they are individual actions that are undertaken in family spaces since there is no organization on the part of citizens with which to promote training and the exchange of knowledge and awareness for the conservation of natural resources. While in the other indicator, they are perceived as comfortable homes, which cover the minimum necessary material goods, that is, houses built of concrete with all services except garbage collection, so each family manages to deal with it, which is usually burned in the backyard.

In sum, the GSI released from the subsystems studied can be seen in Table 6, where the local Production subsystem and its economic efficiency is the one that has the greatest impact on the overall evaluation, which is 3.8, to consider a community system that is at a critical level, that is, it defines a community with serious imbalances in its capacities to satisfy its well-being with social and cultural benefits due to the limited efficiency in its economic and productive activities with sustainable bases and in the conservation of resources and biodiversity for future generations.

**Table 6**

*Results of the General Sustainability Index in the subsystems analyzed*

| Natural Resources and Biodiversity Subsystem | Local Production Subsystem and its economic efficiency | Social Services and Cultural Expression Subsystem |
|---|---|---|
| Value= 4.7 | Value= 3 | Value= 3.8 |
| Overall System Sustainability Index = 3.8 | | |

Source: Own elaboration (2022)

On the other hand, we have the results of the matrix of relationship and interaction of the indicators that yielded interesting results, which can be seen in Table 7. The dynamics that occur between the indicators and their components with the others of the system, which also include those resources that come from outside (resources outside the system that can be tangible or intangible and that the system does not have control over them), or those that come out of the components, are analyzed from the four groups formed in which those indicators that are grouped as critical standout, since they have a double characteristic, that is, they have a lot of capacity to "influence" others as well as to be sensitive to the "influence" of others, their ability to "react" is usually fast and usually contribute to the imbalances in the triad.

**Table 7**
*Classification of the indicators of the interaction matrix*

| Classification of Indicators and their Scale Value |
|---|
| Critical indicators (they have a great ability to influence to weaken or strengthen others and, in turn, are very sensitive to the influence of others):<br>-Participation of HR for a sustainable system: Value=4.0<br>-Social cohesion, power relations, autonomy, and expression of democracy: Value=4.2<br>-Territory and cultural identity (Variable 2: Current traditional practices): Value=4.2<br>Territory and cultural identity (Variable 1: cultural identity preservation): Value = 2.5<br>-Production patterns: Value= 4.0<br>-Biodiversity and environment preservation (Variable 1: biodiversity): value= 3.7<br>-HR training: Value= 3.1<br>-Availability and access to social goods (Variable 1: education and health): Value= 5.5 |
| Active indicators (of great influence on most of the remaining indicators, but they are not influenced by the others -resist the onslaught):<br>-Urban settlement and green areas: Value= 6.6<br>-Community HR participation to conserve the soil: Value= 3.7<br>-Sewage treatment: Value= 3.0<br>treatment-Participation in social financial solidarity organizations: Value= 2.6<br>-Consumption patterns: Value= 3.0 |
| Passive indicators: (they do not have great capacity or influence towards others, but they are very sensitive as receivers of the influence of others).<br>-Local economic sectors: Value= 2.2<br>-Income capacity: Value= 2.3 |
| Indifferent indicators (low capacity or influence towards others, are not influenced by others):<br>-Equitable access to water (Variable 1: Distance and supply capacity): Value= 6.5<br>-Availability of safe water: Value= 3.5<br>-Availability and access to social goods (Variable 2: food): Value= 4.0<br>-Gender equity (Variable 1: Participation and decision-making): Value= 6.1<br>-Institutional support to the system (Variable 1: Availability and access to institutional support programs): Value= 2.2 |

Source: Own elaboration

As an example we can mention the component of cultural identity, which is an indicator classified as critical, that is, susceptible to influence or be influenced by others, which according to the results of the scale maintains a value= 4, and is located in it with an orientation to unsustainable development, this indicator has been very susceptible to changes brought about by "modernizing" policies (external resource to the system), which translates into replacing elements of local cultural life with those of others (for example, soft drinks and fries by pozol and chumulhua), a result of the permanent impact of "modernization" contrary to the principles of sustainability that is committed to local cultures.

Another indicator is that of urban settlement and its relationship with green areas (value= 6.6), which is classified as an active indicator, i.e. it can influence most of the remaining indicators but are not sensitive to be influenced by others (let's say they resist the onslaught to be modified). The green area observed is due, according to local sources, to the actions undertaken by each family in their own backyards or agricultural lands,

which maintain a high preservation of plant resources. The participation of public institutions is very limited in their actions, including awareness-raising, training, or promotion; it is actions undertaken by individuals, which prevent the influence of external resources such as those of "modernization" substantially modify this indicator.

In sum, it can be deduced from the interpretation of the dynamics offered by the scale and matrix that, the recurring question about how to achieve a better balance in the triad, must be considered that it depends to a large extent on the people who are sought to benefit, of the application of the principles of sustainability (say colloquially of the "spirit" of sustainability), which guide the components and their group of indicators towards sustainable development, of criteria that should "nourish" the public policies that development projects propose and their human resources as managers aimed at achieving balance, paying particular attention to the group of sensitive indicators -critical and active- that best respond to the interaction and orientation of sustainability.

On the other hand, considering different elements of reflection and analysis it is possible to visualize the system's future, from a prospective perception. The first scenario is envisioned from the resources that arrive at the system, as "modernizing" policies that contain a high dose of those concepts designed from anthropomorphic visions, of the orientalist-paternalistic paradigm, and economic rationalism, keep "the course" unchanged; it is then likely that the system is moving increasingly towards an orientation of unsustainable development, thus exacerbating the environmental tragedy that humanity lives. A second scenario is possible if these public policies are nourished by the Sustainable Development paradigm, where we have observed that there are reasons, at least at a national level, to think that there are changes in that sense, for example, the practice of participatory democracy in the decisions that are the competence of neighborhoods and communities that reach the system and influence the components strengthening them towards a sustainable development orientation.

Finally, sublimating the ideal system corresponds to a reasoned and balanced articulation in the sustainable triad, between human and cultural well-being, reconciled with appropriate economic practices and the preservation of natural resources for future generations. Achieving this scenario requires inclusion and participation of people, it is perhaps the central and essential element to achieve it, which necessarily involves the structuring of public policies that strongly encourage the construction of sustainable communities and implies the non-alignment of these to corporate interests that, so far, efforts have been made towards unsustainable development.

## CONCLUSION

Based on the observed results, it can be based that the balance of the relationship of the triad of sustainable development given by the GSI=3.8, is oriented towards unsustainable development; in other words, the participation of human beings and their activities to maintain a functional system are oriented towards a development that harms the balance that must keep the dimensional triad of Sustainable Development, in particular to maintain resources for future generations.

The community is on a critical scale that reveals, on the one hand, that the application of "modernizing" policies has contributed to the consumption of environmental resources at a faster rate than the possibilities of their preservation, whose economic activities do not allow their recovery and if they compromise the resources of the following generations, intending to support a quality of life according to what is proposed by the so-called "modernization", therefore, the reservoir of natural resources, as the social-cultural heritage are being committed to sustaining a lifestyle that this "modernity" has imposed (Gutiérrez *et al*., 2008b: 63).

Other reflections that the present study leaves us are those that are extracted from the crossing of results of the GSI with those of the matrix, which help to explain the dynamics of interaction between the components and their indicators and the result in the orientation scale. Highly visible indicators such as cultural ones, for example, can be explained thanks to the high susceptibility to the impact of other resources that come either from other indicators or that arrive as resources external to the system and, at the same time, are of great capacity to influence others favoring modifications, because it is a critical indicator according to the matrix and when crossing with its scale value=3.3 suggest the degree of sensitivity of their responses to stimuli, we see it in the displacement of cultural traits that give identity and cultural value to the community such as gastronomy, dress, and language.

This same dynamic occurs in other indicators, such as the participation of human resources for a sustainable system (critical indicator, with value in scale=4), which has responded significantly to the effects of other external resources, changing its commitment to sustaining a sustainability-oriented system.

As well as these indicators, it is possible to see other important elements that create and recreate the community system and the measure of their actions in using the resources of their environment to satisfy a "modern" lifestyle is, in turn, the measure or condition for the environmental tragedy that is lived in a logic of the accumulation of goods and capital that, suppose,

leads to the so preciously "modern" quality of life and well-being, but subject to a very sensitive and critical loss relationship for the goods of nature.

Where is the system heading? It is a pertinent question for a prospective analysis and the crossing of results of the matrix and scale can help us to understand that future, in which we can point out at least three scenarios, as recorded above, visions that can project from anxiety, if the scenario remains the same, to the greatest optimism, if changes occur, particularly in indicators classified as critical and active.

In short, it can be said that the environment or nature is the one that suffers the most when looking to achieve a lifestyle dictated by "Western modernity" or rather, by "modern" anthropocentrism, economic rationalism, and the orientalist-paternalistic paradigm, the observed results point to the urgent need to reverse this predatory scheme and recover the resources spent on the system, for it to receive the time and attention necessary to restore itself and thus avoid a collapse of great proportions.

For the question of how to achieve the greatest balance in the triad of sustainability? It is essential that people's conscious participation be strengthened, for public policies nourished by the principles of sustainability to be reinforced, and that public projects and programs are implemented towards sustainability.

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# Use of Information and Communication Technologies (ICT) in the teaching-learning of English, a literature review

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*— Abstract—*

This article aimed to analyze the results of various research studies regarding the use of ICT in English teaching and learning in formal educational contexts to contribute to the state-of-the-art. The studies reviewed showed recent progress in the teaching of English mediated by technology and they offered a new perspective for those teachers willing to incorporate those strategies. It was a systematic qualitative assessment of thirty published research between 2017-2022, both in English and Spanish, gathered from various databases containing the categories: *use of ICT*, and *teaching-learning languages*. The selected studies were categorized as follows: country, ICT implemented, results, findings, and recommendations. Results highlighted positive reports about the implementation of ICT in the language classroom; as well as the impact these tools have on motivation, oral and written linguistic skills, and students' autonomy. Countries with the highest production on the topic were Colombia and Indonesia, followed by various developing countries. The most mentioned tools were Kahoot! and Duolingo, which not only have gamification features that encourage necessary abilities for the XXI-century society, but also foster collaboration, and friendly competition and increase motivation through ludic activities. Findings emphasized the benefits of implementing technology in the language classroom; however, they also showed some restraints institutions still suffer in developing countries.

**Keywords:**

*Technology-assisted English learning, ICT, teaching-learning process.*

The goal of incorporating technology into English courses is to improve and optimize the learning process. In addition, including educational technology in English classes creates a much more diverse and interesting environment. Technology opened up a whole new world of possibilities when it came to studying a language. Combining technology with English classes not only helps students improve their skills with these tools but also allows them to incorporate English more effectively; thanks to this, students can establish their own pace of learning and have a more meaningful and personalized experience. On the other hand, when teachers incorporate technology into the English teaching routine, they transfer the power and willingness to learn into the hands of the student. This not only improves engagement but also boosts motivation.

Learning a foreign language involves multiple factors that converge and interrelate in such a way that the student can achieve mastery of a language and, with it, signify a reality and give value to the elements that make up the social and cultural aspects of it. Technology has made it possible, even at a distance, to achieve immersion in all aspects of the language as never before, facilitating the acquisition of language more integrally and naturally. The process of learning English is updated, today, through the use of ICT in the classroom. This allows to change the look of the old guided learning scheme for the student and teacher's active participation.

Learning a language with the help of technology has attracted and fascinated language professionals, engineers, and teachers for decades who have resorted to the development, adaptation, and implementation of ICT to facilitate the teaching-learning process of foreign languages, such as English. The possibility of interacting with a machine and learning aspects of language that years ago were only possible through direct experiences with culture and language has now become the greatest challenge for teachers and researchers alike.

New technologies not only constitute a set of tools at the service of teaching and learning activities but also form an environment, a space, cyberspace, in which human interactions occur (Callister & Burbules, 2006). This is how the process of teaching and learning a foreign language has undergone extraordinary development in recent times, especially due to the great advantage of interactivity offered by technological means.

ICTs allow language teaching and learning to have access to: 1) a variety of informational and instructional media: written, illustrated, oral, design, animation; 2) ease of access for consultation through interactive media or communication contexts; 3) a variety of techniques and methods; 4) accompaniment to conventional teaching in class; 5) flexibility of schedule; 6) own choice of type of information, means of interacting, language level, etc. 7) opportunity to address diversity within the classroom.

## ICT

The acronym ICT stands for Information and Communication Technologies. Alkamel and Chouthaiwale (2018) define the term as those technologies used to transmit, process, store, create, expose, share, or exchange information through electronic means. This definition includes tools such as radio, television, video, telephone, satellite systems, computer, hardware, software, and all the services associated with these tools, such as videoconferencing, email, and blogs, among others.

Rodriguez *et al*. (2017) define ICT as tools that allow the creation of new ways of communicating, through microelectronics, computing, and telecommunication through technological and communication tools to grant access, issue, and process information. In the age of information and knowledge, the world has seen the need to incorporate them even in the educational area to respond to the needs of today's society.

### *The use of information and communication tools in language teaching and learning*

ICTs are tools to facilitate many processes in our lives. Their use has increased exponentially in recent decades at the same rate as the development of technology and many institutions have recognized the importance of implementing these tools in the teaching-learning process. Although ICTs are instruments created to communicate, establish and manipulate information, they have been extremely effective in facilitating the teaching-learning process; mainly for those people who find it difficult to mobilize.

In classrooms, ICTs acquire a very important role as support tools in didactic activities that include visual, auditory, and interactive elements, they promote the use of apps, platforms, and social networks; it facilitates the search and location of information quickly; it promotes a variety of ways of teaching; it allows to boost teaching practice in the classroom; among other benefits. They have also made it possible to know and learn any subject easily, and languages are no exception. Its use is inevitable in the daily work of teachers and students and contributes to increasing the quality of education, as well as responding to the needs of 21st-century society. Unlike in the past when it was necessary to have an immersion experience in the target culture to learn about a language, the Internet and technology have revolutionized this need, allowing us to respond to different ways of learning, saving us time and energy, and allowing us to establish contact with millions of people without the need to physically mobilize. With the Internet and ICT, teachers and students can teach and learn anywhere, at any time, and in many ways improving the learning experience. Various studies and reports (da Cunha, 2020; Artunduaga & Torres, 2021; Bedoya

*et al*. 2018; Lizasoain *et al*, 2018) ensure that the implementation of ICT in language teaching has produced positive results in various aspects, such as:

**Motivation**: ICT has been shown to increase student motivation in language learning, especially among young people. Using online games and interactive activities can be very appealing to them.

**Language Skills**: The implementation of ICT has also improved students' language skills, both oral and written. The possibility of practicing with other native speakers through online platforms or mobile applications has proven to be very effective in this regard.

**Autonomy**: ICT has also allowed students to have a greater degree of autonomy in their language learning. With access to a wide variety of online resources and the ability to work at their own pace, students can take control of their learning process.

**Access to Online Resources**: Technology allows students to access a wide variety of online resources, such as educational videos, tutorials, interactive games, and reading materials, which can enrich their learning experience and help them better understand concepts.

**Online Collaboration**: Technology also allows students to collaborate and work together on online projects, which can encourage teamwork and social learning.

**Learning Personalization**: Technology tools, such as online learning systems, can personalize the learning experience for each student by providing adaptive materials and performance-based assessments.

**Improving information Retention**: Technology can also help improve information retention by utilizing multimedia learning strategies, such as videos, images, and audio, that can supplement verbally presented information.

**Assessments and Feedback**: Technology tools can also provide students with automated assessments and real-time feedback on their progress, allowing them to identify their strengths and weaknesses and focus on areas that require more practice.

**Online learning**: There are many online resources, such as language teaching platforms, educational videos, and mobile apps, that can help students learn a new language from the comfort of their homes.

**Practice with native speakers**: ICT allows students to connect with native speakers of the language they are learning through video conferencing applications and online platforms.

**Access to multimedia materials**: ICT offers access to a wide variety of multimedia materials, such as audio, videos, and presentations, which can help students improve their listening and visual understanding of the language.

## METHODOLOGY

This work was carried out within the qualitative paradigm, of a descriptive documentary type to identify and analyze the results of different investigations to pay attention to the state of the art of use of information and communication technologies (ICT) in the learning of English, in formal educational contexts between the years 2017-2022. To answer the research question, the following procedure was carried out: definition of the search criteria; search and selection of research that met the criteria; analysis and systematization of the information; and generalization of the results. The search criteria were: a) country of origin; b) type of technology applied; c) reported results; d) relevant findings and recommendations.

A search was carried out in various databases, such as Google Academic, Scielo, Eric, and Dialnet, of documents published between 2017 and 2022 in both Spanish and English that contained the variables: *use of ICT*, *teaching-learning of languages* and *digital apps*. 30 documents were found that met the scanning criteria.

## RESULTS

The results show that the countries with the highest production on the subject are Colombia 20% and Indonesia 12%; followed by Spain, Nigeria, Ecuador, and Peru 8%. Mexico, the United States, Venezuela, Chile, Malaysia, the Czech Republic, Japan, Pakistan, and India with 4% each (See Table 1). It is interesting to note that the vast majority of these countries (80%) are included in the list of developing countries of the World Trade Organization (WTO, 2022) and that, among other economic characteristics, they suffer from a very acute educational lag and digital divide mainly because affordability remains the main barrier to connectivity (Bindé, 2005). On the other hand, the increase in the production of these studies could also mean that these countries have increased the use of digital media to facilitate the teaching-learning process in formal educational contexts.

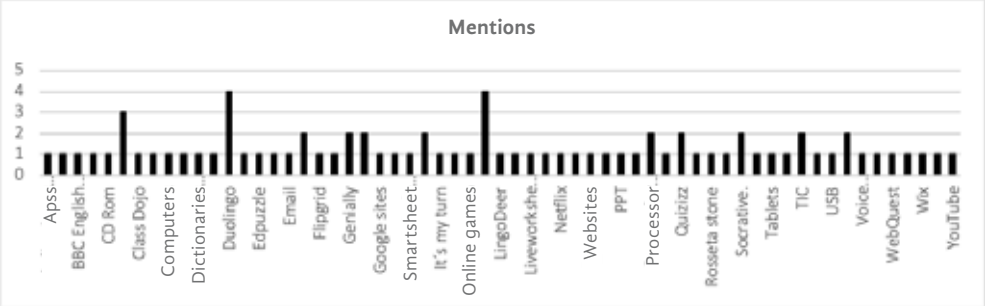
**Table 1**
*Number of published papers by country*

| Country | Published works |
|---|---|
| Colombia | 5 |
| Indonesia | 3 |
| Spain, Peru, Ecuador, Nigeria | 2 |
| Japan, India, Czech Republic, Malaysia, Chile, Mexico, Venezuela, United States, Pakistan, Chile, Brazil, Costa Rica, Panama, and Guatemala | 1 |

The most recurrent ICTs and apps in the studies were Kahoot! and Duolingo (Mészáros, 2020; López & Quispe, 2020; Guaqueta & Castro-Garcés, 2018; Salcedo, 2017), mentioned in four studies. These apps contain elements of gamification that stimulate student motivation and affect teacher-student, student-student interaction positively. Kahoot! and Duolingo are two apps that use gamification to enhance the learning experience and foster important skills in users.

Kahoot! is an online platform that allows you to create and play Q&A games in real-time. This app is widely used in the classroom and allows teachers to create interactive games for students to engage and practice different topics. In addition to improving knowledge, Kahoot! encourages collaboration and friendly competition between students, as they can play in groups and see their results in real-time. On the other hand, Duolingo is a mobile and desktop app that allows you to learn languages playfully and effectively. With a focus on gamification, Duolingo uses challenges, rewards, and a points system to keep users motivated and engaged in their learning. In addition, it allows users to practice both written and oral language skills and improve their confidence in using the language. Both Kahoot! and Duolingo use gamification to enhance the learning experience and foster important skills such as collaboration, friendly competition, and motivation. These apps have proven to be very effective in learning different topics and skills and are widely used in educational areas of all kinds.

The use of mobile devices within classrooms has been increasing, suggesting strategies for the implementation of these devices with academic intentions. Three studies mention their use and their academic implications in the teaching of English (Stockewell, 2021; Aziz *et al*., 2018; Belda-Medina, 2019); other applications such as Quizziz, Socrative, Video Games, Text Processors, Instagram, Google Forms, Genially, and Facebook, with two mentions, suggest the increase in the popularity of online apps that do not require registration or have versions for mobile phones (Ramírez, 2021; López & Quispe, 2020; Temayo *et al*., 2020; Al Arif, 2019; Akpabio & Ogiriki., 2017; Godwin-Jones, 2017); the rest of the technologies and apps implemented only have one mention (See Figure 1).




*Graphic 1.* ICTs mentioned in the studies

The results highlight that the participants' English language skills, mainly oral and written, improved significantly and achieved very satisfactory results (Syahrizal & Pamungkas, 2021; Ramírez, 2021; Martínez & Hunt, 2020; Palma *et al*., 2020; Alobaid, 2020; Temayo *et al*., 2020; Ratminingsih & Divayava, 2018; Guaqueta & Castro-Garcés, 2018). It was determined that strategies based on the use of ICT significantly impact the learning of English in students (Mendo, 2021; Al Arif, 2019). Positive effects are also reported in the interest and motivation to learn English, as well as the increase in autonomy (Ahumada & Dayson, 2021; Stockwell, 2021; Temayo *et al*. 2020; Belda-Medina, 2019; Lizasoain *et al*., 2018; Roussou, 2018), the implementation of ICT apps and tools had a positive effect on collaborative activities allowing the development of team activities (Syahrizal & Pamungkas, 2021; López & Quispe, 2020; Belda-Medina, 2019; Al Arif, 2019).

Authors such as Stockwell (2021) and Godwin-Jones (2017) state that the use of mobile devices in the teaching-learning process should encourage the development of values such as responsibility, collaboration, and lifelong learning. The evolution of these devices has gone from objects for communication and entertainment to pocket computers and their implementation in the classroom should have the objective of supporting the development of academic values and skills, not only the fun factor. However, not all reported results are positive. Some authors state that there are few works related to the training of teachers in the implementation and use of ICT in English classes (Ahumada & Dayson, 2021). In addition, the difficulties and strengths of these as a pedagogical resources are mainly due to ignorance and, therefore, to the inadequate manner of their implementation (Ramírez, 2021). Both private and public institutions in countries such as Nigeria do not have computer equipment, multimedia systems, Internet, or laboratories suitable for the practice of language, and a large number of teachers were incompetent in processes such as keyboard handling, image scanning, sound recording, and PowerPoint presentations (Akpabio & Ogiriki, 2017); many institutions do not have computer equipment, and those that do have some technological resources, the teachers who use them have a very basic level of digital skills, which are summarized in turning on and off the computer, saving documents, searching for information on the Internet, and using a projector (Mbagwu *et al*., 2022); others, such as a case in Mexico, suggest that the technologies used by teachers are little varied and are used mainly for administrative tasks such as registering, writing reports, recording and delivering grades (Gómez *et al*., 2019).

Klimova and Kacet (2017) present a case in which video games hurt the acquisition of English vocabulary because the chosen game required a very high level of concentration and therefore it was difficult for participants to concentrate on vocabulary. This suggests that it is crucial for the success

of the implementation of these types of activities to accurately choose the games that could collaborate in language learning and try to avoid those games that require many skills simultaneously since they could block the learning process rather than benefit it.

The most relevant findings refer to the use of ICT in teaching and learning foreign languages, emphasizing the benefits and also mentioning some difficulties that can still be observed in the implementation of these tools. Lizasoain *et al*. (2018) for example, affirm that ICT can contribute not only to reducing the gap between the rural and urban world but also as a strategy with a view to global development and better living conditions.

Two studies that stand out are those of Salcedo (2017) and Bonilla (2019), who implemented the use of ICT with students with Down Syndrome and visual impairment respectively to improve written and oral ability in English. Although their studies show positive results, the recommendations confirm that the number of investigations is low and that further research is necessary to strengthen the guidelines around working with students with disabilities. For the success of the implementation of these strategies with this type of student, to facilitate the appropriation of knowledge, it is extremely important to have the support of the family, the institution, and technological and economic resources, not only with ICT as the only didactic mediation. Much work is still needed in the pedagogical and didactic training of teachers who serve this segment of the population.

Mészáros *et al*. (2021) recommend the constant updating of studies related to the use of technology and ICT because such accelerated technological progress results in obsolete research after a few years. Some authors call on government and educational authorities to provide technology to schools and train their teachers for its use and application in the development of their students' academic skills (Mbagwu *et al*., 2022; Mendo, 2021; Ramírez, 2021; Akpabio & Ogiriki, 2017); among other things, they suggest that education secretariats should collaborate in the development of programs that foster twenty-first-century skills through technological resources, educational administrations should train their teachers in the application of ICT within the classroom (Tutillo-Piña *et al*., 2020), as well as make ICT-mediated learning mandatory for all elementary-level students; however, they also point out that although classrooms have technological resources and institutions invest in the incorporation of technology, it is no guarantee that teachers will take advantage of their potential (Gómez *et al*. 2019).

Gamification in the classroom is a recurring theme that has been gaining importance in methodologies due to its playful nature, facilitating the internalization of knowledge in a fun way, and provoking positive experiences in students; it works because it motivates participants, encourages

collaboration, and the commitment to learn (Azar & Tan, 2020; López & Quispe, 2020; Ratminingsih & Divayava, 2018).

## CONCLUSIONS

The main objective was to analyze various research related to the use of ICT in English learning to contribute to the state of the art. This objective could be achieved by synthesizing the trends, findings, and recommendations about the subject, but also by expanding the perspective towards the necessary actions to achieve significant progress in technology-mediated language teaching-learning.

The results indicate that the use and implementation of technology-mediated didactics have a positive impact not only on the development of language skills, but also increase the rates of collaboration, motivation, and autonomy in students.

The fact that developing countries are the largest producers of studies related to the implementation of ICT in the teaching-learning of English indicates a positive trend in reducing the rates of lag and the digital divide suffered by many of these countries. It is also very interesting to see that there are studies that include minorities that are usually the least served in the educational context. This means a real advance in educational trends since the inclusion of these minorities improves the education of all and makes real change possible in the social sphere.

Incorporating technology into English courses is a key tool to improve and optimize the learning process. Educational technology creates a more attractive and diverse environment, opens new possibilities, and enables more effective and personalized learning. Teachers can also transfer power and motivation to the student, improving engagement and motivation. Information and communication technology offers a wide variety of means and tools that facilitate learning, such as accessibility, flexibility, and attention to diversity. ICT has become a key element to improve the teaching and learning of foreign languages, especially for its ability to produce human interactions and offer an interactive learning environment.

To replicate the positive results of these studies, it is necessary to promote training and education in these topics, not only for teachers but also for the competent educational authorities and all the actors involved in the language teaching-learning process. Commitment and sacrifice are required if we want to reduce the digital divide, and the educational lag that has always been present in our countries and if we want to be efficient in responding to the needs of the knowledge and information age, preparing our students to be competent in the professional world that awaits them.

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# Life story of a ritual musician

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*— Abstract—*

This article presents a qualitative and phenomenological research study of a life story about music. In this exercise, parts of Gabriel Montejo's autobiography are assembled, which show his vicissitudes regarding his apprenticeship as heir to the lineage of the mysteries and nambujú, related to the music of the most important traditional rituals. Gabriel's life, in context, offers a glimpse into the social and spiritual life of the town of Suchiapa, in Chiapas, Mexico.

**Keywords:**

*Biographical method; life story; mysteries; nambujú*

Dicen que cuando los cuentos suenan,
las plantas no se ocupan de crecer y los pájaros
olvidan la comida de sus hijos.

Eduardo Galeano, *Las palabras andantes.*

Anthropology, from its task of shaping ethnography as a method of great help in its research task has required the biographical method to design the narratives shared by the people with whom it dialogues. This discipline gives it scientific importance. Among all the methods used in qualitative research, life stories are effective in understanding how subjects create and reflect the social world around them. The meaning that people give to their actions and their experiences is found in social spaces and in the way in which the events of reality are narrated. Storytelling gives access to these senses. A narrative can be understood as a reflection on the human condition (Bruner, 2002). That is, what is not structured narratively, it's at risk of being lost in memory since it is a living experience, as Eduardo Galeano (2001) expressed; it is not found in a dream or fantasy; it travels in the voice which continues after coming out of the mouth.

There is no more genuine interest in people than that which stems from self-knowledge. Giving meaning and making sense becomes a path, especially when applying it to a theme that involves the cultural life of a person located in a given context and, at the same time, is an ontological pretext. From this perspective, the story, hand in hand with the ontological conception, is conceived as a mobilizer of consciousness, in a process that more than times or literary objects, deals with the roots and actualization of each being. The autobiographical story is an element for the creation of knowledge that seeks the configuration of life senses and the social involvement of subjects (Pujadas, 2000; Ferrarotti, 2007).

The story path allows us to get to know someone by revealing their life experience, to appreciate in it the changes of their story and the permanences inscribed in the subjectivities that impact on their cultural insertion. The life of Gabriel Montejo José is a common thread (Fig. 3), through which we will know a little about the life of his father. There are moments when this thread stretches and tightens and others when the seemingly disconnected joins. Experiences that bring the narrator closer to the dead and the living. This continually recreates the social contexts to which the biographer belongs, those that cannot be separated from the behavior, explained by himself, according to his experience and his ability to remember. We are facing a logical practice of his life, naturalized, since his communication has been primarily through words.

## METHODOLOGY

The purpose of this work is to offer some methodological tools applied to autobiographical research, mainly through in-depth interviews for the construction of a life story. This allows the translation of life into experiences, anecdotes, memories, and symbols, reproduced in narratives, to define significant elements that allow this analysis.

When Gabriel (Fig.4) shares his memories and perceptions, he aims to collectivize through music, once he performs them in traditional festivities. In this sense, the following pages recreate a journey between the experiences of his musical learning with the transverse flute for the interpretation of the *nambujú* typical of each of the religious rituals of his community, and how he interacts with his natural, symbolic, and social environment, which is printed in the gaze of his listeners for the creation of narratives. They are shared language games, where the lines of time and space are diluted to show us the perspective from which Gabriel situates his world and his human condition. Blacking (2003), who has defined music as "a humanly organized sound," has argued that "we should look for relationships between patterns of human behavior and patterns of sound produced as a result of an organization's interaction." The author explains that "to find out what music is and if a man is a musician, we need to ask who is listening, who is playing, and who is singing in a given society, and ask why." (p. 149).

## CONTEXT

A group of cholutecas and chiapanecas emigrated from central Mexico to the coast of Soconusco, where they lived together for a long time and, under pressure from other groups, were forced to leave that region. Some migrated to Nicaragua and Costa Rica, and others to the center of Chiapas. Thus, after their separation, they formed two distinct groups. Considering the moment of this separation, it is believed that they would have eight hundred to one thousand years of being settled in the heart of Chiapas, on the right bank of the Rio Grande, in a town called *Napiniaca* or Pueblo Grande, the same one that foreigners knew as Chiapa, currently called Chiapa de Corzo. The latter town, together with *Suchiapa* -where this research is located- and *Acala* are the oldest towns in the Chiapas cultural region. Their language, which belonged to the otomangue linguistic family, has already become extinct. However, there is still a large collection of place names and surnames, which make these villages places with a shared identity.

In 1993 we traveled to Suchiapa, invited by a friend, to go to the celebration of *Corpus Christi*, one of the most important of this town (Fig.1). We were greatly impressed by the two dances represented by dozens of people: the

dances of *Calalá* and *La Reinita*, part of this religious festival. Since without music, there is no dance, we could also listen to the compositions that gave life to the event. We learned, by the voice of those who accompanied us, that Don Miguel Montejo Toalá (Fig.2) was the most respectable person in musical matters, that knew over eighty *mysteries* interpreted for the saints. These are musical pieces performed during religious rituals, and there is the idea that because there is no author, they were taught by *charms* and, therefore, are *mysteries*.

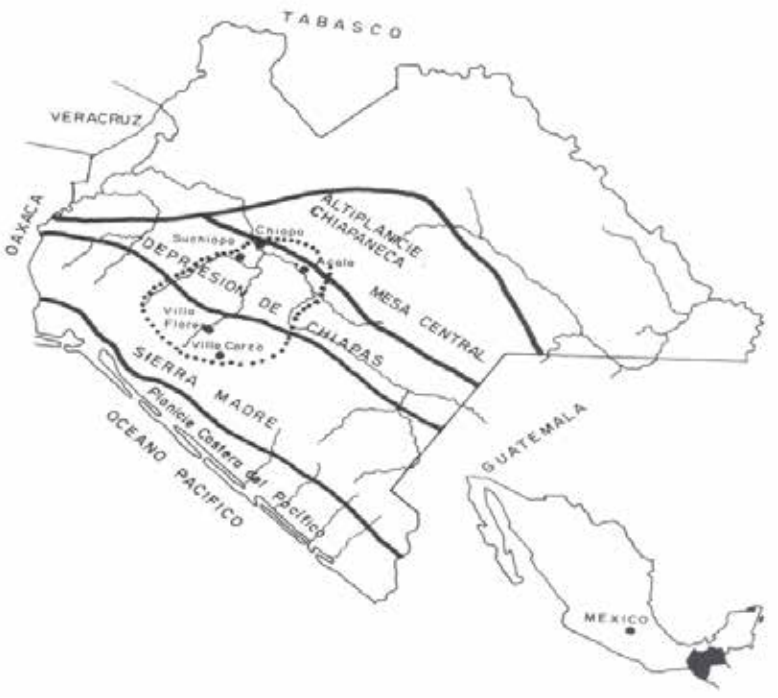


*Figure 1.* The dotted line indicates the Chiapas cultural region, in the Central Depression of the State of Chiapas, Mexico. Source: Carlos Navarrete, 1966, p. 2

On that occasion, we could not talk with Don Miguel Montejo, and his death would prevent us to do so afterward. However, in 2006, when we returned to Suchiapa on the occasion of an investigation about the *nambujú* - a word that in Chiapas language means prayer, invocation, ritual singing-, and the *mysteries*, we met Gabriel Montejo José, the youngest of his three children, with whom we exchanged long conversations about his father, mainly about the way he had been instructed in the music for which he was recognized in the town and it was his occupation until the end of his life. We also chatted about how he had become an apprentice, becoming heir to the *mysteries* his father had responsibly and zealously guarded. Implicitly, these notions (*mystery* and *nambujú*) related to ritual music also connect with the idea of *charm* - alluding to what is alive and

has power, even when it comes to objects, hills, mountains, springs, caves - to give an explanation of its origin and the complexities in its learning.

*Figure 2.* Don Miguel Montejo Toalá, performing a mystery with the reed transverse flute. Source: Personal file

## THE CONTINUITY OF THE LINEAGES AND THE RECOVERED *MYSTERIES*

In Suchiapa, kinship or lineage relating cultural practices, and even mental health, is an issue that has not been addressed. When it comes to music, it is crucial. Beyond their social and environmental implications, the lineages of musicians imply a commitment to the continuity of musical productions. This commitment involves them learning the handling of instruments and musical pieces, the latter transmitted by ear, turning apprentices into teachers at some point in their lives. Oral transmission is also related to its religiosity because the one who teaches does so through the dictates of its *charms*, that is, of its ancestral spirits and, who receives the knowledge does so by contacting those forces. Don Miguel became one of the masters of ritual music.

An example of the task to be done of lineages-musicians, in the preservation of knowledge, is the story around the celebration of San Nicolás. According to the story that Don Miguel told Gabriel, it was approximately in 1940 when he was twenty-six years old, that the "celebration of the stick" was held for the last time. In Navarrete, we found a note about religious celebrations in Chiapa, which mentions <<... we must add a manuscript from

the early eighteenth century where the participation of a *calpul* is discussed in a party called the Pregon in which "el palo" was danced... (1991, p. 145)>>. Since everything has arrived late in Chiapas, the disappearance of the Dance of the Stick will likely be placed in the context of the anticlerical movement in Mexico. Faced with the threat that their saints would be burned after closing their temples, the families organized to hide them and thus avoid action. They continued to perform the *mysteries* at the celebrations, albeit in secret. They could not do the same with the dances, because their public condition denied them the possibility of carrying them out, and by not doing so, they forgot them.

The celebration of San Nicolás was also named "de los alférez" or "de los negritos", for whay Miguel Montejo remembers, because together with Don Pedro and Don Abraham-men older than him and musicians-, they not only knew the mysteries to be played when this saint was celebrated but the *nambujú* in which this ritual was inscribed. These friends died, and only Miguel continued to play some mysteries without transmitting them to anyone else, until after years he told his three children the idea of recovering the mysteries that they no longer knew, but that he still remembered. However, only Gabriel (Fig.3) was prepared to take on the challenge, because they had to play them with a reed-crossing flute, and his brothers did not learn how to play it.

> He told me one day, when he was already old - look, son, we do not play the full mystery of San Nicolás - and it was there that, I am sure, he decided to teach me the mysteries. Since I was the most outgoing, I asked him – and why haven't you taught us everything?– My older brother did not play the flute because he is left-handed, nor did the other one either, but I do because I am also left-handed, but not completely, because I can throw stones with my right hand. I trained with my dad when he had lung issues and could no longer play.
>
> The mystery is missing, he told me, because, with my friend Pedro or Don Abrahamcito, we played here for lieutenants, knights, and everyone danced. The lieutenants danced with "a stick buried in the earth", but only one danced up there and four down. They rolled up crepe paper and wrapped it around the stick. They were entangling it while dancing on the ground. When the first part of the mystery started, they began to root the trunk with a ribbon of crepe paper and danced. And those who danced did not know the lyrics, it was pure intelligence, pure mentality. They finished wrapping the stick halfway through the mystery of San Nicolás. Then, they would untangle it in the second half of the mystery. The dance required a lot of skill, even more so because it was taught through words, by looking, and by listening.

*Image 3.* Gabriel Montejo José plays the mysteries with the reed cross flute. Source: Personal file

> The second part of the *mystery* of San Nicolás is where the flute comes in. That part is quite difficult. The flute is played and the reed enters again, in two parts, ending in the mystery of the dove. Thus, accompanied by flute music, the dancers unwrapped the colored paper ribbon. My dad was able to see it up until he was 26. At the end of the dance, some knights passed by, and the people told the men on horseback that they were "jimbando"[1] fruit to the people and distributing red scarves. I did not get to see this, but my father and grandfather told us, and I thought, how did it not occur to them to continue teaching it? Because only someone special can climb the stick.

Unfortunately, we do not have more than the data provided by Don Miguel to his son Gabriel, together with the scarce memories of the latter. However, it is interesting to know that Gabriel still retains knowledge of the *mysteries* learned from his father. A father who forged his son's character to understand the *nambujú* and the *charms* that would guide his life. As happened with the

1 Throwing them fruit.

musical productions for the celebration of San Nicolás, they also recovered and transmitted those that accompany the two dances of the celebration of *Calalá* (del Gigante and La Reinita), during the celebration of *Corpus Christi*, and those of Los hojeros, travelers of May 3 to the *Nambiyuguá* Hill, with bulrush leaves for the celebration of the Holy Cross. These are the most important festivities of the village of Suchiapa. It is in this way that "an outstanding individual musician comes into contact with the strength of spirits." (Blacking, 2003, p. 159).

## THE *MYSTERIES* AND THE *NAMBUJÚ* IN GABRIEL'S WORLDVIEW

When Gabriel asked about the origin of music and dances, his father always answered - it was the charms who had the intelligence and mindset to create something so powerful-. In the course of his life experience, Gabriel already has the possibility of defining what is "charm", mainly to understand it as the creator of the mysteries, considering that they are alive and have power. Not all music is called a mystery, only that which relates to compositions for important rituals. Sometimes, when they are not part of a lineage, the old musicians choose the disciples, who meet certain requirements to assume such a commitment. Gabriel needed fourteen years to master the reed transverse flute, necessary for his intervention in the mysteries of the ritual.

> According to my grandfather and my dad, charms are the ones that are always alive and have power. Because before, as my father taught us, the charms lived here in the holy land, in the village, together with the humans, when Suchiapa began to grow. They were the ones who gave people intelligence, because they didn't know anything, nor did they know how to read. Because it was knowledge that couldn't be found in any book.
>
> Ah, you'll see, I was already about eighteen when I understood better because my mind had changed. My father was very strict; for us to wander around, we had to fill three bottles with water before leaving, and with that, since we are three brothers, we gathered nine bottles of water, and not only that, when we returned in the early morning we had to fill another nine. And we filled them in the river. Everybody bathed naked, all the women, and we didn't see them, we had respect, not like now when there's violence. This began to change when I was in my twenties. That's why one day I asked my dad where the music came from if it was already known from my great-grandparents, if he thought that ordinary people had created it. I'm playing because the charms made this music, he told me. It couldn't have been human.

Thus, once a friend took me to El Estoraque hill, where the people of San José Terán go to bring bulrush[2] and wanted me to play. I waited for it to get dark to rehearse because I kept messing up and I did not want them to hear me, I was ashamed. My dad was temperamental, I didn't ask him to teach me. Our job was to go to the hill, pick up a wand and stick and palm to make brooms; then tan the shell and make our huarache. And that's where I asked again - when I already knew more about music. Who composed the music? Did someone tell you who composed this music? I told my dad, I have been thinking about it since I spoke to my grandfather, I think it was the charms. What are you saying? he asked me. Because this is what my uncle and several old people told me, it is not easy for someone dull to want to compose music for the image. An uncle of mine cleared it up and told me that the charms composed it. Well, yes -my dad said-, your uncle is right, the charms composed music. Not everyone played *nacalí*, which is played in *Corpus Christi*, or the mystery of the chapulin, the mystery of the tiger and the deer, and that of the chamula.

I don't question what my father taught me. Life on the Hill helped me to understand it and to know that it is true. He always used that word: it was the charms that helped them. These people must have had power. How they made music, and how they taught it because not everyone has the power to create it so that it remains for future generations. I have composed music with the boy that comes with me to gather bulrush, we make some music to play with the reed or with the drum, but it is not music that has power. That music is different. Among them lived the charms, they walked together with them in this land, but as the generations passed and the young people began to have no respect and to be spoiled, they went away. Some remain in caves, but I don't know if there are any left if they have children like us. But some live forever in the cave.

By the way, ritual musicians express themselves, it is meant that "the effect of music depends on the context in which it is interpreted and heard. But ultimately it depends on the music itself" (Blacking, 2003, p. 155), of the person who plays it and of its belonging to the lineage of heirs of this knowledge. Gabriel's memory is creating his world as he hikes the hill. He contemplates the place, in turn, it contemplates him. Text and context are unified for the vision of his world. From dawn until sunset, for fifteen years, day by day he walked the roads and paths that led him to the hill. Even every

2 On the feast of Santa Cruz, from April 26 to 30, a group of men travels to the Cerro del Nambiyuguá (Cerro Brujo) to collect bulrush leaves (Dioon merolae, Zamiaceae), an endemic, ancestral, and sacred plant, specially brought for this devotion.

day was extraordinary in that solitude of the mountain when the work of planting ended and the collection of "wand, stick, and palm" began to make brooms, because from those lands not much was expected in the harvest. When the silence is big, the murmurs are intense. Gabriel knows that the charms perform their parties inside the caves, he has heard music coming from there several times. Undoubtedly, mountains and hills are abodes of memory. They are spaces in which both immaterial domains - myth, worldview, memory - and material domains - the hill, the cave, water, and some objects - are inscribed, and arranged according to different cultural and symbolic patterns (Palacios, 2016). Some agricultural communities assume their history as part of a living process that makes the past a reference for the present and its natural places their own memory (Cassigoli, 2011).

> But you'll see, I made milpa about fifteen years there on the hill. I had a few donkeys. Since my son was studying, I used to walk that hill alone, always alone. Once at about half past eleven o'clock in the day, I was carrying water with a boatload and I was going very fast because I had my donkey and I was worse than a donkey carrying water from a puddle of land,[3] with a boat that loaded them like two blocks and so, all day long, to irrigate three hectares of land where I planted. I made the last trip already late when I started listening to the music set. You could hear it in a distant stream that we knew as El Jocotillo or the descent of La Cieneguita. No car would go up there because it was a large rock! From time to time, the air reached my ear; the music also approached me. The bass could be heard and I even wanted to go and look. I loaded the pump I was watering with and got on a glide because curiosity killed the cat. I was going with the pair of gallons and I kept hearing it louder, and I kept walking. Only my machete and my dog accompanied me until I reached the stream that was about fifteen blocks away. When I was in the stream you could hear in another, in the cave of La Cotorra, and you could already hear the music closer and louder, but I had to enter the cave. I wasn't there anymore, it was too late, I had to go back. One day I was talking to a friend who takes me about five years and who has hiked the hill like me. Hey, friend - I said - you who have walked the hill, have you ever heard music inside the cave? I have heard it, he told me. "But I did not dare to go to the cave because the charms make their parties inside, where they are living.

Gabriel's questions revolve around music, certainly motivated by his heritage of ritual music. Many events that occurred in the hill and its caves, where

3 As a memory of their native language, Chiapanecas tend to unite words creating extensive, very peculiar linguistic forms.

his life developed for many years, were giving him some answers, or at least possible answers. The charms have attracted musicians to the caves, to play as if they were normal village parties, but when they come out of there, they have lost track of time, and believe they have been absent for a few hours when in fact it has been weeks or months. It seems that the dimension of time is very different from what we humans live in as if the cave were the access to a level in which time is eternalized. Inside the cave, there are all kinds of fruits and dishes, and beautiful landscapes, like a paradise image. Many musicians have wished to stay there, where the sorrows of the human world are diluted in the eternal feast.

> My father and grandfather said yes, that they open a path, well, some type of path, to bring some marimba from the town to play at their party. They carry the marimba with their musician and after they send them away. We don't know how they do it because it is a rock the height of a great tree; it is a stream full of mountains, a *mujular*[4], a dark shade of green. But then inside the cave, they say that it is a very large room where the party is held. My grandfather said to my father: never look inside son, because the charms are throwing a party. He also listened to music. It's just that there are several caves, not just that one. We have respected them because the charms still live there.

The charms that lived in the hills (Fig. 6) in meteorological ways, granted or controlled rain in Suchiapa. There was a time when they existed in human form, having the power to transform into lightning. The fact that they still exist is not ruled out (Palacios, 2010).

> There was a dryness of about twenty-five days, the milpa was already about to die. I was about fourteen years old and was on the hill "jimbando" palm to make brooms. The hill of La Cotorra was above and the hillside below where we cut the palm, when my father approached me and said - look, son, tie your palm, let's drink pozol but tie your palm because it is going to rain. I couldn't believe it, because the sky was very clear, there wasn't a single rain cloud. What do you mean it's going to rain? I asked if the sky is clear. It's going to rain, look at the cave, the cloud that will bring the rain is there, hurry up. I listened and started tying my palm. I finished tying it up when I got a glimpse of La Cotorra. I saw the fire that came out of the cave and then the Cerro Brujo or the Zanate that is in Copoya, another fire came from there. And in the middle of the sky, they crossed each other, and we could hear the thunder

4 It refers to an area covered with *muju* trees (*brosimum alicastrum*), endemic to Mesoamerica.

> that went into the cave. Hurry up son, because on our way down it will start pouring, my dad told me. And so it was, it started pouring halfway. When we came down the hill, the rain stopped. You see son, the charms that live here have always had contact with the charms of Cerro de Copoya. Also with those of Cerro Mactumatzá.[5] That's what my dad told us. When the lightning charms went away, that's when things changed. Look, these are the charms that the mysteries gave us, but they also took many of them away because we no longer know how to read the sky or the earth.

We found ourselves sitting in front of Gabriel, in small chairs, almost at ground level. His eyes are not looking at us, they are lost in the abyss of the sandy floor in which he drew small spirals with a wand held in one of his hands, like a mirror that reflects the images of him and his father. He was absorbed in his thoughts and spoke and spoke and, for a moment, we felt that Miguel Montejo was present.

## WHEN THE DRUM STARTS PLAYING IT'S BECAUSE THERE'S GOING TO BE A PARTY

For the musicians of this town, not all music has the same value. It is the process of creation of musical productions, and the kinship of the musician, that makes them grow; they represent human experiences that merge directly with social life, as indispensable instruments for the transformation of the human being and his environment.

Gabriel is the youngest of the three sons of Don Miguel Montejo Toalá. He lives with his brother Guillerman, also a musician, in a small house on the ground floor. His brother Rosendo lives almost next to his place. At the back of Gabriel's house, there is a rustic table that serves as an altar. On it are several saints they inherited from their parents, and their grandparents; we also observe a tiger mask used to represent one of the characters of the dance of *Calala*; in addition to some *chamales*[6] of withered flowers. At the top, stands a poster of when CONECULTA organized a tribute for Don Miguel, his father, the best drummer and reed flute musician of Suchiapa, in 2000, two years before he died at the age of 88. In his old age, Don Miguel had a lung issue that, according to Gabriel, was due to his father playing

5 Zoque word is interpreted as Stone Hill or Eleven Stars Hill.

6 Chamales are pieces made with leaves and flower petals, circular. With these materials, they design animal figures, flowers, and some religious forms. For this purpose, men and women gather during the festivities of Easter and Santa Cruz. Once finished they are offered to the saints of the hermitages, or they are taken to the altars of their homes.

throughout his life in most of the festivities of the town, and the streets were not paved, producing a lot of dust when walking, while he played his instruments.

However, his illnesses could have been derived from working in the field, to which he devoted himself at the same time as music, where the use of pesticides has been alarming and without knowledge of the consequences on his health. Gabriel says about this:

> I do not know if it was because he played among so much dust that sometimes he would choked, that my dad damaged his lungs. He couldn't play the flute anymore because he would start coughing. Or if it was because he worked a lot on the hill. But he died because of it.

Next to the altar, on the ground, and protected with fabrics and plastics, rest the three large drums (Fig.4) that accompanied the entire life of Don Miguel performing the music for the "images", whether invited or paid for by those who fulfilled their devotional commitments. The drums used to belong to Pedro Flores Nucamendi (Fig.5), an important character in the history of ritual music in this town, who lived in El Amatal, a town near Suchiapa, and who was the last man to play the Tinco, an ancient and large teponaztle currently on display in the hermitage of the Blessed Sacrament[7] as a sacred figure.

It is known that Don Miguel became a disciple of this musician from a very young age, and he traveled constantly to the place where he lived with the interest of being instructed in the mysteries that he knew. None of Don Pedro's children was interested in this knowledge, which motivated the decision not only to entrust the music to him but to sell him the drums for a symbolic price, giving him the privilege of being the next guardian of the music of the most important religious festivities of Suchiapa. The drums currently belong to Gabriel and retain the original materials, although it is unknown whether the skin is beef or deer. What Gabriel is sure of is that the wood with which they were built is fine mahogany. "Come in, he said, I'll show you my dad's drum. You know, they are alive because inside them they have his and of all our ancestors' strength". The drums emit strange sounds to warn them that soon they will be the main protagonists of the holiday. When they are played, it is because someone will come to ask for their occupation's gifts.

7 There is an interesting relationship between this character and the Tinco of Suchiapa. For more information on the subject, see Palacios, 2010.

*Images 4 and 5*. Gabriel and the drums he inherited from his father Miguel, and Mr. Pedro Flores Nucamendi, his teacher, who granted him the instruments and *mysteries*. The image shows the Tinco and the Tinajita, with which he performed the ritual music of Suchiapa. Source: Personal file

> My father began playing at the age of sixteen, almost like me, and at twenty-three Mr. Pedro Flores Nucamendi sold him the three drums that had been his ancestor's. Look, these drums, you won't believe it, but when the party is near, they sound loud in the early morning. Sometimes I think it's because of the heat. But other times, at four in the morning, I swear to our God, the drums are playing. My dad would tell me: when the drums are playing, it's because there will be a party or you're going to be invited to play for an image. And in a couple of days, I'd be invited to one. Whether as a guest or paid, there was a celebration. Sometimes I come to uncover them because they sound loud.

One by one he uncovered them from the plastics with which they were covered. He stacked the smaller ones on top of the larger ones (Fig.4). "Play them Gabriel" we said, and his eyes shone like a child's, as he struck the intense, prolonged blows that occupied the space of sound, of energy, of intense energy that transformed not only space but time. The sound flowed from Gabriel's hands, as it must have flowed in the ancient times of Pedro Flores and Miguel Montejo, transmitting this emotion to our bodies! The drums sound is a gate to infinity.

## ALTHOUGH WE HAVE A GIFT FOR MUSIC, LEARNING IT REQUIRES PATIENCE

Of the three brothers, although musicians all, Gabriel overcame the rigor imposed by his father, Miguel Montejo Toalá until he gained the confidence to play the flute that is played "traversed", as he himself refers, that is, a transverse flute, traverse or transversal, of reed. To play it there must be specific conditions of the body to hold your breath for long periods. Gabriel confesses that his mastery of it provided him with the will and patience necessary to be the heir of the knowledge for which his father was guardian throughout his life.

In the following lines, Gabriel Montejo recounts his experiences with the execution of this instrument. At times, the narration is emotional, showing us its impotence in the purpose of bringing music to Cerro *Nambiyuguá* during its religious rituals. In the story, we discover a stubborn young man, full of courage and passion, whose life transformed into a thoughtful, serene, and patient man, who prepared himself for more than a decade of his life to master the flute. The virtue of patience had been his father's condition for granting him the right of the Montejo lineage: that of being the guardian of the mysteries in the *nambujú*.

> I studied, but I didn't finish sixth grade, and that's why I couldn't be a teacher anymore. Before, if you finish elementary school you were able to become a teacher. Because I wrote love letters to women, I didn't learn math and failed sixth grade. I used to love the bulrush flute, the transverse one, but I didn't know how to play it; I could play a reed flute and even the drums, I learned when I was eight years old, but not that flute. I learn how to play the reed by myself, and my father improved me, I was able to play from two holes, but not six. I learned that until I was sixteen. But I wanted to play the flute because I had been carrying the bulrush one since I was ten years old. I would get upset when I saw my dad playing at the celebrations, I would look at his fingers, but I couldn't play it.
>
> Then, time went by about six years. I watched my dad play sitting by the altar. Where the saint was. If he was rehearsing and I dared to get close, he would hit me with it. I wanted to learn. He had long benches of mahogany wood. My grandfather gave them to him, they were even polished even after being made so long ago. That's where I sat and no matter how hard I tried, I couldn't play it, and one day I threw the flute on the floor and broke it. The second time, I did the same thing and my dad saw me. He came to me and slapped me twice. –Why did you break the flute? - my dad yelled at me. Because it doesn't work! -I replied. You are the one who does not work! -he yelled at me again. I was so upset that I didn't cry.

So I went to the hill (Fig. 6),[8] I would fall and hit myself because of the heavy load of palms, rods, and shells. It was worse when it rained, we would fall with everything and had to reload three or four times. And I was stubborn. One day I told my dad I wouldn't go to the hill anymore. He asked me why. I'm bored, I told him, of all the bruises, injuries, and scratches on my knees. Then we go to Tuxtla to sell brooms from early morning until three in the afternoon, we didn't sell anything, and we could only have breakfast until then, we would only drink pozol. My father demanded a lot of us and we didn't eat until really late. Since I had studied, I became more rebellious and reflected more. Well, I'm not going to the hill anymore, I told him, and if you want to kill me, do it because I'm not going anymore. I wanted to work in roofing,[9] making mud and shingles. Try another experience. If you want to hit me you can do it, I won't dodge it, but I'm not going to go to the hill anymore.

I didn't tell him the real reason I didn't want to go to the hill anymore. I was determined to learn to play the flute, I wanted to carry a third of bulrush on the journey to *Nambiyuguá* and the only way was to dedicate more time to that, to learn to play well. That was my mindset, that I wanted to play that flute. We came home from the hill late at night and tired, not wanting to do anything else. It was terrible, it was late at night and we barely ate! We were suffering! Sometimes I think about it again. Thanks to them: my grandfather, my mother, and my father, we learned to work, to be responsible for our children because we have always cared for each other.

Since I quit school, I decided, in addition to everything I learned on the hill, to learn to play music, and you won't believe it, but playing the flute took me fourteen years of my life. So I could learn to master all music. It wasn't easy. I don't know how long it took my dad, but it took me fourteen years. Don't be eager, he would tell me when I wanted things to go faster. One of my friends would tell me the same thing when we were working on road construction. I wanted us to work fast on a fifty-meter-long section of the road, and my friend would tell me, calm down, Gabriel, this requires time! That's when I learned that he was right, anything goes wrong if you do it violently, and I continued

8 During the agrarian reforms, Don Miguel Montejo obtained the land he worked hard for with his children. For the poor peasant, there is only the option of the hill, of the thin lands... He has had to draw strength from his spirituality and from his connection with the beings that inhabit every hill, every cave, every river, and tree. It may have been the only food nature has given him.

Suchiapa has distinguished itself by the craft of weaving and making bricks, as it has important clay banks to achieve the clay. However, with the use of industrialized materials in construction, the almost artisanal production of these others has been affected and, therefore, the economy of families dedicated to this trade.

9 Suchiapa has been distinguished by the craft of weaving and brickmaking, as it has important banks of clay for making fire clay. However, with the use of industrialized materials in construction, the almost artisanal production of these materials has been affected and, therefore, the economy of the families dedicated to this trade.

learning. Until one day, my dad gave me a chance. I used to leave at three o'clock in the morning to make brick and tile. I had to make seven hundred bricks a day. I started working with an ambitious family. I think they wanted me to finish the whole earthen wall to make so many bricks and tiles. But since I was learning, I didn't say anything and it forced me to work a lot. But when a few months passed I was already a master of making mud.

My dad kept pushing me to go to the hill, but in my new job, if I left at three in the morning, I was back and in a hammock by noon, I dedicated myself to rehearsing the flute hours and hours until I got tired, and I fell asleep. I was rehearsing with my dad's flute, I rehearsed because I didn't have one. My mother looked at me and laughed. About three months later, I knew five mysteries. I jumped happily because I was going to carry bulrush at the next party playing my flute. I listened to my father's plays, and they practiced many times until I played right. He did not tell me anything, but when he heard that I already knew five mysteries, he told me - Come here, this is how it's played. That's when he started teaching me! Here, near the saint - he said. That's when my dad started teaching me, and I started to learn all kinds of music. I am the youngest of the three brothers and I can say that my father loved me very much. I was his favorite (he stops the conversation when he starts tearing up, remembering).

This is a long story, I tell my boys (his children) how much we suffered. My dad was very strict and very nervous. So I told him one day, why can't everyone play the mystery of the Holy Cross? Why are you, Uncle Tranquilino, and Uncle Abrahamcito the only ones who can? Because we come from all our musician ancestors, he told me, because it's difficult, it takes time, but mainly patience, and not everyone has patience. It's true, we have a gift, but it requires patience. I understand I told him, that's why I haven't been able to play the flute, I haven't had patience. I've been rushing things, I haven't taken my time. That's when I realized that I was building my character. But it took years.

*Figure 6*. Suchiapa, scene of Gabriel Montejo's life. Source: Personal file

I LEARNED BY WATCHING, JUST AS I LEARNED EVERYTHING IN LIFE.

Gabriel is a thin, frail-looking man, but he has the unwavering strength of his will and his hands. He's sixty-three years old. In addition to playing the mysteries, at present (Fig.7), he builds flutes and drums, a profession that his father also taught him. He earns his living with it. In front of his small house, there is a corridor where the materials to carry out his work are scattered.

> Of the three brothers, I'm the only one who learned how to make drums. I learned by watching, as I have learned everything in life. I saw how he put them together and disassembled them, and then I tried to do it because I thought if I played music, I had to build the instruments too. On one occasion, I heard my dad arguing with one of my brothers who was helping him make the drums. My brother was very "outgoing" and did not pay attention. Since he didn't go to school, maybe that's why it was harder for him to learn how to do things. He had cut some **pieces of leather** to tie him up but they were too short and my dad got angry and was scolding him. I was able to hear him say, "Go get that brother of yours. He will put it together well. You'll see that he'll be able to put it together"-. When I arrived I told my brother, why don't you let him teach you? If you'd pay attention, you would've cut it well. Look, I learned because on one occasion we were with my dad on the hill and he told me that since I was already encouraged to play the drums, I should learn to measure well because the drums are like a weapon. You have to disassemble it so that

it is cleaned and oiled, and put everything in place. –Are the drums like a gun? My brother asked. Yes, I replied -They have their differences, their details.

That day, with my dad's teaching, I put together the first full drum. Afterward, it was easy because that's where I got to experience, the intelligence to do everything, not only on drums, but also flute, reed, whatever. Now I dedicate myself to that too. Thanks to my grandfather and my father, I learned all that. I put together all kinds of instruments for the people who participate in the parties.

He commits to this task with greater intensity on the eve of the village festivities. It is common to see him accompanied by a young man interested in this art. In the courtyard he cuts the skins in the sun and gathers the wood necessary to build drums; he also collects the reeds for the flutes on the bank of the river. As we talked, we moved to both points of the courtyard of his house, adjacent to the space that ,in times of rain, becomes a stream. There are huge stones to prove it. The shadow of a mango tree sheltered us in that afternoon of memories, of nostalgia. "Look, these mango seeds are ready to sow," Gabriel said. He brought us back to the present, while in the distance the hill seemed so close and alive.

*Figure 7.* A few instruments that Gabriel built. Source: Personal file

## FINAL THOUGHTS

Roger Bastide made a detailed analysis of Maurice Halbwachs' work on collective memory, arguing that memories are so caught up in the fabric of human groupings that they can only be reconstructed or re-established on their ancient foundations. We thought about Bastide's reflection after questioning a group of black Brazilians participating in an indigenous popular religion, about the reasons that had driven them to abandon their own ritual systems to adopt others. The answer was unanimous: the nature spirits that they worshiped in Africa were bound to a certain landscape that they had not been able to transport with them in the slave ships. These were the spirits of a mountain, a river, or a sacred forest (Bastide, 2005).

In this way, the importance of space was underlined, according to Bastide, as a place where memories are hooked to be preserved. Many reflections precede us now for a better understanding. This is moving from material space to spiritual space. We will then say that the images of the memory use a double mechanism: they are based, in the first place, on the morphology of the localized group, on the inscription of the religious in a field, as Halbwachs proposes. If someone else is always required to remember, as this author refers to it, it is not because "me" and "someone" is immersed in the same social thought but because our memories are articulated with the memories of other people in a well-regulated set of complementary images. This explains why these images are evoked each time the community meets again and can recover, through the intercommunication of roles, the vocal or gestural mechanisms learned from the ancestors. But it is the present that operates as a filter that lets only that part of the memory adaptable to the circumstances, into place. Above all, it reminds us that tradition does not survive, or at least is not evoked, but insofar as it can be inscribed in the practice of individuals or groups.

The story of Gabriel's life and the memories that make it up had an axis that we wish to comment on in these lines. In Suchiapa, the conception of *charm*, of hidden, attributed to music in this same condition. Thus the mysteries arose, but the restlessness is not derived from who the authors were, but from how this creation was possible, having the connotations of spirituality, complexity, the healing power of the soul, strength, collective convocation, nostalgia, of joy. The force of drums and flutes could only have been transmitted by those special beings who still exist: charms. For when they emit sounds, the soul rejoices in a timeless dimension, as in the caves where they remain alive. Then it becomes the ancient word, that of its mother tongue: the *nambujú*, which integrates everything. *Nambujú* is the mystery, the charm, the prayer, the song, the strength of your spirituality, of your vital world. Ritual words and music establish the most perfect combination

to reach all geographical places and all cardinal points, both of the bodily microcosm and of the cosmos in which man exists.

These "openings", as Eliade (1981) considers them, have been interpreted from different perspectives. One of them is that they introduce the sacred, which is located within one of the multiple realities that the human manifests in terms of its spiritual life, around some natural spaces and devotional practices. The World allows itself to be grasped as a world, as Cosmos, insofar as the sacred world is revealed, is real par excellence. We are intimately connected to the source of all life. In this way, "consciousness arises only when understanding is capturing common patterns" (Grinberg, 1976, p. 129). To talk about this is to let go of certainty, according to Maturana (1996), it is a change of gaze. To be in the sacred place is to find a relational sense in living, to continue having faith in the human being, in a kind of spiritual poetics of living. It is the realization of continuous self-production that makes us "alive". Therefore, according to Maturana, there is no reality, but we live in multiple realities, and each of them arises as a coherence of experience. We generate a world of behavioral coherences, therefore, the created world is not arbitrary, each one reproduces a world with its living. Everyone is the center of the cosmos. In this way, consciousness is an "awareness", a "seeing", like the spiritual experience, which is an expansion of consciousness, of belonging to a larger area. In the musical production of the rite, what really "moves" those who listen is the human content of the humanly organized sounds... In a very similar way that magnetic waves conduct a telephone conversation from one speaker to another. (Blacking, 2003, p. 150). The musical terms are those of their society and their culture, as well as those of the bodies of human beings who listen to, create, and interpret them (Blacking, 2006, p. 13).

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# Chuño production derived from potatoes grown in the community of Pucará and its link with gastronomy

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*— Abstract—*

Chuño is an ancestral product obtained from potatoes undergoing a dehydration process, and it is a food that could potentially contribute to the gastronomical identity of an entire people group. The objective of this article is to report on studies focused on the production of chuño in the community of Pucará and its use within the local gastronomy. With this goal in mind, we worked with a qualitative approach and an ethnographic design to carry out the research. We employed direct observation and interviews along with bibliographic techniques to interpret and understand the diverse customs and traditions of this people group and the role of chuño in their gastronomy. The results of the study showed that the production of chuño is an essential activity within the Pucará community and the product is produced almost entirely for internal consumption within the community. It appears that chuño is not being used in as many gastronomical recipes as it could potentially be used in even though it has qualities that are useful in a whole variety of recipes, mainly as a replacement for corn or wheat flour. In conclusion, it appears that the community of Pucará is unaware of the great benefit chuño could add to their gastronomy and this negatively affects the production of this product. Due to this lack of knowledge, it could negatively influence future production of chuño and result in a disappearance of the product altogether meaning the community will not only lose the product but also its valuable biocultural heritage.

**Keywords:**

*Cangahua; chuño; gastronomy; potato; production; cultivation.*

According to Clavijo and Pérez (2014), peasant communities play a significant role in the domestication and preservation processes of various plant species through the observation, selection, exchange, and improvement of various products for human consumption. As a result, food production suitable for feeding, agriculture, sustainable development, and ecosystem services is obtained. In other words, the provision of food that manages to survive over time will be an important factor for the development of communities both in economic aspects and in food sovereignty (Swiderska *et al*., 2022), which is why the existence of agroecological models that are closely related to the sustainability of production, food consumption, and nutrition in the family are fundamental for the strengthening of a society and biocultural heritage (Franco-Crespo *et al*., 2021).

Faced with this position, both communities and society in general must ensure the existence of a diversity of plants and animals that adapt to various climatic conditions, pests, or diseases that ensure the lifestyle of people and the survival of communities considering that not all products are accessible to everyone and that not everyone knows the origin of all foods (FAO, 2019). In this sense, the importance of managing the traceability of certain products that ensure the origin, production, processing, and distribution of food until it reaches the final consumer will contribute to the progressive development of the communities that are dedicated to boosting their agricultural or livestock production (Ferreira & Rosado, 2019).

The potato, for example, is an Andean product that depends on several natural or artificial factors for its production, processing, and storage; which is why it becomes a perishable food that decomposes easily, so alternatives must be sought for its conservation for long periods (Perdigón *et al*., 2020). In that regard, an alternative preservation technique for potatoes is dehydration; an ancestral method carried out by several neighboring communities in South America to obtain a product called "chuño"; a food that can be stored and preserved for long seasons and sometimes for years (Ferrández *et al*., 2022).

Thanks to the physical and organoleptic characteristics that this product acquires, it can be used in various gastronomic preparations in both home and avant-garde kitchens. Its proper commercialization can significantly contribute to the traditions and customs of a people as well as to their food sovereignty (Devaux & Ordinola, 2021).

However, even though this type of product can contribute to the local economy, certain communities are dedicated to the process of transforming potatoes into chuño, such as the community of Pucará located in the parish of Cangahua in the province of Pichincha - Ecuador, where its commercial potential and its contribution to the biocultural heritage are devalued. The lack of knowledge about this product, its traceability, and its lack of existence throughout the year are limitations that do not favor its valuation.

The main objective of this work is to study the production of chuño in the community of Pucará and its intervention in local gastronomy; allowing, in this way, to generate new key information for three possible stakeholders on this type of product: the first, academia, through the development of updated data that can be useful in future research on potatoes and chuño; second, for society in general, who seek to understand and comprehend the importance of its production and consumption in a responsible way; and third, for those producers or traders, who seek to ensure the quality and safety of the product, labor, social and animal welfare, and the protection of human health and the environment.

To achieve this objective, this research considers its approach to the disciplinary structure in the field of Social Sciences regarding economics and anthropology, delimiting the latter to the place where chuño is cultivated, produced, and processed, as well as the representations and forms of consumption of a community around this product (Torres-Salcido & Saavedra, 2022). To this end, in the first instance, a global study on the general aspects of Ecuadorian agricultural production with emphasis on potatoes and their subsequent production in chuño is presented to consequently analyze the contribution of the community of Pucará and its link with the gastronomy around this product.

## DEVELOPMENT

### *Ecuadorian agricultural production*

Agricultural production is the result of the exploitation of the land to obtain goods, mainly, food such as cereals and various types of vegetables for social benefit (Colquehuanca & Blanco, 2021) and refers to everything related to all the various economic activities that have to do with agriculture such as: cultivation and soil treatment for food production, harvesting, distribution, and sales. Its contribution to new employment sources, especially for the rural sector, seeks to integrate responsible processes for production and consumption aimed at the well-being of producers and the conservation of the ecosystem (Prado *et al*., 2021).

Considering various agroecological and biocultural alternatives contribute to production, exploitation, and commercialization that play a part in a healthy diet and continuous sustainability (Franco-Crespo *et al*., 2021).

Faced with this scenario, studies such as those by Sánchez *et al*. (2020) or the National Institute of Statistics and Censuses - INEC (2019) state the existence in Ecuador of six important crops that occupy a greater extension in Ecuadorian soil such as sugar cane, banana, African palm, rice, potato, and corn, consider the importance of implementing various productive mechanisms

that contribute significantly to the development of food and communities where these types of products are valued for adequate consumption.

Just to give an example, potatoes, the object of study for this article, are cultivated in an area between 50 thousand and 66 thousand hectares and contribute a production between 300 thousand and 480 thousand metric tons per year (Institute of Statistics and Censuses – INEN- cited in Suquilanda, n.d.; Barrera *et al*., 2019) compared to an approximate production of 1,2 million tons of corn, in a crop of around 200 thousand hectares (Castillo 2018) or 1,4million tons of rice in 370 406 hectares (Zambrano *et al*., 2019), which are foods that are part of the daily diet of the Andean region in the main family kitchens.

In this regard, Andean tubers, such as potato, achira, white carrot, sweet potato, oxalis tuberosa, melloco, Chinese potato, and mashua, among others, are cultivated by various communities settled in different ecological zones between 2 800 and 3 500 meters above sea level, in Bolivia, Colombia, Ecuador, and Peru (Araujo *et al*., 2021) are a clear example of the great variety of foods that contribute to the food sovereignty of a people.

## *Potatoes*

The potato, considered one of the main productive activities of the Andean region, (Institute of Statistics and Censuses – INEN- cited in Suquilanda, n.d.; Barrera *et al*., 2019), is a food that is part of the daily diet of families of the Ecuadorian highlands and is very useful in various traditional and daily gastronomic preparations. According to the studies of Araujo *et al*. (2021) and Beals (2019), this product is rich in carbohydrates, fiber, vitamins, and minerals, which can prevent cardiovascular or brain diseases, making it an important food in the human diet.

In Ecuador, potato cultivation has become one of the main productive activities of the Andean region and links a large number of actors that make up the productive, industrial, and commercial sectors. The largest amount of potato production and cultivation is distributed throughout the Ecuadorian highlands in rural areas that have adapted their soil to the productive development of this type of food.

Studies conducted by Mastrocola *et al*. (2016) stated that, of the 100% of potato production grown in Ecuador, 81% is consumed by the domestic fresh market and 19% is destined for the industry sector to be processed into fries, flakes, or strips. This contemplates a strong demand at the national level, with greater demand in the Andean region where consumption per person reaches approximately 24 to 30 kilos per year (Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP), 2014).

An interesting fact in Ecuador is that there are about 400 native and improved varieties of potatoes, of which only 4% to 5% (approximately 17 to 20 varieties) are marketed (Pumisacho & Sherwood, 2002; Hidalgo, *et al*., 2011; Navarrete *et al*., 2022). Among some native potatoes that stand out commercially, some examples can be mentioned: Yema de Huevo, Bolona, Uvilla, Leona Negra, Leona Blanca, Pera, Coneja Negra or Coneja Blanca (Monteros *et al*., 2005, p. 13) and among the improved ones; the following stand out: Santa Catalina, María, Cecilia, Gabriela, Esperanza, Fripapa, Superchola (Torres *et al*., 2011; Tejada *et al*., 2016; Devaux *et al*., 2021).

In that sense, since there are so many varieties of potatoes on the market, they can be used gastronomically in various preparations. In this regard, if a variety of potato has an excess of water (like fripapa or super chola potatoes) it is because it has a lower solids content and can be used for frying in flakes or French fries and for salads (Araujo *et al*., 2021), but, if a variety of potato is sandy (for example, bolona, red pea, or uvilla potatoes) it is because it has a higher solids content and therefore they are more nutritious and give a special flavor to the preparations, being their use more recurrent in preparations such as locros or purées (Monteros *et al*., 2005).

### *Chuño or chuno*

Chuño, chuno, or potato starch is a product that is often conceived of as this tuber for human consumption. It comes from the Quechua word "chuñu" as a result of the Indianism, that translated into Spanish means starch. This type of food is the result of freezing, drying, and squeezing certain types of potatoes during an ancestral process that lasts several days. That is, normally the potato previously selected for this process is exposed for several days to the weather for four or five days where at night, it freezes, and during the day, it thaws with the presence of the sun; in this first step, it is essential not to move the potato to maintain quality. Subsequently, at this time, we proceed to the manual squeezing stage that is normally stepped on with bare feet and heels; in this phase, all the liquid that the potato has is extracted. At the end, it is refrozen and thawed in the open air for another ten to fifteen days until it is completely dry. After this time, the shell is removed and stored (Mamani, 1978).

Another alternative traditional process that could last up to fifteen days in total is when the production of chuño is carried out by considering the cycles of freezing, sunbathing, and treading. That is, it first begins by spreading the tuber on the flat soil, which in turn is covered with straw or dry grass, to maintain the desired temperature; after this step, the temperature is changed according to the conditions provided by the sun itself;

finally, it culminates with the treading process to completely extract the water from the product and lengthen its life (Égüez, 2017).

In other words, the traditional chuño is characterized by being an ancient tuber dehydration technique that is carried out in several countries of southern America such as Ecuador, Peru, and Bolivia whose main objective is the conservation and storage for a long time of up to almost three years; which is why it has been constituted as the basis for the preparation of several gastronomic dishes that make up the family diet (Égüez, 2017).

Currently, the existence of different types of chuño is identified that depend on the ancestral process that is destined for its production. Black, for example, whose production process to obtain said characteristic color is carried out through sunlight through contact with air, which produces oxidation that causes it to vary to a brown or black tone, while another kind of chuño, also known as tunta or white, appears by a freezing process that takes place between the months of June-July where dehydration is carried out through the action of treading to extract all the remaining water and cooling when placed in the waters of the river or some lagoon at sunset in permeable plastic bags (Gianella, 2004).

Nutritionally speaking, chuño, having a large amount of starch and fiber, in addition to being an important source of iron and calcium, is a high-energy food compared to other foods of plant origin (Salgado, 2009; Callizaya, 2021).

In several countries of South America, such as Peru and the Bolivian highlands, chuño becomes part of traditional cuisine; an example of this is the particular case of Peru donating chuño, as it is a mechanism of preservation of the potato for many years, obtained by dehydration with the help of various elements such as salt, lime, casana, qoa, ishmuna, izaño, or bentonite (Le Cordon Bleu Peru, 2008), and it is used in various culinary preparations such as sauces, *marzamorras*, or cookies.

### *The Pucará community*

The community of Pucará, belonging to the parish of Cangahua, is located in the Province of Pichincha, about 30 or 40 minutes from San Juan de Cangahua. It is an independent community made up of more than 200 families, with a population of around 2000 people. Its main economic activity is livestock and agriculture, and its livestock production is very limited due to the altitude and its climate. As for agriculture, they are mainly dedicated to the planting of potatoes, mellocos, wheat, and onions.

## METHODOLOGY

To meet the proposed objective of studying the production of chuño in the community of Pucará and its contribution to local gastronomy was considered to carry out the research through the position of the qualitative approach where an ethnographic design was taken into account whose fundamental principle was inclined to observe various cultural practices that the different social groups considered as subjects of study. With this design, it was possible to interpret the various behaviors that are present in the customs and traditions of these people when describing, understanding, and explaining their social system around the production and consumption of chuño (Jesús Contreras & Medina, 2022). For this case study, the research axis focused on variables such as product traceability and contribution to food heritage from gastronomy.

According to Hernández *et al*. (2014), among the first steps to be taken in this type of ethnographic study is the formulation of the questions to be answered based on the proposed objective. In that sense, the following concerns were raised: 1) How is the production of potatoes in Pucará?, 2) How is the production of chuño in Pucará?, and 3) What is the contribution of chuño in the gastronomic field?

Subsequently, the information collection instruments that according to the latter authors may be useful and appropriate in this type of study were identified, considering techniques such as participant observation, field notes, interviews, or documents. Therefore, the information was collected during the second and third quarters of 2022 in two ways: the first, through the existing literature in various bibliographic sources from articles, institutional reports, and books that have been written about chuño; and the second, through two research methods: field observation and open interview carried out in situ between the various farmers and inhabitants of the same community of Pucará and the entrepreneurs of the food and beverage or gastronomic sector. For these last two techniques, some criteria or keywords were considered to gather information such as production and cultivation of potatoes, chuño, processing of chuño, ancestral knowledge around chuño and gastronomic contribution of chuño.

Once the necessary information was collected, its analysis was carried out using triangulation between the data obtained and the instruments considered (Sánchez *et al*., 2021).

## RESULTS AND DISCUSSION

This section considers the results obtained that were previously surveyed and triangulated to interpret the cultural practices of the Pucará community concerning chuño.

**1. Regarding the first question, how is the potato production in Pucará? the following information was obtained:**

On an area of 33 237 hectares, over 3 200 meters above sea level, the parish of Cangahua has several communities that devote their efforts to various agricultural and livestock activities. Here the white onion, for example, occupies 4.51% of that area, alfalfa 0.69%, barley 0.39%, and potato 0.09% (Decentralized Autonomous Government of the Parish of Cangahua, 2014). Of the various communities in this parish, the community of Pucará is a place that is characterized by the production of several foods suitable for human consumption where the potato stands out. In this community, 58% of its population is dedicated to this crop, generating up to 30 quintals per family on average per season (Vivanco, 2015).

Within the community of Pucará, it is possible to identify the existence of some potato varieties that are grown in this area, such as Chola, Única, Capira, Leona, and Chaucha, which are destined for internal consumption of the community and which, sporadically, are sold in the same area or outside of it. There is also the existence of potatoes that are harvested at the last moment because they are considered very small, and are destined for the production of potato starch or chuno.

The study carried out in the community also showed the existence of some limitations in terms of the variety of food products that may exist in this area, which affects the nutrition of the population and social and economic development.

Another problem identified in this study, on this same topic, is the lack of knowledge that the inhabitants or farmers of this community have about how to build and generate a business model or brand image around food grown or produced in the area. In this sense, the highest percentage of family income, between approximately 60 to 70% comes from work activities related to construction, and a very low percentage from agriculture and livestock, especially milk production (J. Coyago, personal communication, September 10, 2022).

**2. Regarding the second question, how is the production of chuño in Pucará? the following references were found:**

Although in the community of Pucará it is known only as chuno and not as chuño, the production of this product has its origin since the beginning of the community. The traditional process carried out by all the inhabitants starts 1) initially with the fresh potatoes that were not considered for immediate consumption, or sale, the ones that were left aside or at the end of the harvest because they were very small in size, are selected to be transformed

into chuno. Then 2) it goes through a process where the tubers are washed and soaked overnight by repeating this process twice; then 3) they are ground in a mill manually until they are reduced to particles that improve the efficiency of the product in future preparations. 4) Then it is led to a sieving technique where a product very similar to a fine grit is obtained, usually called starch; the latter process can take up to three days to obtain chuno. 5) Subsequently, the product obtained is washed again and left to rest until the starch of the potato settles and is separated from the water. 6) After a day or so, the water is slowly removed until only the starch remains. 7) These last two steps are repeated twice to remove all impurities. 8) The last step is to dehydrate the starch for a few days in a cloth (white cloth) until it loses all its moisture to the environment during sunshine hours, and we get a product that is suitable for use in various gastronomic recipes (J. Coyago, personal communication, September 10, 2022). Finally, it is stored in plastic bowls or clay pots that do not have contact with moisture.

Although the process for obtaining chuño can vary from farmer to farmer, the production becomes part of the diet of the local inhabitants who see this food as a product that can save them from some setbacks. That is, in the face of a pest or drought, the production of chuño is used as a substitute food for the inhabitants.

A clear example of how the preventive storage of chuño helps society was during the pandemic caused by COVID-19, when several families had to modify their food consumption habits by not having enough economic income, or not being able to leave home, to get enough and varied products that contribute to an adequate diet.

For this reason, most families living in this community keep chuño in mind in their lives as a food source and do not see it as a product that can generate economic income inside or outside the community, due to two important factors: the first, because it has a long process for obtaining it, and second because people, potential customers or local markets, are unaware of the existence of this type of starch.

**3. Regarding the last question, what is the contribution of the Pucará chuño in the gastronomic field? the following information was obtained:**

The use of potatoes, from a gastronomic approach, is a product that is appreciated in traditional preparations such as locros or soups that are very characteristic of the town and the Andean region in Ecuador.

From the family kitchens of Cangahua, the chuno preparations that are mostly developed in this community are: a) the colada de chuno, which goes through a process of hydration of the starch in water and then is cooked until it thickens, obtaining a texture very similar to the gmachica, but in

this case with the starch of the potato; and b) The chuño tortilla, where the starch goes through a process of hydration, with the incorporation of sugar or salt and egg to then be cooked on the coals or in a frying pan. However, there are a few relevant preparations that are prepared sporadically ras: bread.

From the stoves of nearby restaurants located in different areas of the Cayambe canton, where specialists in the gastronomic area work, and who handle a modern avant-garde proposal, they do not use chuño within their recipes. This is because no source of production is dedicated to trade due to the long process needed to obtain it and therefore does not supply local establishments.

However, this can be very useful for making chuño tortillas, coladas, and desserts and as an emulsifying element for sauces or cooked doughs; this product is considered by this type of establishment as a substitute for other alternative products such as cassava starch or wheat flour (S. Imbago, personal communication, September 1, 2022).

As can be seen, chuño plays an important role in local cuisine both in salt preparations and in sweet elaborations related to confectionery, pastry, and bakery, which is perceived not only as one more ingredient of a recipe but because it links signs of culture, reflected in its domestication, and its use.

While chuño has been identified as a characteristic product of some gastronomic preparations, it is also an important element that benefits health favorably. That is, chuño is also considered an alternative and ancestral medicine to solve some diseases; this is thanks to its numerous medicinal properties and benefits as well as its nutritional components. In this sense, chuño is very useful for protecting the stomach, in cardiovascular diseases, as a food for diabetics, or for gargling to reduce the effect caused by the flu or discomfort by acting as an anti-inflammatory mechanism (Callizaya, 2021).

## CONCLUSIONS

The method and type of study selected for this research made it possible to meet the objective proposed in this manuscript, which generated significant and useful information for several sectors; including academia, business, and agriculture, which allows us to understand the importance of chuño production, not only for a specific community but for various populations distributed throughout the Andean region of South America, where years of culture are linked and goes beyond an economic sphere.

In the particular case of the potato, within the community of Pucará, it was understood that, although there are varieties that are grown in this area such as chola, única, capira, leona, and chaucha that contribute favorably to the food security of this town, they do not necessarily cover all the needs of a locality. The low sustainable production and marketing of this product or chuño can harm the collective development of the community from a

domestication, nutritional, and economic point of view; the most likely causes for this problem are the misuse and exploitation of the land, where most of the time the cultivation and harvest lapses are not respected due to the lack of good agricultural practices, which do not allow the generation of products rich in vitamins and minerals that the market demands; and, the poor vision of some farmers when conceiving the cultivation of potatoes and the production of chuño only for internal consumption and not as part of a business model.

Specifically, from the field of domestication, actions aimed at maximizing the production of chuño must focus on conservation and genetic improvement, as well as on the research of this product and its varieties to enhance its value. It is concluded that, given the ideology of looking for alternatives to preserve various foods that may be useful over time, it has led to recovering ancestral techniques for the development of productive activities in the field and gastronomy, which have been adapted to the needs of the communities in these times and giving value to the culture of the inhabitants of a certain area.

From an economic point of view, it is concluded that chuño is a clear example of a product that can contribute income to a community. However, although it is very common to get chuño in the community of Pucará, it is only oriented as a food that is part of the diet of the local community members, so it does not have a very strong projection to be marketed. In this sense, the little interest that society gives to the existence and benefits of this food is overshadowed by the presence of other alternative products for gastronomic use such as corn starch or wheat flour.

As a general conclusion, we understand the usefulness of chuño as another ingredient that supports the preparation of some gastronomic recipes and as a substitute for other ingredients that support popular and avant-garde cuisine. That is to say, the representation that this product has within the gastronomy of the high-altitude villages (Andean communities) is valued through a culinary proposal that seeks to promote and highlight to the world the traditional gastronomy of a town as well as its natural and cultural resources from its Andean worldview. In this sense, ignoring that chuño production contributes significantly to community development and social benefit can cause a rapid loss of food-related biocultural heritage.

As a final reflection, this study highlights the importance of expanding and carrying out future research aimed at understanding or analyzing other very few studied Andean, coastal, or Amazonian foods such as the green banana, cassava, chonta, goose, melloco, chocho (tarwi), bean or quinoa, to mention a few examples, which still depend on ancestral techniques for their cultivation, processing or transformation process before finalizing their traceability as a food product where their contribution to local, regional, national, or international gastronomy is highlighted.

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# Hydrological simulation of the Teapa river basin

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*— Abstract—*

In this research, the hydrological simulation of the Teapa River basin was carried out with the hydrological model CEQUEAU from 1980 to 2017. The research objectives are a) to evaluate the efficiency of the CEQUEAU hydrological model to simulate the average daily flows of the Teapa River basin and b) to calibrate and validate the model CEQUEAU at the Teapa hydrometric station. A hydrogeomatic module was used to obtain the input files required by CEQUEAU. The efficiency of the model was evaluated with the Nash-Sutcliffe coefficient of efficiency (*NSE*), the percentage of bias (*PBIAS*), and the coefficient of determination (R2). The results show that CEQUEAU reproduces the hydrological behavior of the Teapa River basin in rainy and dry seasons.

**Keywords:**

*Hydrological modelling; CEQUEAU; Teapa river.*

Understanding the hydrological functioning of a region is important for the evaluation, development, and management of its water resources. Hydrological models aim to estimate water resources in a basin. Continuous hydrological modeling is a natural evolution of the event-based design approach in modern hydrology. It improves rainfall-runoff transformation and provides professionals with more effective output hydrological information for risk assessment (Grimaldi *et al*. 2022).

This research aims to: a) evaluate the efficiency of the CEQUEAU hydrological model to simulate the average daily flow rates of the Teapa River basin and b) calibrate and validate the model at the Teapa hydrometric station (CONAGUA Code: 30032).

CEQUEAU is a free hydrological model of distributed parameters; it has been used in different regions (Canada, Morocco, Mexico, Spain, Senegal, etc.) for the hydrological modeling of basins. CEQUEAU can be applied for different purposes, for example: a) obtaining flow rates in non-gapped sites in the basin, b) completing missing hydrometric records in hydrometric stations, c) designing hydraulic infrastructure for flood control, d) drinking water supply, and in general for the evaluation of water resources in a basin.

Bâ *et al*. (2001) used CEQUEAU for the simulation of the average daily flows in the Amacuzac and San Jerónimo rivers in the State of Mexico, Mexico. Bâ *et al*. (2013) simulated with CEQUEAU the average daily flows of the Senegal River in two hydrometric stations (Bakel and Kayes) and the daily water levels in the Manantali reservoir. Llanos and Bâ (2011) evaluated through CEQEAU the hydrological behavior of the basin system of the Nervión and Ibaizabal rivers (Basque Country). Vilchis-Mata *et al*. (2015) implemented the use of precipitation data estimated by remote sensors for the simulation of average daily flows in the Amacuzac River basin (Mexico) with the CEQUEAU model. Kwak *et al*. (2017) used CEQUEAU to simulate the future flow rates and water temperatures of the Fourche River (Quebec) with projected meteorological data in the future. Fniguire *et al*. (2022) used CEQUEAU for the daily simulation of flows in an arid and semi-arid mountainous area in the Ourika River basin, Morocco

## METHODOLOGY

The Teapa River is part of the La Sierra River, it is located in the states of Chiapas and Tabasco, Mexico, in the R. H. No. 30 Grijalva-Usumacinta (**Figure 1**). The Teapa River basin drains an area of 424 km² to the Teapa hydrometric station (CONAGUA code: 30032). The average annual rainfall in the area under study ranges from 2,500 to 4,000 mm. The predominant climate in the basin is warm-humid.

The CEQUEAU hydrological model was used to carry out daily hydrological simulations in the Teapa River basin for the period from 1980 to 2017. CEQUEAU (Morin *et al*. 1998) was developed at the National Institute of Scientific Research-Water (INRS-EAU) of the University of Québec, Canada. CEQUEAU is a hydrological model of distributed parameters where the basin is divided into a grid of squares. This allows the model to calculate the flows in each table and take into account the spatial and temporal variations of the physiographic characteristics of the basin (Magaña-Hernández *et al*. 2021). The model is structured in two main modules (production and transfer function, **Figure 2**), which together describe the water runoff from when it reaches the surface of the basin until it reaches the exit point (hydrometric station). The production function models the vertical flow of water (rain, evapotranspiration, infiltration, etc.), and calculates the volume of water in the three containers that CEQUEAU considers (soil, aquifer, lakes, and swamps,). On the other hand, the transfer function analyzes the movement of the flow in the drainage network and takes into account the influence of lakes, swamps, and artificial installations such as dams and by-passes, among others (Morin & Paquet, 1995).

Figure 3 presents the structure for performing hydrological modeling with the CEQUEAU model. Table 1 shows the input data for the implementation of the CEQUEAU model in the Teapa River basin. The CEQUEAU model requires a database with hydrometeorological information (flow rates, precipitation, maximum and minimum temperature), and four files in text format to perform the hydrological simulations: physiographic data (* .PHY), basin data (* .BV), hydrometeorological data (*.DHM) and model parameters (*.PAH).

For this study, daily hydrometeorological data (flow rates, precipitation, maximum and minimum temperature) were collected from 1980 to 2017. Precipitation, maximum, and minimum temperature records were obtained from ten climatological stations of the Computerized Climate Database (CLICOM). In addition, hydrometric information on the daily average flows of the Teapa hydrometric station was used (CONAGUA code: 30032).

The input files to CEQUEAU were obtained automatically with a hydrogeomatic module developed in the Idrisi GIS. In the application of the hydrogeomatic module, the following were used: a) the Digital Elevation Model (DEM) of the area under study, b) the land cover map, c) the basin map, and d) the location of ten climatologicalstations and the Teapa hydrometric station.

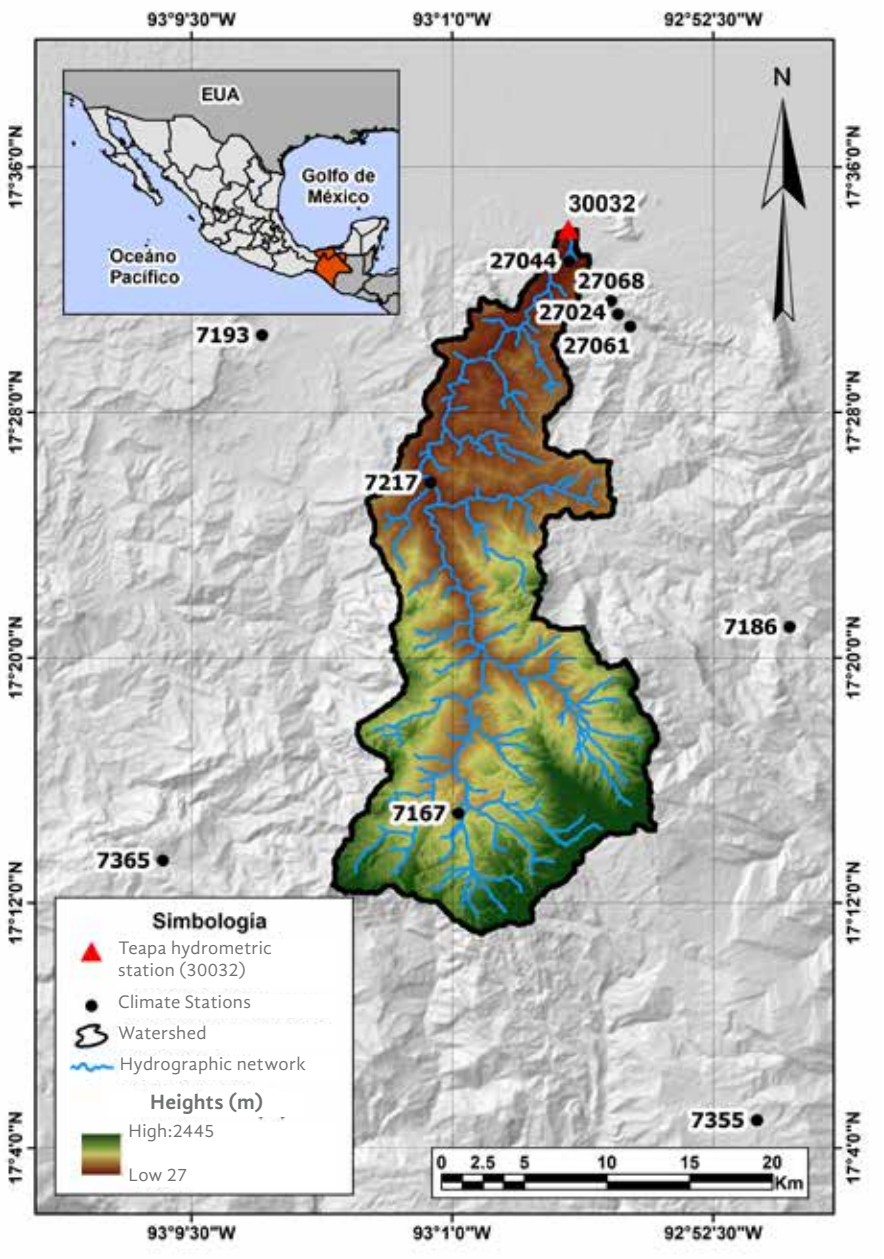


*Figure 1.* Area under study. Source: Own elaboration

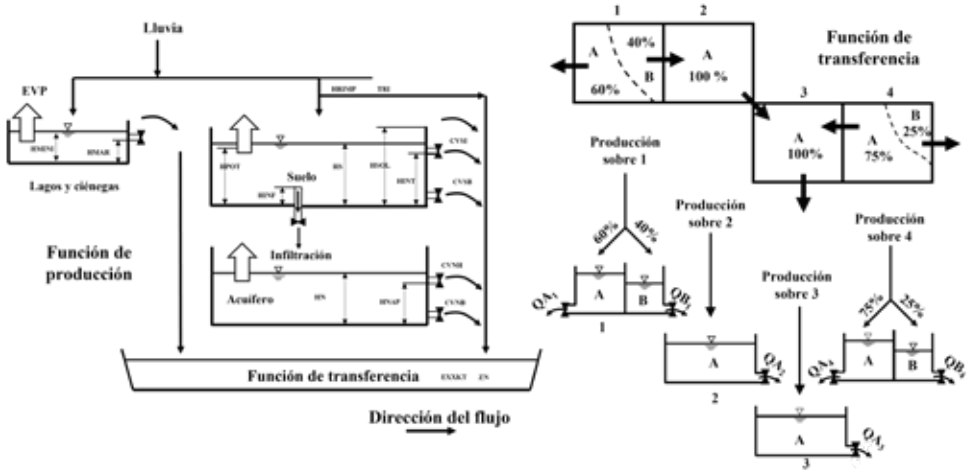


*Figure 2.* Production and transfer function. Source: Adapted from Morin & Paquet, 1995

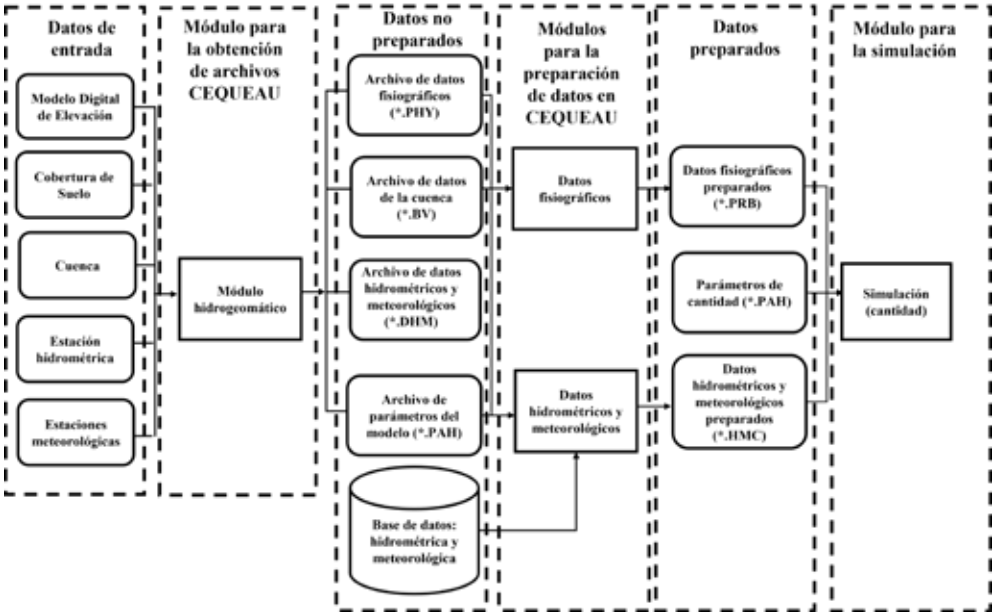


*Figure 3.* Structure for hydrological modeling with CEQUEAU. Source: Adapted from Morin & Paquet, 1995

**Table 1**
*Input data for the implementation of the CEQUEAU model in the Teapa River basin*

| Input data | Format | Period | Spatial Scale | Time scale | Source |
|---|---|---|---|---|---|
| Digital Elevation Model (DEM) | Raster | | 50 m | | National Institute of Statistics and Geography (INEGI) |
| Ground cover | Raster | | 50 m | | National Institute of Statistics and Geography (INEGI) |
| Teapa River Basin | Raster | | 50 m | | Defined with a Geographic Information System (GIS) |
| Physiographic data file, watershed data file, hydrometeorological data file, and model parameter file | Ascii | | | | They are obtained with the application of a hydrogeomatic module |
| Location of climatological stations and hydrometric station | Vector | | | | Own elaboration |
| Precipitation | Ascii | 1980-2017 | | Daily | Computerized Climate Database (CLICOM) |
| Maximum andminimum temperature | Ascii | 1980-2017 | | Daily | Computerized Climate Database (CLICOM) |
| Flow | Ascii | 1980-2017 | | Daily | National Surface Water Data Bank (BANDA) |

The calibration of the CEQUEAU model was carried out for the period from 1990 to 2017, and the validation from 1980 to 1989 daily. In this study, the calibration was performed by trial and error, manually varying the parameters of the model and trying to adjust the simulated hydrographs with those observed in the Teapa hydrometric station. Calibration is a process by which the parameters of the model are adjusted, the objective is to minimize the difference between the observed and simulated flow rates. Validation consists of testing the parameters obtained in the calibration for another period to know the prediction efficiency of the model.

Three statistics were used to evaluate the efficiency of the model, according to Moriasi *et al.* (2015): the Nash-Sutcliffe coefficient of efficiency (very good $NSE > 0.80$, good $0.70 < NSE \leq 0.80$, satisfactory $0.50 < NSE \leq 0.70$, unsatisfactory NSE $\leq 0.50$, equation [1]), the percentage of bias (very good PBIAS < ±5, good ±5 ≤ PBIAS ≤ ±10, satisfactory ± 10 ≤ PBIAS ≤ ±15, unsatisfactory PBIAS ≥ ±15, equation [2])) and the coefficient of determi-

nation (very good $R^2 > 0.85$, *good* $0.75 < R^2 \leq 0.85$, satisfactory $0.60 < R^2 \leq 0.75$, unsatisfactory $R^2 \leq 0.60$, *equation* [3]).

$$NSE = 1 - \frac{\sum_{i=1}^{n} \left(Q_{Obs_i} - Q_{Cal_i}\right)^2}{\sum_{i=1}^{n} \left(Q_{Obs_i} - \bar{Q}_{Obs}\right)^2} \quad [1]$$

$$PBIAS = \left[\frac{\sum_{i=1}^{n} \left(Q_{Obs_i} - Q_{Cal_i}\right)}{\sum_{i=1}^{n} Q_{Obs_i}}\right] \times 100 \quad [2]$$

$$R^2 = \left[\frac{\sum_{i=1}^{n} \left(Q_{Obs_i} - \bar{Q}_{Obs}\right)\left(Q_{Cal_i} - \bar{Q}_{Cal}\right)}{\sqrt{\sum_{i=1}^{n} \left(Q_{Obs_i} - \bar{Q}_{Obs}\right)^2} \sqrt{\sum_{i=1}^{n} \left(Q_{Cal_i} - \bar{Q}_{Cal}\right)^2}}\right]^2 \quad [3]$$

where QObsi and QCali = flow rates observed and calculated on day i ($m^3/s$), $\bar{Q}_{Obs}$ and $\bar{Q}_{Cal}$= average flow rates observed and calculated on n days ($m^3/s$).

## RESULTS

The Idrisi-CEQUEAU module allowed obtaining the physiographic information (soil occupation, altitudes, and flow directions) required by the model, using the information available in digital format. Table 2 shows the parameters obtained in the calibration of the CEQUEAU model in the Teapa River basin from 1990 to 2017. 21 parameters were adjusted in the calibration and used for model validation (1980 to 1989). Table 3 presents the results of the calibration and validation of the model in the Teapa River basin.

Figure 4 presents the hydrographs of the daily interannual flows observed and simulated at the Teapa hydrometric station. In the entire simulation period (1980 to 2017, Figure 4a) the model is very good (*NSE = 0.82* and $R^2 = 0.83$), and the *PBIAS = 1.02* is positive, indicating that the model underestimates the flows, mainly in March to May. In calibration (1990 to 2017, Figure 4c) and validation (1980 to 1989, Figure 4e) the model is good with *NSE values = 0.76*. CEQUEAU underestimates the flow rates in the calibration (*PBIAS = 1.5*) and overestimates them in the validation (*PBIAS = - 1.01*). In the dispersion diagrams (Figure 4b, 4d, and 4f) the good performance of the model is observed, the flow rates are grouped at a line of 45°.

Figure 5 shows the hydrograms of the daily flows observed and simulated for the years 1980, 1983, and 1999 at the Teapa hydrometric station. According to Moriasi *et al*. (2015), the model is good since $0.70 < NSE \leq 0.80$, for 1980 ($NSE = 0.79$, Figure 5a) and 1983 ($NSE = 0.79$, Figure 5b); and very good for 1999 ($NSE$ = 0.86, Figure 5c). In the scatter plots (Figure 5b, 5d, and 5f), the good performance of the model is observed, the flows are grouped at a 45° line between the range of 10 to 90 $m^3/s$.

Figure 6 shows the hydrographs of the daily flows observed and simulated for the years 2000, 2005, and 2011 at the Teapa hydrometric station. According to Moriasi *et al*. (2015), the model is satisfactory since $0.50 < NSE \leq 0.70$, for 2000 ($NSE = 0.70$, Figure 6a) and 2005 ($NSE = 0.67$, Figure 6c); and good for 2011 ($NSE = 0.74$, Figure 6e) since $0.70 < NSE \leq 0.80$. In the scatter plots (Figure 6b, 6d, and 6f) the good performance of the model is observed, the flows are grouped at a 45° line between the range of 10 to 100 $m^3/s$.

**Table 2**
*Parameters in the calibration of the CEQUEAU model in the Teapa River basin*

| No | Parameters | Description | Value |
|---|---|---|---|
| 1 | CIN | Coefficient of infiltration of the soil container into the aquifer | 0.17 |
| 2 | CVMAR | Emptying coefficient of the lakes and bogs container | 0.000 |
| 3 | CVNB | Emptying coefficient of the aquifer container (bottom hole) | 0.018 |
| 4 | CVNH | Emptying coefficient of the aquifer container (upper hole) | 0.033 |
| 5 | CVSB | Emptying coefficient of the floor container (bottom hole) | 0.059 |
| 6 | CVSI | Emptying coefficient of the floor container (intermediate hole) | 0.055 |
| 7 | HINF | Threshold of infiltration into the aquifer container (mm) | 38.5 |
| 8 | HINT | Intermediate emptying threshold of the floor container (mm) | 7 |
| 9 | HNAP | Upper Emptying Threshold of the Aquifer Container (mm) | 140 |
| 10 | HRIMP | Rain sheet necessary to initiate runoff on impermeable surfaces (mm) | 4.5 |
| 11 | HSOL | Container floor height (mm) | 105 |
| 12 | EVNAP | Percentage of evapotranspiration in the aquifer container (0.0 to 1.0) | 0.17 |
| 13 | HPOT | Threshold of water extraction at potential rate by evapotranspiration (mm) | 6.5 |
| 14 | XAA | Thornthwaite's formula exponent | 3.81 |
| 15 | XIT | Thornthwaite Thermal Index Value | 135.9 |
| 16 | EXXKT | Adjustment parameter of the transfer coefficient | 0.002 |
| 17 | ZN | Basin Concentration Time (Days) | 0.675 |
| 18 | COET | Temperature correction coefficient concerning altitude | 0.1 |
| 19 | COEP | Precipitation correction coefficient concerning altitude (mm/m/year) | 1.28 |
| 20 | XINFMA | Maximum infiltration per day (mm/day) | 25.50 |
| 21 | TRI | Percentage of impermeable surface 0.0 to 1.0) | 0.02 |

**Table 3**

*Calibration and validation of the CEQUEAU model in the Teapa River basin*

| Description | $Q_{Obs}$ ($m^3/s$ 1) | $Q_{Cal}$ ($m^3/s$) | $L_{Obs}$ (mm) | $L_{Cal}$ (mm) | *NSE* | *PBIAS* | $R^2$ |
|---|---|---|---|---|---|---|---|
| Simulation (1980 a 2017) | 35.1 | 34.8 | 2629 | 2602 | 0.82 | 1.02 | 0.83 |
| Calibration (1990 a 2017) | 33.0 | 32.6 | 2474 | 2437 | 0.76 | 1.5 | 0.77 |
| Validation (1980 a 1989) | 40.4 | 40.80 | 3024 | 3055 | 0.76 | -1.01 | 0.78 |
| 1980 | 49.1 | 43.7 | 3686 | 3282 | 0.79 | 10.96 | 0.80 |
| 1983 | 30.8 | 32.6 | 2304 | 2439 | 0.79 | -5.83 | 0.80 |
| 1999 | 38.3 | 36.9 | 2869 | 2762 | 0.86 | 3.72 | 0.86 |
| 2000 | 35.5 | 38.5 | 2231 | 2893 | 0.70 | -13.24 | 0.72 |
| 2005 | 20.1 | 21.7 | 1501 | 1625 | 0.67 | -8.24 | 0.67 |
| 2011 | 41.0 | 45.0 | 2807 | 3366 | 0.74 | -10.54 | 0.75 |

QObs = observed flow rates; QCal = calculated flow rates; LObs = observerd rain level; LCal = calculated rain level

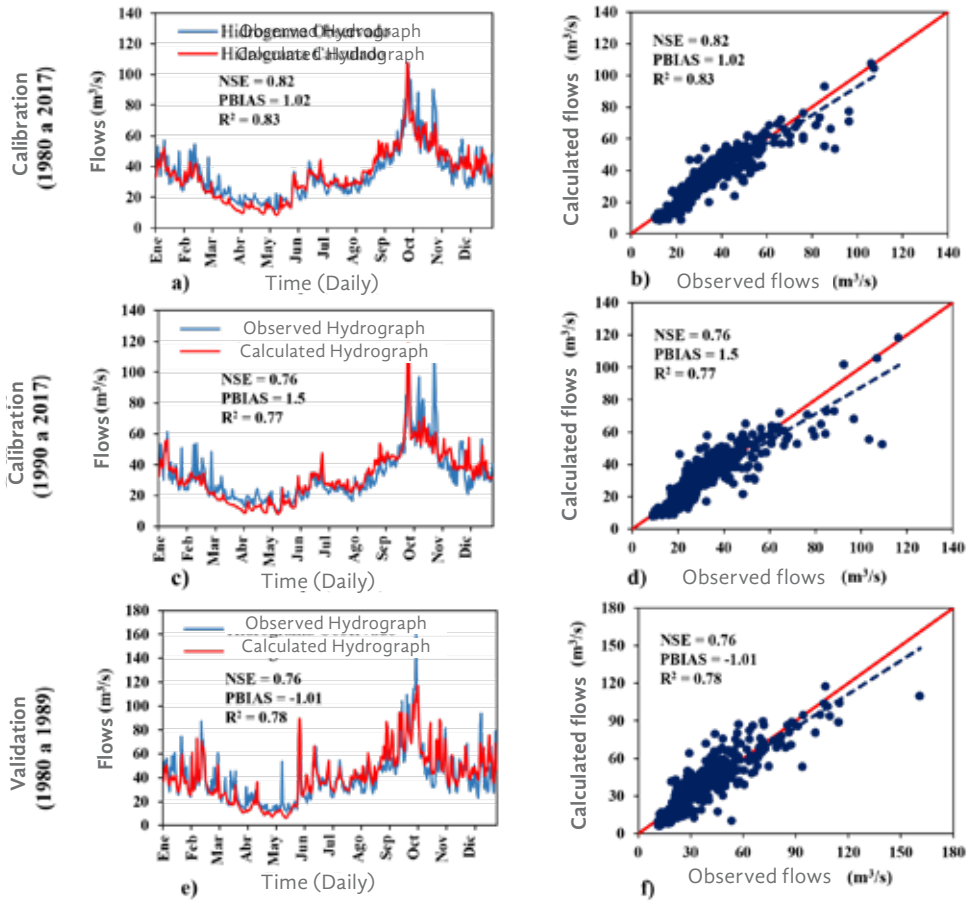


*Figure 4.* Interannual daily flows observed and simulated at the Teapa hydrometric station: simulation period (1980 to 2017), calibration (1990 to 2017), and validation (1980 to 1989)

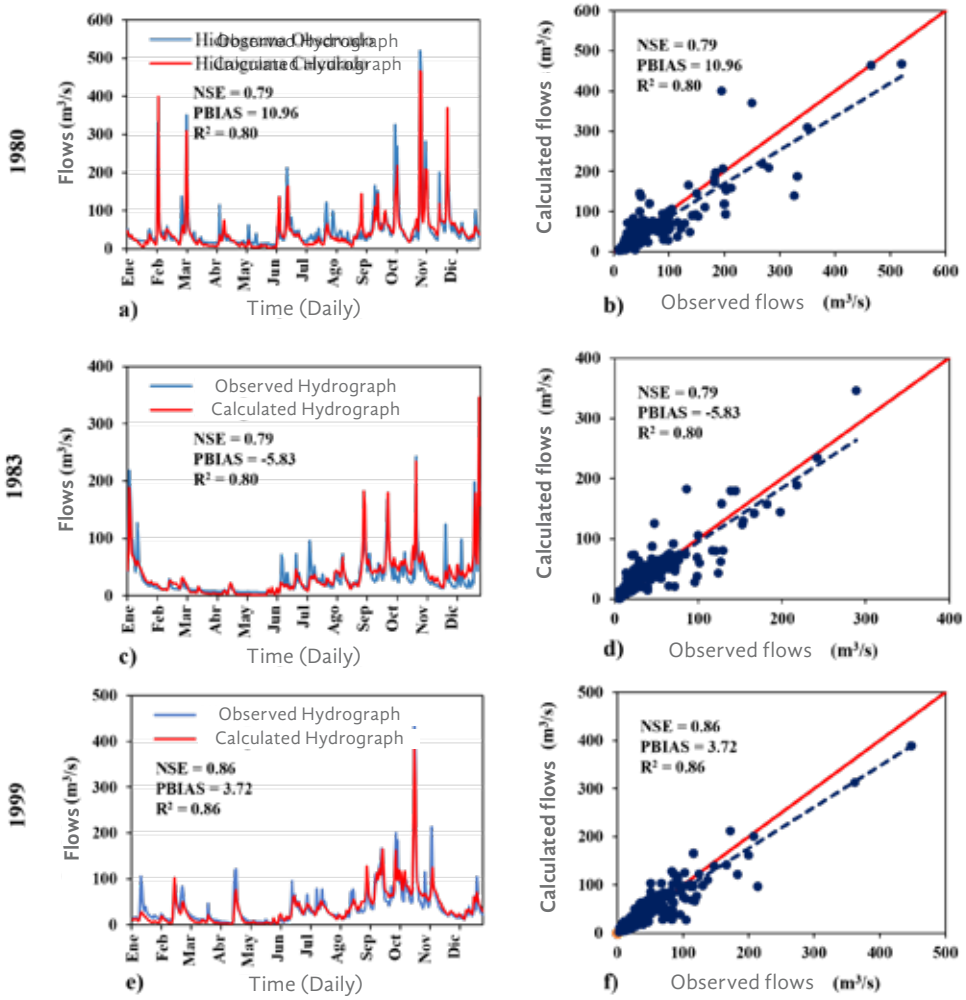


*Figure 5.* Daily flow rates observed and simulated at the Teapa hydrometric station for the years: 1980, 1983 and 1999

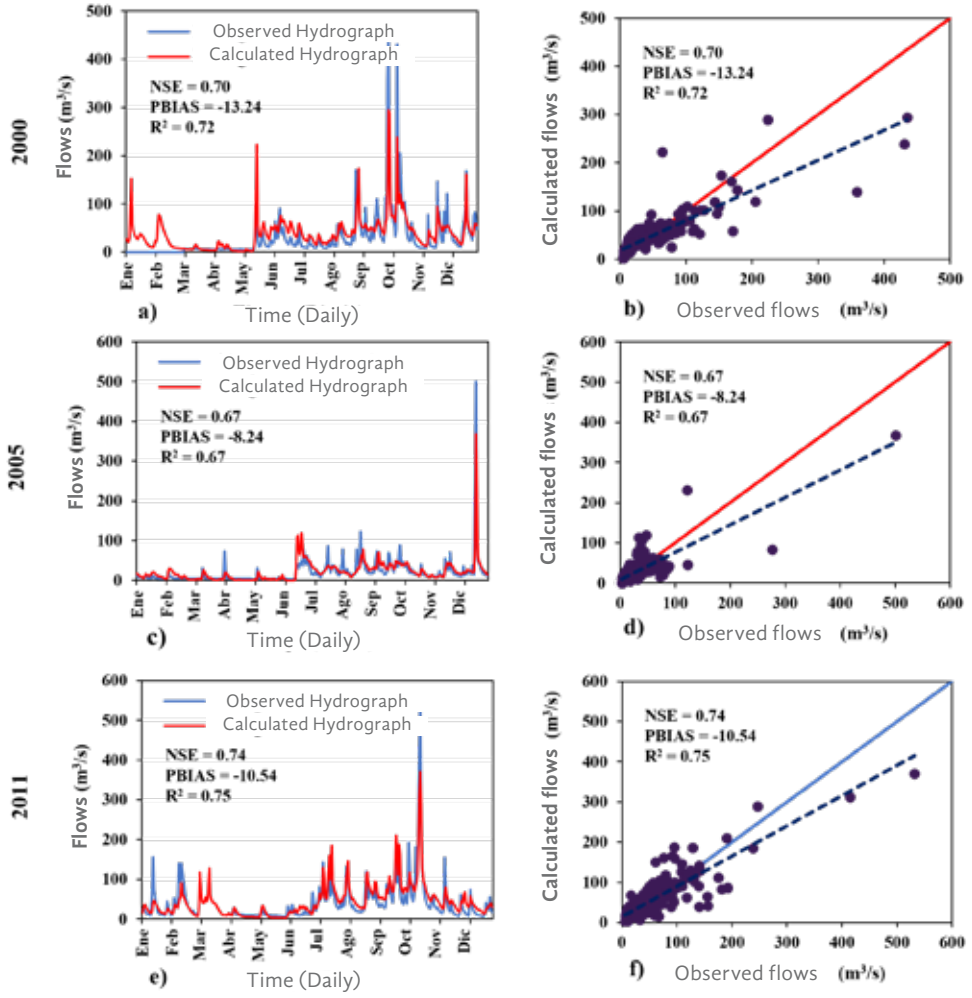


*Figure 6.* Daily flow rates observed and simulated at the Teapa hydrometric station: 2000, 2005 and 2011

## DISCUSSION

CEQUEAU is a hydrological model for accessible and free use. This has been used in different climatic regions. The results presented in this research show that the CEQUEAU model is capable of reproducing the rainfall-runoff process of the Teapa River basin, and they are compared with other studies carried out in Mexico and other countries.

Díaz-Mercado *et al.* (2015), Torres *et al.* (2018) and Magaña-Hernández *et al.* (2021) conducted studies in the same climate region with the CEQUEAU model. Díaz-Mercado *et al.* (2015) simulated the average daily flows of the La Sierra River to the Pueblo Nuevo hydrometric station (CONAGUA code: 30032) from 1968 to 1998, obtaining NSE values of 0.83 to 0.88 for the interannual daily flows. Magaña-Hernández *et al.* (2022) applied CEQUEAU for the estimation of flows in non-volumed sites in the Tacotalpa

river basin, calibrated and validated the model in the Tapijulapa hydrometric station (CONAGUA code: 30093) and Oxolotán (CONAGUA code: 30111), with NSE values of 0.94 and 0.97 in the calibration and *NSE* values of 0.89 in the validation. Torres *et al*. (2018) performed the hydrological simulation of the Teapa River basin with the MIKE-SHE model. Model calibration was from 1998 to 2000, and validation from 2003 to 2005. The NSE in the calibration is between 0.40 and 0.64, and in the validation 0.35 and 0.46 for the daily flows in the Teapa hydrometric station. In this study, two climatological stations and the Teapa hydrometric station were used for the calibration and validation of the model.

In our research, the CEQUEAU model was used to simulate the daily flows of the Teapa River basin. Ten climatological stations were used in the hydrological simulation, which are inside and outside the basin under study. Therefore, the spatial distribution of rainfall can be better determined. The *NSE* was 0.76 in calibration (1900 to 2017) and 0.76 in validation (1980 to 1989).

## CONCLUSIONS

In the research, the hydrological model of distributed parameters CEQUEAU was used to evaluate the efficiency in the simulation of the daily average flows of the Teapa River basin for the period from 1980 to 2017. The CEQUEAU model was calibrated from 1990 to 2017 and validated from 1980 to 1989 at the Teapa hydrometric station. The three statistics used to measure the efficiency of the model indicate that it is good.

Finally, the results obtained in the hydrological simulation of the Teapa River basin using the CEQUEAU model, represent the hydrological behavior of the basin in times of rain and drought.

For future research, it is important to carry out hydrological simulations on a smaller time scale, in basins where there are records of rainfall at short intervals since this is fundamental for hydrological forecasting and disaster warning. An alternative is the use of estimated precipitation by meteorological satellite that provides real-time data at different time scales and globally. However, there are uncertainties in satellite rainfall estimates, as they determine rainfall indirectly. Therefore, it is necessary to validate these estimates with ground rainfall measurements to use it in hydrological applications.

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# Influence of cultural references on the distance between the original humorous message and the one translated in the dubbing of the film *Finding Dory*

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*— Abstract—*

Audiovisual Translation (AT) is the modality that covers the translation of audiovisual products such as movies, and series, among others. The translated text is transmitted through two communication channels simultaneously: the acoustic channel and the visual channel. Alanis (2015) stated that AT is a modality that presents various problems, especially when it comes to dubbing because many aspects go beyond the verbal aspects that must be considered. One of the problems of AT is translating the cultural referents contained in the dialogue of a film into the target language (in this case, from English to Spanish), where the referents can be an obstacle for translation because the target audience cannot understand them. The principal aim of this article was to examine how cultural references affect the translation of humorous moments in the film Finding Dory. We selected segments of the film and analyzed present cultural elements, applied translation techniques, and the distance of the humorous message from the original language to the target language. As a result, the following types of cultural referents were found to be the most prominent in the dialogues: linguistic, social, and ecologist. Literal translation, modulation, adaptation, and transposition were the main translation techniques applied for dubbing. Regarding the distance of the dubbed version (DV) from the original version (OV), there were minor changes from the original dialogue; however, these changes were adapted for the target audience so that the humor was maintained, and the main message was not lost.

**Keywords:**

*Dubbing; audiovisual translation; cultural references.*

Audiovisual Translation (AT) aims to translate films, TV shows, video games, among other audiovisual products. These are mainly translated through subtitling or dubbing, the latter being the modality in which this article focuses on. One of the problems that translators face in this work is the translation of humor, especially when there are cultural references involved because the translator has the task of maintaining the humor of the film even in the target language.

On the other hand, Vives (2013) assures that dubbing is the best form of AT for films intended for children; although, he also mentions that the translation of humor and cultural references make this type of task the most difficult for an audiovisual translator. Another author who supports this idea is Gor (2015), who mentions that AT is one of the most complex forms of translation and states that translating films (especially comedy) is a challenge. At the beginning of the 21st century, several research works were carried out on AT, especially in cases where translations are directed toward a child and youth audience. Despite this, in recent years there has been little research covering the translation of cultural references into audiovisual products for children, even though the digital age currently means that most individuals have access to this type of content through streaming, including young people.

In this way, it is emphasized that it is important to investigate AT in more depth in the current era, given the boom in audiovisual products. Such popularity ensures that the viewer has closer contact with other languages (especially English); although the option of watching movies and series dubbed into the target language (in this case, in Latin Spanish) is increasingly less requested, as authors such as Gonzales *et al*. (2012) and Botella (2006) argue that the original message of audiovisual products can be distanced during dubbing and, in the case of comedies, jokes and puns are lost. For this reason, we decided to carry out this work; its main objective was to analyze how cultural references influence the translation of the humorous fragments present in the film *Finding Dory*, questioning what types of cultural references are found when translating an animated film, what translation techniques are applied when translating the dialogue from its original language (English) to the target language (Latin Spanish), and equally how far the translation of the dubbing is from that of the original dialogue. It is assumed that social culture could impede the translation of a dialogue. Similarly, it is argued that translators use oblique translation to try to maintain or improve the mood of the film in the target language and that, for this reason, target language dialogues may stray from the original message.

## AUDIOVISUAL TRANSLATION

According to Martín (2012), AT is the specialty dedicated to the translation of audiovisual products. The translated text is transmitted through two communication channels simultaneously: acoustic (words, paralinguistic information, soundtrack, and special effects) and visual (images, information written on posters or labels) (Chaume 2004, cited in Álvarez *et al*., 2015). Normally, films or TV shows are translated; however, other types of products go through this modality: advertising, opera, theater, and video games, among others (Martín, 2012). In short, Chaume (2000, cited in Arbelo, 2008) considers the AT as a variety with different characteristics that require certain strategies.

However, the beginnings of AT date back to those of cinematography, since silent cinema used intertitles to convey the message to viewers, which described sounds or arguments using frames with text written between scenes and can currently be considered predecessors of subtitles (Orrego, 2013).

On the other hand, Alsina and Herreros (2015) mention that AT had never been an exploited research area until the end of the 20th century and that its current name was not determined until recently, as it was called by many different names such as film translation or multimedia translation. It was after the incorporation of other media such as television or video games, that the term emerged as it is known today.

Although this type of translation has a wide variety of modalities such as superimposed voices, simultaneous interpretation, narration, localization, etc., the two main ones are subtitling and dubbing. While subtitling consists of superimposing a translated written text on the image and maintaining the original sound so that the subtitles match the interventions of the actors on the screen, dubbing consists of replacing the soundtrack in the source language with a soundtrack in the target language. The characteristic that defines and differentiates this modality is the need to achieve visual synchrony (which is related to the harmony between the articulatory movements that are seen and the sounds that are heard), as well as maintaining two other synchronisms: one of characterization, which implies harmony between the voice of dubbing and the appearance of the actor on screen; and one of content, which implies congruence between the translation and the original argument (August 1999, cited in Alanís, 2015; Costa, 2015). In this sense, content synchrony is the one that will be taken into account to analyze the distance between the message in the Original Version (OV) of a film and the Dubbed Version (DV), which will be presented later.

### *Cultural references in translation*

Cultural references are non-universal aspects of human culture that represent cultural wealth and diversity (Díaz, 2010). In the words of Arbelo (2008), cultural references are those textual elements that require knowledge and experiences typical of a cultural tradition for their interpretation and which the translator of a text will have to deal with following one of the different translation techniques that exist.

On the other hand, Franco (1996, Cited in Álvarez *et al*., 2015) defines them as those textually updated elements whose function and connotations in an original text (OT) imply a translation problem in its transfer to a final text (FT), provided that this problem is the product of the non-existence of the referred element or its different intertextual status in the cultural system of the readers of the FT.

One of the difficulties in the translation of cultural references, according to Vives (2013), is that the translator acts as a linguistic mediator between the OT and the FT. This is even though a translation is not only determined by the text itself, but that behind each textual content there is a society, a language, and a culture for which such specific content has been created. In addition, Vives (2013) mentions that, when translating that text, culture must be kept in mind. Together, the translator must try to ensure that these cultural references can be understood by the recipients. In this way, it could be pointed out that the translator, while acting as a linguistic mediator, does so as a cultural mediator. Like Vives, Nida (1945, Cited in Arbelo, 2008) highlights the importance of taking culture into account when translating a text, since the cultural differences reflected in each language must be considered. Likewise, said author shows five spheres of cultural elements that can cause problems when translating: ecology, material culture, social culture, religious culture, and linguistic culture, considering material culture as the most important. Added to the above, Álvarez *et al*. (2015) mention that when the audiovisual product to be translated is humorous, the difficulties produced by the characteristic elements of the origin culture (OC) will be exponentially increased, since not only the number of cultural references that appear will be greater, but the same cultural references will be the basis for generating the laughter of the receiver.

### *The translation of humor*

Humor is a complex term to describe. Vandaele (1999, cited in Alsina & Herreros, 2015; Nijland, 2012) characterizes humor as a very little tangible concept and bases humor on two different cases: incongruence and superiority. Incongruence occurs when the phrase creates expectations that are

ultimately not met; while superiority is based on high self-esteem. That is, in the fact that some feel superior to others. However, although these cases of incongruity and superiority are necessary, they are not sufficient to create humor on their own, since it depends on the context in which it occurs (images, sounds, etc.), the purpose (social criticism, entertainment, distraction, etc.), and the sociocultural and linguistic knowledge of each person (Alsina & Herreros, 2015), they also mention that one of the most complex problems in the translation of humor is to manage to pass on to the target audience the author's intention in aspects such as taboo topics, stereotypes, ethnic humor, irony, cultural or linguistic factors and the inadequacy of the record, as well as "The translation of this aspect requires not only great linguistic and extralinguistic competence, but also an imaginative effort and special creativity" (Gor, 2015). It is for this reason that the comedy elements of a text are added to the cultural references when identifying possible translation problems; this is pointed out by Álvarez *et al*. (2015), who highlight that the translation problems caused by humorous elements have their origin, for the most part, in the appearance of cultural references, since humor tends to be created from a common culture and language.

From another point of view, on the translation of humor in children's cinema, Ruzicka (2009, cited in De Los Reyes, 2015) emphasizes that, as with the translation of children's and youth literature, agents intervene with some freedom in the linguistic adaptations of audiovisual products for children, both in translation and in the dubbing study, adding playful elements and word games. On this subject, Costa (2015) adds that, despite the advantages they may have, if the translator is faced with cartoons intended for children, it will be convenient to maintain a level of language that is simple and without words that are too complicated for them.

## RESEARCH BACKGROUND

The studies on AT that have been carried out are varied and abundant. One of the most important is that of Botella (2006), who analyzed the naturalization of humor in the Audiovisual Translation of the film *Ali G Indahouse*. The approach was summarized in that a new trend had been observed in cinematographic and television dubbing, and that this innovation was evident in North American comedy series until it was extended in feature films. Botella (2006) determined that naturalization is obtained by changing the type of humor to approach the new audience and changing cultural references with an adaptation for the receiving audience.

Arbelo (2008) made a treatment of cultural references in the animated series Futurama where he mentioned the difficult job of translating scripts. Its main objective was to find out if the use of one or another translation

technique is acceptable in the cultural references of the series. It was deduced that segments have been chosen to be exotic, and to a lesser extent, generalization and domestication are used.

Subsequently, given that the interest in the study of translated audiovisual texts and their translation process had grown exponentially over the years, Murphy (2010) researched the cultural and intertextual references in the translation and subtitling of *Friends* (whose title in English is the one known and used in Latin America). As a result, he obtained that the most used strategies are the generalization and omission of unknown cultural and intertextual references.

Lammertyn (2010) researched the translation of the verbal humor of Oscar Wilde's film T*he Importance of Being Earnest*. It was pointed out that over time, numerous and disparate Spanish translations of the title have been proposed. Its study aimed to highlight the difficulties posed by the translation of linguistic humor, particularly wordplay. It was concluded that the pun of the title of said film was considered roughly translatable. According to Lammertyn (2010), the impossibility of an exact translation is due to the very nature of linguistic humor, since it is based on the specific materiality of a language, and the passage from one to another involves the alteration and even loss of the original humor.

On the other hand, Sánchez and Bustos (2011) analyzed the dubbing in Mexican Spanish of the animated film *Finding Nemo*, where they addressed how the fact that this text was not originally written in Spanish affected the characters' way of speaking in its approach to the linguistic variation and dubbing fields, so it was expected to find traits of the influence that English exerts on Spanish. In conclusion, it was pointed out that the dubbing of Disney films is "localized", although it tends a little towards neutrality within Latin America to reach more consumers, in addition to not presenting some of the most colloquial features of real oral communication.

A year later, Martín (2012) researched colloquialism and humor in *South Park* (a title also used in Latin America). The author stated that colloquial language has great relevance in translation due to its presence in different textual genres. Despite this, he concluded that the translation faculties do not teach subjects in this type of language, since the vast majority of graduates do not have the necessary knowledge to properly translate colloquial texts. In addition, it was found that the most recurrent comedy resource is wordplay, which, due to its intrinsic relationship with the source language, is usually the most complicated to translate.

The issue of translation for the dubbing of the cultural references of the animated film *Madagascar* was also analyzed by Vives (2013), where he argued that dubbing is the best modality of AT for films aimed at a child audience and analyzed the differences between this modality between Spain

and Latin America. The hypothesis was that, in the translation of cultural references in children's films, the techniques that translators choose in Spain are different from those chosen in Latin America. It was concluded that the cultural references found, the humorous traits, etc., were adequately resolved.

Alanís (2015) criticized the translation of film dubbing and subtitling from discourse analysis, taking as his object of study the film *The Green Mile*, where he proposed that the AT is a modality that presents various problems, especially when it comes to dubbing and subtitling. What was intended was to compare the characteristics between the OV of the film, the subtitled version, and the DV to determine the equivalence between these in aspects such as speech acts, the paralinguistic and isochronic elements, the handling of the different dialects and registers in the OV and even in specific aspects of the plot such as racist ideologies and other forms of discrimination. It was argued that the general meaning of the message is preserved in both versions of AT, but that in aspects of pragmatics during subtitling, substitutions or omissions are made among other more complex translation techniques to respect the technical specifications required for subtitling. Likewise, some aspects of relevance in the OV such as dialects, registration, and even racist ideological manifestations or other "strong" behaviors for the audience are attenuated in translation, both for dubbing and subtitling. However, it was determined that the DV is more attached to the target culture since the subtitled version is usually more literal.

Almost a decade later from Botella's research (2006), Alsina and Herreros (2015) carried out an analysis on the AT in the series *How I Met Your Mother*. The authors stated that it is a separate world that has unique and specific characteristics and difficulties. In addition, they added that it is not simply a matter of translating a text, but that the translation must be adapted to the image, the sound, and, therefore, to exact times. They found that dubbing is much more constrained by lip-sync and kinetics, so content has to be adapted or shrunk. On the other hand, it was found that subtitles only have a limit of space, but not of content, since lip and kinetic synchronization was not a priority.

Costa (2015) conducted a study on the translation for the dubbing of the songs of the animated series *Adventure Time* because not much similar research had been done. The author aimed to reflect on how the chosen songs to make up the corpus were translated.

It was stated that the translation of the songs of said animated series is quite free since it very often uses translation through discursive creation. However, another of the most used techniques is literal translation thanks to the characteristics of the text.

In the same year, Gor (2015) researched the translation of humor in the dubbing of the film *Life of Brian*. The author stated that AT is one

of the most complex forms of translation as it is limited by other factors completely unrelated to the translator's task, given that the translation and adaptation of the text subject to the image represents a significant challenge, especially in the case of comedy movies. Gor (2015) decided to compare the film's scripts in English and Spanish to study the translation techniques that had been used on each occasion, taking into account the type of joke and its relationship with the image. In conclusion, the author commented that it is not correct to speak of "untranslatability", since all elements can be translated, even when using adaptation.

## METHOD

This study starts from the basis of content analysis, a method that allows analyzing the internal structure of the information that is presented in various contents of communication through inference, according to López (2002). Thus, to study the Influence that cultural elements have during the translation of humor for film dubbing, the film *Finding Dory* was chosen, which was released in 2016 and directed by Andrew Stanton and Angus MacLane as a sequel to *Finding Nemo*. The film was distributed by Walt Disney Pictures and produced by Pixar. It was selected because it is mainly aimed at a child and youth audience, this audience being complex according to various authors, especially when transferring humor from one culture to another since cultural references play an important role depending on the public's understanding of them.

Subsequently, both the original English script and the dubbed script were transcribed and dialogue segments were selected in the film that show the relationship between cultural elements and humor for the audience. This was done with the help of the Quirkos software, which admitted to analyzing both text sources at the same time and designating with the use of labels the encodings related to the content synchronization between dialogues and the translation techniques used. This software allowed the lines of text, phrases, or words identified corresponding to the assigned labels to be highlighted by colors, which made it easier to determine the subordination of the content, the distance between the original message, and its humorous impact on the translation.

It should be noted that two elementary foundations were taken into account for the above. On the one hand, Agost's (1999, cited in Alanís, 2015) definition of content synchrony. On the other hand, we used Hurtado's work (2001) in which the techniques that are farther away or closer to the original versions of a translation are mentioned.

Subsequently, matrix analyses were made to have a clear record of the comparison between the segments in the OV and the DV segments, as well

as to identify the main content of the scenes that were subordinate to performing the translation and the translation techniques used in each segment. Finally, it was determined if the DV translations distanced themselves from the OV versions, being that the intentionality of this resource.

### *Analysis*

The analysis is shown by segments in order of appearance during the film. In each one, the OV and then the DV are presented, to then analyze the content, translation techniques, the influence of cultural references, and the distance between comedic messages.

SEGMENT 1, MINUTE 05:40-06:08

**Table 1**
*Segment of dialogue one*

| OV | DV |
|---|---|
| DORY: Hi! I´m Dory... Was it something I said? Kidding. Okay, okay, you're not coming back.<br>[...]<br>DORY: I was looking for something and I... Okay, totally get it. Date night. Have fun.<br>[...]<br>FISH: Well, I hope you find whatever it is you´re looking for.<br>DORY: You and me both. Any idea what that was?<br>[...]<br>DORY: I´m sorry. I´m sorry. I´m sorry. Okay. Guess we'll hang out another time. Don't be a stranger, stranger. | DORY: ¡Hola! Soy Dory... ¿Tengo mal aliento? Es broma. Oigan, oigan. No van a volver.<br>[...]<br>DORY: Era algo importante y... Claro, los entiendo. Es una cita. Todo bien.<br>[...]<br>PEZ: Pues, espero que encuentres lo que sea que estás buscando.<br>DORY: Si, también yo. ¿Tienes idea de que busco?<br>[...]<br>DORY: Disculpen. Disculpen. Disculpen. Adiós. Conversamos otro día. No me vayas a olvidar, olvidar. |

### *Subordinating Content Items for Synchrony*

In the previous segment, the scene can be considered an approach to the essential plot of the film, as it emphasizes Dory's (the main character) short-term memory loss as an adult after being lost as a child, which makes it subordinate content that allows little possibility for change or excessive alteration during translation.

The situation is summarized in that Dory surprisingly greets a group of fish that flee as a reaction, so she questions if she is the cause of it. In the OV she asks if it was something she said, while in the DV she asks if she has bad breath, a change that impacts in a slightly different way depending on the culture, but that allows her to show her clueless personality. Then she yells at them saying it was just a joke, but when he sees that they do not

return, she resigns herself to the fact that they will not return. Subsequently, Dory is seen talking to a couple of crabs about something she was looking for (her parents, whom she had already forgotten), but they also run away and Dory assumes that they are on a date and that they want time alone, so she wished them to have fun. A fish is then observed wishing Dory to find whatever it is she is looking for. Dory thanks him, but she asks him what she is looking for, as she gradually forgets that she is looking for her parents. Finally, Dory can be seen apologizing to different animals to ask them about her parents' whereabouts, but the latter simply ignores her and Dory tells her that they'd better have a conversation another time. In the OV she tells him not to become a stranger, while in the DV she asks him not to forget her. This dialogue can be considered a subordinating element due to the lack of explicitness of the original, since in the DV the message for the rapid understanding of the context is made much clearer considering the child audience, as well indicated by authors mentioned in this work.

*Distance from the original message*

In the dialogues that correspond to this scene, the DV translation is not far from the OV dialogue, since the majority corresponds to literal translation and modulation. However, in Latin American dubbing, an adaptation is used in one of the dialogues at the beginning of the scene, when Dory greets a group of fish fleeing from her. She then wonders if she had bad breath, which can represent a comedic element to the child audience and is a known cultural expression for a situation where someone feels weird about someone else's attitude. In contrast, in OV, Dory wonders if she said something that made them run away, implying that it may have been a bad thing. Thus, although they were two completely different questions, the pragmatic intention was similar in showing her bewilderment, but the humorous connotation is more present in the DV, especially because of the impact it can have on children.

SEGMENT 2, MINUTE 20:38-21:02

**Table 2**
*Segment of dialogue two*

| OV | DV |
|---|---|
| DORY: Hello? Someone? Hello? Anyone? Hello? Anyone? | DORY: ¿Hola? ¿Hay alguien? ¿Hola? ¿No hay nadie? ¿Hola? ¿Hay alguien? |
| SIGOURNEY: Hello. | RODOLFO: Hola. |
| DORY: Hello? | DORY: ¿Hola? |
| SIGOURNEY: I´m Sigourney Weaver | RODOLFO: Soy Rodolfo Neri Vela. |
| DORY: Oh, Hi, Sigourney. I need your help. | DORY: Ah, hola. Señor Pez Vela. Necesito ayuda. |
| SIGOURNEY: Won't you please join us... | RODOLFO: Por favor, acompáñanos... |
| DORY: Oh. Great, great, great. | DORY: Ay. Sí, sí, sí... |
| SIGOURNEY: As we explore the wonders of the Pacific Ocean and the amazing life it holds within. | RODOLFO: A explorar las maravillas del Océano Pacifico, la asombrosa vida que oculta en su interior. |

*Subordinating Content Items for Synchrony*

In the previous scene what happens is that, after Dory, Marlin, and Nemo were attacked by a giant squid, thanks to Dory waking him up with her screams, she felt guilty that Nemo was hurt, so she swam for help asking if there was anyone out there, until she hears a voice saying "hello" and she greets back. In the OV, the voice that replies to her is introduced as Sigourney Weaver (in real life, Weaver is an American movie and television actress), while in the DV he is introduced as Rodolfo Neri Vela (who in real life is a Mexican astronaut). Dory asks Sigourney/Rudolph for help, and Sigourney/Rudolph "asks" her to accompany her and she accepts. Dory gets out of the water but doesn't see Sigourney/Rudolph. This segment is subordinate to translating for the dubbing because whoever replies to Dory is not observed and it is the name with which they are introduced that causes an impact on the public, so culture is essential for this. She mistakenly believes that it is some other marine animal, but the voice came from a megaphone of the Institute of Marine Life and was only giving a message of what can be found in said institute.

*Distance from the original message*

In this scene, the DV dialogue is not very far from the OV, but a cultural adaptation was used with the voice of the megaphone of the Marine Life Institute and the "character" it represented, which changes the context and also the humor. The Pixar studio decided that this voice would be given by someone related to science or the environment in each culture and that their real name would also be used as the name of this character. In the OV the voice of Sigourney Weaver was used, while in the VD for Latin America, the

voice of Rodolfo Neri Vela was used, who by his surname can also generate a word game related to navigation. It is worth mentioning that, in the DV, to give it more humor, Dory refers to Rodolfo Neri Vela as "Señor Pez Vela" (Mr. Sailfish), alluding to the marine species, because Dory believes that the voice she heard was from some animal that lived in the ocean, which changes how the message impacts the target audience.

SEGMENT 3, MINUTE 21:21-21:35

**Table 3**
*Segment of dialogue three*

| OV | DV |
|---|---|
| NEMO: Dory! Dory!<br>MARLIN: Don´t worry, Dory! Stay calm. We'll come find you!<br>SIGOURNEY: And welcome to the Marine Life Institute where we believe in Rescue, Rehabilitation and Release. | NEMO: Dory! Dory!<br>MARLIN: ¡No te asustes, Dory! Cálmate. ¡Te buscaremos!<br>RODOLFO: Y bienvenido al Instituto de la Vida Marina donde nuestra misión es Rescatar, Rehabilitar y Liberar. |

*Subordinating Content Items for Synchrony*

In this scene, Dory is "kidnapped" by some workers from the institute (who actually took her to remove the soft drink plastic she was wearing). Nemo screams for help and Marlin tells him not to worry and that they will rescue her. Afterward, Sigourney/Rodolfo is heard welcoming them to the Marine Life Institute and saying that the mission of the institute is to Rescue, Rehabilitation, and Release, implying that it is a safe place. The reason why this segment is subordinate is precisely the motto of the institute, which plays with the use of the three Rs in the original, but for the dubbing, this aspect had to be omitted to maintain the message.

*Distance from the original message*

The dialogue in this scene does not move away from the OV, although modulation is used. After they took Dory to quarantine, in the DV Marlin tells her not to panic, to calm down, and that they will look for her; however, in the OV he says not to worry, to keep calm, and that they will find her. Even though the dialogues are slightly different, the message is the same. However, another example of modulation is observed when the megaphone voice says that the mission of the institute is to Rescue, Rehabilitation, and Release. In OV, instead of saying “nuestra misión” (our mission is), the expression “we believe in” is used. In that same dialogue, when they say

the three words of the institute's mission, "Rehabilitation" was translated as "Rehabilitate", changing the grammatical category (in this case going from noun to verb so that in Spanish the three words were verbs), using the transposition technique. However, using the literal translation in “Release”, when translated as “Liberar”, the pun is lost, or the idea that the mission can be remembered mnemonically by mentioning the three R. This aspect, from a personal perspective, could have been maintained by using the term "Reintroducir" (Reintroduce), used precisely for the release of species in their natural habitats after having rehabilitated them. While it is possible that the decision to use "Liberar" (Release) was aimed at keeping the content much more understandable to the child audience.

SEGMENT 4, MINUTE 23:32-24:14

**Table 4**
*Segment of dialogue four*

| OV | DV |
|---|---|
| HANK: Well, there´s one thing I can think of to help you get to your family. If I just take...<br>DORY: Yes! Great idea. You take me to find them. Why didn´t think of that?<br>HANK: Uh, no, no, no. If I just take your tag I can take your place on the transport truck then you can go back inside and find your family. All you have to do is give me the tag.<br>DORY: What tag? There´s a tag on my fin!<br>HANK: How you could forget you have a tag on your fin?<br>DORY: Oh, no. I´m sorry. I... I suffer from short-term memory loss.<br>HANK: You don´t remember what we were talking about?<br>DORY: Mm-mm. Not a clue. What were we talking about?<br>HANK: Um, you were about to give me your tag.<br>DORY: Well, I kind of like my tag. Why do you want it?<br>HANK: So I can go to... So I can go to Cleveland. | HANK: Hay una cosa que se me ocurre para ayudarte a llegar con tu familia. Si me llevo tu...<br>DORY: ¡Sí! Gran idea. Llévame a buscarlos. ¿Por qué no lo pensé antes? Vamos.<br>HANK: Uh, no, no, no, no. Si me llevo tu etiqueta tomaré tu lugar en el camión de carga y tú volverás adentro a buscar a tu familia. Lo único que tienes que hacer es darme la etiqueta.<br>DORY: ¿Qué etiqueta? ¡Tengo una etiqueta puesta!<br>HANK: ¿Cómo olvidaste que tienes una etiqueta?<br>DORY: Ay, no. Lo lamento. Yo... sufro de falta de memoria de corto plazo.<br>HANK: ¿No recuerdas de qué estábamos hablando?<br>DORY: Mm-mm. Nadita. ¿De que estábamos hablando?<br>HANK: Ibas a darme tu etiqueta.<br>DORY: Pero me gusta vestir de etiqueta. ¿Por qué la quieres?<br>HANK: Porque quiero ir... Porque quiero ir a Cleveland. |

*Subordinating Content Items for Synchrony*

After some institute employees took Dory to quarantine, she wakes up in a fish tank with a tag and suddenly meets Hank, an octopus who does not want to return to the ocean and asks Dory to give him her tag, since the tagged fish would be sent to an aquarium in Cleveland. However, Dory wants Hank to help her find her family first, but he asks for the tag first so that he can go to Cleveland while Dory is returned to the ocean and so he can continue looking for her parents. Then Dory realizes (again) that she

has a tag on her fin and Hank asks her how she could forget that she had a tag on and she replies that she suffers from short-term memory loss and that is why she forgets things. Afterward, Hank asks her if she remembered anything they were talking about, to which she replies no and asks what they were talking about. Taking advantage of the situation, Hank replies that she would give him her tag, but Dory tells him that she likes her tag (in the DV she mentions that she likes to dress etiquette) and asks him why he wants it. Already desperate, Hank was yelling at her, but realizing that they could hear him, he decided to whisper it to her instead. This scene is subordinate to the translation decisions for dubbing, since being such a changing situation, the comedic connotation may be lost for a certain audience, so in the DV an aspect is added that linguistically causes a much more evident confusion.

*Distance from the original message*

The translation of the dialogue of this scene does not depart from the OV, since literal translation was used for the most part. Although, modulation, transposition, and a brief adaptation were also used. Modulation can be observed when Dory notices that she has a tag on, in the OV she specifies that she has a label on her fin. In the case of the adaptation, after Hank assures her that she is about to give him her tag, in the OV, Dory mentions that she likes her tag and asks him why he wants it; however, in the DV she tells her that she likes to wear etiquette, making a wordplay because wearing etiquette culturally refers to dressing up, giving more humor to the dialogue due to the confusion. In the case of transposition, when Hank asks Dory, "¿Cómo olvidaste que tienes una etiqueta?" (How did you forget that you have a tag?), in the OV he says, "How you could forget you have a tag on your fin?", which would translate to, "¿Cómo pudiste olvidar que tenías una etiqueta en tu aleta?", removing the "you could" so that the verb "forget" would change from present to past tense and be a simpler sentence for the audience.

SEGMENT 5, 29:45-30:06

**Table 5**
*Segment of dialogue five*

| VO | VD |
|---|---|
| HANK: See what you did?<br>DORY: Sorry<br>HANK: This could not be worse.<br>DORY: Hmm. «Destiny». Destiny. Hank.<br>HANK: Sh!<br>DORY: I got a feeling. I think we should get in the bucket.<br>HANK: No. Stop.<br>DORY: Seriously. It says "Destiny" and it is...<br>HANK: No, no, no, no, no.<br>DORY: We've got to get in that bucket.<br>HANK: I´m not going with you in that bucket.<br>DORY: Here... I... go... in... the... bucket. Bye. | HANK: ¿Ves lo que hiciste?<br>DORY: Perdón.<br>HANK: Esto no puede empeorar.<br>DORY: Hmm. "Destiny". Destiny. Hank.<br>HANK: ¡Ni una palabra!<br>DORY: Siento un impulso, hay que saltar a ese balde.<br>HANK: No hables.<br>DORY: «Destiny» quiere decir «Destino» y creo que...<br>HANK: No, no, no, no, no.<br>DORY: Hay que saltar al balde.<br>HANK: No voy a saltar a ese balde.<br>DORY: Yo... salto... en... el... balde. Bye. |

*Subordinating Content Items for Synchrony*

In this scene, Dory and Hank are escaping quarantine to look for Dory's parents, but they are almost discovered by an employee. Hank (holding Dory in a coffee maker with water and camouflaged in a tube) scolds Dory and she apologizes to him. Then, Dory sees a bucket that says "Destiny" and tells Hank that they should jump into that bucket since she thinks it is "Destiny" (in the DV she clarifies what "Destiny" means in Spanish), but Hank just silences her and refuses to jump into the bucket. Then, Dory slowly started to get out of the coffee maker and jumped into the bucket on her own. In this way, the subordination before this scene starts from the image on the screen, since when showing the bucket with the word written in English the translator must solve the fact that the soundtrack of the dubbing does not match the text and at the same time maintain the play on words between Destiny as an abstract aspect about the future of both and Destiny as a physical goal, in this case the bucket.

*Distance from the original message*

This dialogue is also not very far from the OV; but, like the previous ones, it has examples of adaptation to preserve the comedic impact of the situation in the target culture. For example, in one part of the dialogue, Hank silences Dory by saying, "Not a word!"; while in the OV, he simply says, "Sh!" Another example is when Dory tells Hank that they should jump into that bucket and in the OV she tells him that the bucket said "Destiny" and she was talking to him a few moments before their encounter came

from destiny, so in the OV the audience's knowledge on the subject is what helps the understanding of the situation. In the DV, Dory specifies what "Destiny" means in Spanish to make the pun clearer to the audience, taking into account what was happening in the scene and what they could see (the text of the bucket).

SEGMENT 6, 33:02-33:22

**Table 6**
*Segment of dialogue six*

| VO | VD |
|---|---|
| HANK: There you are! Listen up, you and I are square. I took you to the map, now give me the tag!<br>DORY: Wait, wait, wait, no. I know where my parents are. They're in the... what's it called? The place... The soap and lotion?<br>BAILEY Y DESTINY: Open ocean.<br>DORY: Open ocean!<br>HANK: Open ocean! I know where that is. That's the exhibit located right next to... I don´t care. | HANK: ¡Te encontré! ¿Sabes qué?, estamos a mano. Te llevé hasta el mapa, ahora, ¡dame la etiqueta!<br>DORY: Ey, ey, ey, no. Encontré a mis padres. Están en el... um. ¿Qué era? ¿Cómo se...? ¿Man ambiento?<br>BAILEY Y DESTINY: Mar abierto.<br>DORY: ¡Sí, mar Abierto!<br>HANK: ¡Mar abierto! Sé dónde queda. Es la exhibición justo al lado de... no me interesa. |

*Subordinating Content Items for Synchrony*

After Dory ends up in an exhibition where she meets the whale shark called Destiny and the beluga whale Bailey, Hank appears angry with her saying that he has already fulfilled his part of the deal and demands the tag so he can go to Cleveland. At that moment, Dory interrupts him and tells him that she already knows where her parents are, although she suddenly forgets it, so she asks her new friends if it is in a certain place, but they correct her by telling her that the place where her parents are is in the open ocean. Then Hank replies that he doesn't care where the exhibition is. The subordination in this segment of the story is again due to a wordplay, this time influenced by both phonetic and geographical aspects, which is inherent in the cultures of the languages.

*Distance from the original message*

Although in this scene, the VD dialogue has the same message as that of the OV, in addition to the literal translation, adaptation was once again used to achieve an impact on the target audience. When Dory does not remember the "exhibition" where her parents were trying to remember the place she says "Man Ambiento", but her friends correct her and say "Mar Abierto" (Open Sea). However, in the OV, they said in English "Open

Ocean" and when she got confused, she said "The Soap and Lotion", which phonetically sounds similar to "Open Ocean" and that was funny in the OV for the cultural knowledge of the Anglo-Saxon audience about the terms. Therefore, in the DV, this technique was used so that the joke was adapted to the target audience in Spanish, and the confusion of words due to the phonetic similarity was funny.

SEGMENT 7, 34:35-35:00

**Table 7**
*Segment of dialogue seven*

| VO | VD |
|---|---|
| DORY: Nope. My father said there´s always another way.<br>HANK: What? There is no another way.<br>DORY: Open Ocean. Open Ocean.<br>Hmm.<br>DESTINY: Open Ocean. I´m pretty sure it's the building over there. That's ill-defined and roundish. Like Bailey's head.<br>BAILEY:Wait,what?<br>DORY: Always another way. There's...<br>There! Guys, follow me. I know how we can get to locomotion.<br>BAILEY Y DESTINY: Open Ocean.<br>DORY: Exactly.<br>BAILEY: Um, guys. You know I can't swim over there, right? | DORY: No. Papi dijo que siempre hay otro modo.<br>HANK: ¿Qué? No hay otro modo.<br>DORY: Mar Abierto. Mar Abierto. Mar Abierto.<br>DESTINY: Mar Abierto. Debe ser el edificio que se ve allá. Medio borroso y semirredondo. Como su cráneo.<br>BAILEY: ¿Mi qué?<br>DORY: Siempre hay otro modo, siempre hay... Ahí. Oigan, síganme. Ya sé cómo llegar al Mal Almuerzo.<br>BAILEY Y DESTINY: Mar Abierto.<br>DORY: Exacto.<br>BAILEY: Oigan. Oigan. Les recuerdo que no puedo nadar hacia allá. |

*Subordinating Content Items for Synchrony*

After Dory was told that there would be no other way to get to the open ocean, she remembers that once her dad told her that there is always another way to achieve things, which Hank doubts. Then Dory comes out of the water to see where the "display" might be. Next, Destiny comes out and tells him that it is probably in a building similar to Bailey's head and she also comes out of the water. At that moment, Dory begins to look around and comes up with an idea of how to get to the open ocean, although she confuses the name again and her friends correct her again. She asks them to follow her, but Bailey cannot swim to her, because she was prevented from doing so by the display wall. As in the previous segment, subordination stems from the words used in the original message and phonetic similarity that confuses Dory.

### *Distance from the original message*

For the dialogue of this scene, the message was the same, but the adaptation was also used once again in a similar way to the previous dialogue. In this case, Dory confused the words “Mar Abierto” (Open Sea) again, but this time saying “Mal Almuerzo” (Bad Lunch). This was adapted for the DV in Latin America because in the OV she says “Locomotion” instead of “Open Ocean”. Modulation was also used for other phrases that, despite being different, maintain the same intention.

## DISCUSSION

The objective of this work was to determine how cultural references influence the translation of comedic segments in an animated film aimed at children and young people. After watching the animated film Finding Dory as an object of analysis, seven segments of the film were selected, which were analyzed one by one to identify the cultural elements, in addition to the translation techniques that were applied and the distance of the message that the dialogues have from the OV to the DVD.

As a result, different cultural elements were found in each segment, of which Nida (1945, Cited in Arbelo, 2008) mentioned that they can cause problems when translated, such as ecology, material culture, social culture, religious culture, and linguistic culture.

### *Segment 1*

Linguistic culture stood out more in this segment. A great example was when Dory said, "Was it something I said?" ("¿Fue algo que dije?"), and it was translated as "¿Tengo mal aliento?" (Do I have bad breath?). Despite being two different questions, pragmatically they have the same intention, since both questions they refer to whether Dory did something to scare away a group of fish. In this case, the question could have been changed mainly to give it a little more humor and thus get the target audience to laugh a little more. As mentioned by Ruzicka (2009, cited in De Los Reyes, 2015), agents intervene in the adaptation of audiovisual products for children by adding playful elements and pu, so that the target audience interprets the DV dialogues with those of the VO equally or more humorously.

Another example of linguistic culture was when they translated the phrase (also said by Dory) "Don't be a stranger, stranger", for (No me nvayas a olvidar, olvidar) "Don't forget me, forget", instead of literally translating it as "No seas un extraño, extraño". As Costa (2015) mentions, for audiovisual products aimed at a child audience, the translator would have to maintain a

simpler language so that the target audience (children and young people) understands the situation a little more. In this case, the phrase "Don't forget me," forgetting emphasizes Dory's memory loss, which is what is intended to be shown in this segment, than the phrase "Don't be a stranger, stranger."

*Segment 2*

The main element of this segment is social culture. During the scene, while looking for help for Nemo, Dory hears a voice that says "Hello", she replies to the greeting, and this voice is presented as Sigourney Weaver (in the OV). The voice was actually heard from a megaphone where Sigourney spoke to give warnings about the Institute of Marine Life, but Dory believed it was some kind of animal, so it came out of the ocean, but she does not see the said character. For the DV, the megaphone voice was from a man, who introduced himself as Rodolfo Neri Vela. This change happened because, in the adaptations for the different dubs of each language of the film, public figures related to science fiction or the environment were chosen, depending on the place of origin, in addition to keeping their real names for the name of the character. So, for OV, the voice of Sigourney Weaver was used in the United States. As mentioned above, Weaver is an American film and television actress, known for participating in science fiction-related projects (e.g., the Alien films). For this reason, she is nicknamed the Queen of Science Fiction. On the other hand, in the DV for both Mexico and the rest of Latin America, it was Rodolfo Neri Vela's voice, who is a famous Mexican astronaut, being the first Mexican and the second Latin American to travel to space. As mentioned by Vives (2013), the translator must ensure that the target audience understands the cultural references that come from the original language, but in other cases such as this, the cultural references of the original language are adapted to those of the target language so that a better impact on the audience is achieved and it is consistent with the context of the story without altering the sequence of dialogues.

Another notable element in this segment is that of ecology. In the OV, Dory calls Sigourney Weaver by name; while, in the DV, because Rodolfo Neri Vela is the one who gives voice to this character, Dory calls him "Señor Pez Vela" (Mr. Sailfish), alluding to the marine species. This gives a more comical touch to the dubbing thanks to the pun with the surname of the character and the fish, also highlighting that Dory thought that said character was some kind of marine animal.

*Segment 3*

The most prominent element of this segment was that of ecology. This is due to the moment in which the mission of the Institute of Marine Life was translated, since in the OV the mission was referred to as Rescue, Rehabilitation, and Release, which for the DV was translated as "*Rescatar, Rehabilitar y Liberar*" (*Rescue, Rehabilitation, and Release*). In this sense, the translation was literal; however, as could be seen in the OV, the three words that make up the mission of the Institute of Marine Life begin with the letter R. And, when translated into Spanish, two of the three words remain with the letter R, but in the case of Release this pun is lost. According to Álvarez *et al*. (2015), humor starts directly from a common culture and language, so the ecological culture, in this segment, is equivalent, but not the linguistic concordance that was also relevant, especially if we take into account that this motto represents an educational element for the child and youth audience.

*Segment 4*

The highlight of this segment is language culture. Having forgotten the conversation they had, Dory asks Hank what they were talking about, and Hank replies that she was about to give him her tag. In the OV, Dory replies that she likes her tag and why she wants it, while in the DV she replies that she likes to wear etiquette. Here you can see another wordplay where they relate the word tag (etiqueta) with dress etiquette, which refers to dressing up, giving a more comedic touch to dubbing by creating confusion. This is related to what Ruzicka (2009, cited in De Los Reyes, 2015) argued, since in the translation of humor aimed at this type of target audience, translators intervene more freely, creating puns to cause a greater impact.

*Segment 5*

Linguistic culture was the highlight of this segment. When Dory sees the bucket that has the word *destiny* written on it, moments before that scene, Dory explains to Hank that their encounter could have been because of fate, but Hank does not believe in fate. After almost being discovered by an employee, Hank was hiding in camouflage while holding a coffee maker with water where Dory was. At that moment, Dory sees the bucket that has the word "Destiny" written on it. In the OV, she tells Hank that they have to jump into the *bucket* arguing that it is a matter of destiny; in the DV, Dory specifies that Destiny means "Destino". Although there is not much difference in the translation, this dialogue had to be said in the DV so that the target audience

would understand the issue a little more. As mentioned by Agost (1999, cited in Alanís, 2015; Costa, 2015), there must be congruence between the translation and the original argument, in short synchrony of content, so that the message does not stray too far. In short, for humor to be more coherent, other elements such as images and sounds are necessary, as mentioned by Vandaele (1999, cited in Alsina & Herreros, 2015; Nijland, 2012), so in this case the image was essential for the viewer.

*Segment 6*

On this occasion, there were two outstanding elements, ecology and Linguistics. Ecology stands out in this segment due to the translation of Open Ocean into Spanish, which was translated as "Mar abierto" (Open Sea), rather than something literal like "Océano Abierto". Although the translation is correct, ocean and sea are not exactly the same, however, because the ocean at sea is known as the open sea in Spanish, this translation was used to make it more understandable to the target audience and to subsequently facilitate a pun between the original term and the one erroneously used by Dory due to the phonetic similarity.

Next, the linguistic culture was present at the time when Dory tries to remember the place where her parents are, because instead of saying "Mar Abierto" she says "Man Ambiento" (in the DV). In the OV, Dory instead of saying Open Ocean, says Soap and Lotion, they also sound phonetically similar, but they are not the same. However, the joke here was that Dory confused the term with words that sounded similar to the place where her parents were. Therefore, in the translation for the DV into Latin Spanish, this joke had to be adapted so that it could cause laughter to the target audience since if Soap and Lotion were literally translated instead of adapting it to Man Ambiento, the phonetic similarity with the correct term of the place would be lost and the laughter caused by the clueless personality of the character would be lost.

*Segment 7*

The highlight of this segment is language culture. Like segment 6, Dory again confuses "Mar Abierto" but this time with "Mal Almuerzo". In the OV, Dory confuses Open Ocean with Locomotion, therefore, what happened in segment 6, is repeated, where the joke had to be adapted so that the DV had the comedic timing as the OV. In both segments, we observe once again what Ruzicka (2009, cited in De Los Reyes, 2015) mentions about the agents involved in adaptations to add puns to them, especially when it comes to films aimed at children.

## CONCLUSION

After the analysis of the audiovisual product was carried out, several conclusions were reached. To begin with, it is necessary to emphasize that the main purpose of this article was to determine how cultural references influence the translation of comedic segments in the film Finding Dory. In this way, it was possible to identify some cultural references that according to Nida (1945, Cited in Arbelo, 2008) cause problems in translation.

In this sense, linguistic culture was the most outstanding element in the analysis, followed by ecology as the second element that stood out the most, and, finally, social culture. Likewise, material culture and religious culture were not identified in the analysis.

On the influence that these elements caused in the translation of the film, most of the segments of the DV are not very far from the OV, since literal translation was used a lot as a translation technique; however, in each segment minor linguistic changes were found with techniques such as modulation and transposition, and other pragmatically significant ones where the adaptation technique that corresponds to oblique translation was used, where Vinay and Darbelnet (1958, cited in Hurtado, 2001) explain that this refers to avoiding word by word translation. This fact may indicate that this technique was necessary for the dubbing of the film Finding Dory in Latin Spanish to adapt to the target audience and generate more laughter, thus achieving an impact on both children and young people in Latin America.

In conclusion, AT's work has evolved and is currently increasingly in demand in a variety of audiovisual products, such as animated or non-animated films and series. However, it has also become more complex due to the need to make an impact on the target audience and maintain fidelity to the original dialogue. In the case of comedy movies, in most cases, it is necessary to maintain or improve the comical side of the dialogues and adapt it to the culture and language of the country to which it is translated. In this sense, AT could be considered a "double-edged sword": it either harms the product or improves it for the target audience.

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