



EDUCATIONAL RESOURCES TO PROMOTE INTERCULTURALITY IN ETHNOMATHEMATICS

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ABSTRACT

The present article will be based on the diverse lines such as cultural anthropology, Latin American thought, contemporary pedagogy, intercultural curricular design, social theory, Andean anthropology, and didactics of mathematics learning. Its objective will be to analyze and systematize how the didactic resources of ancestral wisdom foster interculturality in ethnomathematics. This manuscript presents a Latin American vision of Ethnomathematics from the perspective of analysis, research, to integrate educational programs in the classroom. The central approach is that ethnomathematics manages to understand other ways of learning in the teaching-learning process, to know and relate to the world from a decolonizing conception, and from there it is possible to manifest what is understood by mathematical knowledge. Subsequently, some conceptions, inclinations and alternatives that are part of this field of research are presented. Each people has implemented knowledge based on their way of being, knowing and interrelated with the society of which they are part as beings that are diverse and have their own culture, these needs appear in the way of life that has developed. The same happens today with the different socio-cultural groups that coexist in our societies. The study of such knowledge generated in their own social and cultural environments is part of the interest of ethnomathematics, which assumes that there may be different ways of knowing how to incorporate into society.

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INTRODUCTION

In the current educational reality you can see the low importance of attending the classroom, especially in the subject of mathematics, by students, due to the lack of motivation when sharing the class with their classmates, taking into account he says that students live in towns far from educational establishments, the same ones that confuse their dialect with their writing, thus learning to memorize content and not the reasoning of it.

In most of the current educational scenarios, students do not comply with homework assignments, especially in the area of mathematics because the classes become vertical and do not invite reasoning, based on difficulties when using materials and useful that interculturality vary.

Duties sent home most of the time are not presented in time by students, because many of the time they do not understand the subject and in the home they have the majority of illiterate parents who are not able to provide them the necessary support.

The change of language can generate difficulty when learning, because there are cases of native *Kichwa* students, who have difficulty communicating orally and in writing, omitting vowels and accents, the lack of intercultural dialogue causes students to leave the language. Own culture, feel shame for their dress, the same that leads to detachment and adaptation of new customs, being more seen in female students, thus leading to disinterest in maintaining their customs and traditions.

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The absence of intercultural didactic resources according to the reality of each student means that the classes are not participatory and the students become memorizers or mechanics, who do not awaken their self-criticism when they think about the topic, taking into account that the teacher must be the manager that the student reason and share experiences with other classmates.

The present article is of vital contribution within the classroom, the didactic resources that foster interculturality focusing on ethnomathematics. Facilitate the teacher to guide the student towards an education according to the real context, thus allowing the solution of mathematical problems focusing on ethnomathematics and interculturality.

In this way interculturality is appropriated, thus allowing an ethnomathematical education to be developed from different perspectives allowing the logical reasoning before different situations, scientifically managed and providing a mathematical education, in such a way guiding them with didactic resources to be able to share it with the students.

Thus entering the current society that is living, taking into account that the reality of each teacher is different, that is why it promotes an education based on interculturality, where teachers through strategies, processes and under the use of resources appropriate to the context share dynamic and profitable classes with students.

So we should build a project that addresses the need to create new practices in the application of social immigration policies, since in the classroom we meet every day with a number of ethnic and diverse groups, whether in the street, in the neighborhood, at work, in the square, and mainly in the school, these students look for an adequate way of living, sharing, integrating, knowing, interacting, collaborating to improve the ways and conditions of life where they are. (Moreno, 2016).

These situations, plus the difficulties in the learning of mathematics against added to the current economic situation, in the welfare state, in the realization of their rights and the common good, create in some way a restriction for the integration coming from problems of coexistence.

It is very important to take into account the process of interculturality, in order that the situations in which they live do not lead to an increase in this problem, even due to unacceptable, unfounded circumstances and full of social difficulties, all this entails to have clear and logical answers in an integral conjuncture of the society and for them, it is confronted to answer a quantity of questions that orient in the renovation of those policies and practices for the integral socialization of the students.

All this leads us to the elementary question that is to know if the school or higher institutions are capable of taking responsibility for having a correct answer to this diversity of the educated. So it is very clear that educational institutions alone are not capable of completing an intercultural pedagogical project, but need to create an integral social project in which interculturality is not reduced to the collegial environment and that thoughts and actions are increased from all environments of

management and responsibility of society. (MEC, 1996). Attending the author Aguado (1997) the domain of multiculturalism is shown in the educational system, but although the manifestations in the environment of formal education are necessary, they are not enough to go beyond coexistence to the intercultural experience.

In this regard, the authors Sanchez and Mesa (2002) state that adding activities to promote positive and active qualities towards cultural diversity in the classroom, changes some traditional ideas of teachers in the area of mathematics which should take into account integrating qualities intercultural as the need for these teachers to be involved with new teaching resources more actively in the preparation of dynamic activities where students have the main role in the classroom, imparting a way of continuity in the same activities and not as a memory where the student does not need knowledge and when he passes forget that enrichment. On the other hand, it is important to mention the advice of specialists as guides for the development of ethnomathematics issues integrated into the teaching-learning process of mathematics.

Taking into account this problem, some symptoms diagnosed in the classroom will be presented below, not including interculturality as a curricular project, not as a transversal axis:

1. Students who miss class.
2. Students unmotivated by learning.
3. Written memoirs.
4. They do not fulfill tasks and the low performance in the mathematical matter.
5. Absence of intercultural materials and school supplies.
6. Reading and writing not very understandable.
7. Difficulty speaking the Spanish language.
8. They do not use their native clothing.
9. Disinterest in maintaining their customs and traditions.
10. They do not present homework assignments in time indicated.

By not taking into account practical didactic solutions in the classroom for the resolution of these conflicts mentioned above, some negative causes for students may be specified, as will be shown below, according to some diagnoses analyzed:

1. Disinterest in study.
2. Traditionalist teachers.
3. Theoretical classes.
4. Vertical classes.
5. Households with low economic income.
6. Native Kichwa students and language mix.
7. The Kichwa language has three vowels.
8. Social embarrassment.
9. Lack of knowledge about interculturality.
10. Children of illiterate parents.

Depending on the way in which the teacher plays his role in the classroom as the maximum figure for the educated and as a fundamental example to follow, these authors can mention some alternatives that may solve their difficulty of the students on the learning of mathematics mediated by ethnomathematics in order to make the subject of

mathematics more dynamic for students and in some way call attention to learn and participate actively in classes, we mention below some aspects to take into account to solve these conflicts in mathematics:

1. Improve the teaching resources.
2. Promote interculturality.
3. New teaching strategies using ethnomathematics as a means.
4. An ethnomathematics according to the context.
5. Propose intercultural didactic resources.
6. Encourage reading and writing.
7. Presentation of readings according to the context.
8. Encourage each student's own culture.
9. Instruct on own identity.
10. Improve education within the classroom.

Development

How to promote interculturality through didactic resources?

The creation of didactic materials on Intercultural Education has increased in recent years, both in national and international contexts, due to the lack of interculturality in the classroom, where peace, harmony and coexistence among all are observed. The great part of the activities that will be manifested in this article is suggested that in the implements edited to work the multi and intercultural topics in the classroom of today or educational centers in general, they are integrated within the preforms on values education and mainly in the programming of the transversal themes. The objective is to analyze and systematize the relationship of these didactic strategies, shown in different educational materials that do not respond to the need of today in large part.

Therefore, according to what the authors Reyzábal and Sanz (1995) express, in order to achieve an interculturality through didactic resources, one must work in the education of values, a posture for the preparation of work on moral dilemmas, critical analysis, and of contexts, deputation of values and dramatizations or bring real or fictitious situations to the classroom.

However for Yus (1996) increases indications for the education of values in work on critical knowledge as the talks from contexts, comparison and analysis of these values, based on the purification of values manifests concrete talks, sheets of values, and endless arguments, so it proposes self-expressive instructions such as ideas sheets, own creations. For moral dilemmas expresses that must have as a fundamental element the work of self-regulation, self-observation, self-effort to achieve their interpersonal goals, debates or skills to change behavior. According to Jordán (1996) he summarizes his context of action in the stimulation of positive positions towards interculturality, showing the alternation in the classroom of socio-moral and didactic socio-affective didactics. Within the former, he conceives in the same sense as the previous authors mentioned, in the elaboration of purification of values, critical analysis, the discussion of moral dilemmas and instructions of self-control and self-regulation. Within the socio-affective expressions, it

exposes the work designated "The World Restaurant", as a logical model of this type of didactics.

But for Hernando (1996) he divided the techniques exposed for the Education of values, in three phases: those that are adapted to all the subjects of the curriculum, the apt ones to work in time of tutorials and the didactics for the comprehension of the educated group, in which it tries to guide the tutor in dynamics to be aware of the group with which he is working. On this first stage, the author proposes activities to generate within the organization of the class in different curricular areas, starting from the thought that there are no more important subjects than others to work in the environment of values.

So these authors can conclude from the above that for the didactic manifested in the tutorial sessions, they coincide with other alternatives in the indication on the implementation of purification of values, moral dilemmas and increase simulation games based on life real daily in order to draw the attention of students and take it to be active in the classroom, to contribute to the teaching-learning paradigm changing the traditional methods, boring and tireless, to influence the sense of resolution of cultural conflicts as sustenance for the exercise of democratic and tolerant qualities of each other.

Pérez (1997) covers his expressions within the objective of an education for democracy and fragmented into different blocks such as moral education, education for coexistence and tolerance and education for social harmony. For these aforementioned stages, he argues some of the tasks previously discussed, such as the purification of values, moral dilemmas, value sheets and the resolution of interpersonal conflicts.

However for Paniego and Llopis (1998) focus their work on the proposal of correct activities to educate students in mutual solidarity, through the practice of reading as texts on arbitrariness, collaborative games, communication didactics, role play or Acquisitions of consensual measures.

Some authors, such as Essomba (1999) or Arroyo (2000) maintain as a basis for their educational alternatives the objectives and materials decreed by intercultural education, for the creation of curricular programs and didactic contents in the different areas of the curriculum. The author Lucini (2000) highlights the importance of the teacher as an example of personal identification for the student, essentially in the phases of childhood and pre-adolescence. For this reason, the teacher who is involved in the protection of the values originated by cross-cutting arguments in general, must be involved with the improvement of their authentic professional ethics in any situation. In the same content, the author reflects three ways of generating the themes of intercultural transversality in the classroom:

1. Contemplate the organized topics and congruently within the systematizations of the curricular spheres, which would have to be a daily validity in the tasks within the classroom.
2. Organize special contexts for teaching-learning related to the values originated by cross-cultural contents, such as the implementation

of an "intercultural week", with the participation of the entire educational community. It is necessary that these activities do not remain as off-stage actions, but are part of a continuous process of the purposes of the educational collective on education in values.

3. As a final and more innovative proposal and what would be the most fundamental role in the traditional educational projects of teachers: organize a curricular space based on cross-cultural cross-content, such as, for example, build the themes of the area of history from the perspective of equity of opportunities for all, or from the point of view of intercultural education.

Mentioning Cid *et al.* (2001) that propose their alternative of strategic didactics for the increase of positive qualities on the principles of transversal cross-cultural contents, manifesting concrete methods for the work within the classroom on moral education and values. The following conceptions systematize the practical suggestions of these authors:

Methods of self-knowledge and purification of values

- Unfinished sentence activities
- Enlightening questions
- Value sheets
- Self-expressive activities
- Self-biographical activities

Strategies for the development of moral judgment

- Discussion of moral dilemmas
- Diagnosis of real or fictitious contexts.

Strategies for the development of the ability to take a social perspective and empathy

- Role-playing
- Role-model

Strategies for the critical understanding of reality

- Dialogues from a real context
- Write to understand critically

Teaching skills for dialogue and communication

Activities of dialogical spaces: knowing, listening, expressing, respecting, and analyzing alternatives.

Acquisition-learning of social skills

- Methods for conflict resolution
- Self-regulation and self-control: activities in which the teacher's collaboration and directly personal activities are needed
- Role-playing

These authors making an analysis of the various intercultural didactics to promote interculturality coincide with the MEC (1992) which state that the teacher's main role in the exercise of teaching strategies must be based on the following aspects mentioned below:

- Legitimacy, matching what it manifests with what it does. It does not have logic or pedagogical advantage that a teacher spreads anti-ethical qualities, if his performance in the classroom shows

that he is not suitable to accept and work with the cultural diversity of the same.

- Ability to face conflicting contexts in the classroom. For this, it is necessary that the teacher be trained in the strategies of self-regulation of conflicts. Knowing and carrying out actions on agreements, active listener, empathy or intervention is essential to achieve a good atmosphere in the classroom, not only in the interpersonal relations of its students, but of the entire institution and the educational society in general.
- Necessary acceptance of their own students, considering them, from an initial moment, as beings worthy of all respect and consideration. Mocking or embarrassing students from an early age, favors the vision of a deformed self-esteem.
- Understanding and trust. They are very integral aspects of the previous manifested; the teacher must be able to understand the student world and the confidence towards his students will be the most immediate result of this process.
- Mutual stimulation among student-teachers, in the different and immense didactic experiences.
- Collaborative activities that increase relations between different students, facilitating the removal of possible previous stereotypes.

Taking into account the aforementioned suggestions to make and take into account the teacher of today in the classroom, a series of exercises that are raised in a continuous manner for the work of education in securities mentioned previously (purification of values, moral problems, role-playing games) and that, due to the experience of many years of interest in this subject, are very fundamental, if they are done continuously in the institution and in the classroom and taking into account a correct projection and collaboration from the educational society, in this way, Sanchez and Mesa (2002) express some of the essential turns that the educational institution must make at the time of entering these didactics in the dynamics of the institution:

- Begin to work intercultural education from the primary education phase.
- Active scope of all teachers in the creation and development of these activities.
- Enter them in classroom systematizations, so that a continuous and intact work is achieved.
- Have the support of guidance specialists, essentially by including these activities in the draft of the tutoring Action Plan.
- Organize actions in which the entire educational society intercedes.
- Need for collaborative work of all educators involved in the center to get the guarantee of the activities, for which correct moments of meeting and meeting are needed.

These authors will present below some specific skills to take into account for teachers to revise this manuscript and can reuse them in their classrooms, always dealing with the possibility of inserting them to the appropriate qualities of their educated, place and time available.

They are a chain of didactics that are usually used at the end of the continuous process of execution of work on education in values, with the main objective of the student interpreting and analyzing their values and opinions, facilitating to realize their own identity. On the other hand, the teacher who has worked with the group verifies if some variations have been made in the thoughts of beginning their opinions in small groups and when finished, put in common in the majority of the group.

The activity on the purification of values is shown below and by way of example: (Sánchez and Mesa, 2002: 112/113).

What are our values?

Goals

- Perform dialogue as the main value among participants in a group.
- Reconsider the values of taxpayers individually and collaboratively.
- Collaborate the individual values with the group and know the values of others.

Participants

- Minimum age: Adolescents, youth and adults.
- The whole group participates (20 or 25 people).
- Duration: One hour

Materials

- List of incomplete sentences.
- Continuous paper.
- Colors (pencils, markers, watercolors, etc.).
- Press cuttings.
- Cardboards.
- Glue.

Game development

Each member is given a list of incomplete sentences and will be asked to complete them, quickly and with the first occurrences that come to mind; In addition, it is suggested that they elaborate other phrases that are not in the list and that they believe should be collected.

There they are waiting for you...

The best inheritance is...

Life is...

Love is like...

Do you really know...?

Men and women are...

Gloria Rojas Ruiz

All religions are...

The cultural differences are...

Different reasons for...

My rights are...

My duties are...

I wish that...

I dream with...

Violence is...

I do not want to stop...

We have all changed in...

Collaborating with others makes...

We thought we could get...

Equality is...

I do not want more than...

I cannot stand that...

I like people...

I would be happy with...

Injustice produces me...

Respect is...

Intolerance makes...

I do not listen when...

I feel bad whenever...

The most important thing for me is...

Live is...

After completing the sentences, a discussion is made and it is decided which are the most important for them.

Evaluation

The animator the group, at the end of the activity, will ask questions such as:

Has it been difficult for me to finish the incomplete sentences?

Which has been harder to complete?

How have I felt with this experience?

What response from my colleagues has surprised me the most?

What have I learned with this activity?

Is there anything that is not reflected in any of the answers and I consider important?

Which phrase is more suited to my way of thinking?

Towards a vision to promote Interculturality in Ethnomathematics.

We will begin by conceptualizing ethnomathematics, it not only redeems part of the culture of a people or society, but also the culture contributes to the casual knowledge of students or people through historical traditions, as well as the integration of culture and mathematics has been of influence to this terminology used in many spaces and continents for education from the primary student stage.

Ethnomathematics is a terminology that few people recognize in the environment of education (native language), is formed of two significant words such as ethnography (is the science that includes and details the people and their cultures) and mathematics (from knowledge casual), which is why ethnomathematics manages to integrate portions or recover essences from the culture of a society or people that, when integrated, are practices to be used in mathematics. (Guzñay, 2017).

In the cultures of a people there are many materials, is such that in the Andean cultures are found that they already used calculation tools long before the arrival of the Spaniards to the continent being among them the Ecuador, the *Taptana* used by the Cañaris, in Peru; the *Yupana*, used by the Incas, in Bolivia, to mention some examples.

Each culture has implemented and elaborated its own tools and calculation methods, the vast majority of this knowledge has been eliminated in the advance of history, so it is not possible to completely rescue and benefit its application in each stage of knowledge. By means of these tools, all kinds of mathematical calculations could be executed with unconventional methods, using space differently from Western perception, and in many cases

with numerical methods based on vigesimal (which begins with fingers and feet).

To cite an example in Ecuador in the area of the Cañaris (indigenous community) these tools and methods, have been recovered because they have collaborated with the strengthening of mathematics in bilingual education (*Kichwa-Castilian*), they contain a stone that contributed for the calculation that is called *Taptana*, this is a matrix that contains 9 rows to show the numbers from 1 to 9 and the number of columns that are required to show the value of the numbers following the powers of the number 10, this tool It is rooted in the ancestral peoples of Ecuador and its discovery has made the modern Western world recognize the progress of mathematics of indigenous peoples.

In this intercultural perception of education the ethnomathematics proper of the original place to which the student concerns, together with the school mathematics, enters, the determined characteristic began in the context of the discourse on the interrelations between education, culture, politics and mathematics. This composite expression was contrasted by D'Ambrosio (1985), who used ethnomathematical terminology to relate the mathematical practices of various recognizable cultural groups (Powell and Frankenstein, 1997). Another conception of ethnomathematics is that used by Ascher (1986): Ethnomathematics is "the study of the mathematical thoughts of non-literate people" (Powell and Frankenstein, 1997:10). The investigations of the author Zalavsky (1989), have contributed to the increasingly globalized conception that the capacity of mathematical expression of a cultural set is as unique as its capacity for communication.

From another point of view we have analyzed the constant criticism that has been called Millroy's paradox (1990), which is essentially based on the question of whether or not to think mathematically of cultural practices that were not initially perceived or implemented under that disciplinary classification. . It has been expressed then of monoglossia, of versatility, or of observing in the other its features, as if this discipline were in itself something disadvantageous or proof of refutation. This apparently theoretical controversial situation is undoubtedly an exposition of the problem of reflexivity according to Robben (2007), long understood in cultural anthropology, and which is thought by means of generalities as "emico" and "ethical" according to the author Wielewcki (2001). This criticism has also been answered considerably by Barton (2007), Adam *et al.* (2010) and Knijnik (1996), and has released positive theoretical implementations within the study, such as that of D'Ambrosio (2006) when designing new perceptions, leaving the review to mathematics and expressing the etymology of "matema" and "ticas" "In various ethnos, or that of Knijnik *et al.* (2012) from a Wittgensteinian conception, investigating perceptions as games of languages, ways of life and similar family, the critics are on that scenario, and many researchers within the ethnomathematics continue to be based on that perception. (Peña, Tamayo and Parra, 2015). Due to the above, these authors can conclude according to the analysis made that this tension is based on the influence that ethnographic methodology has historically

had on the research field, so we consider that if the research is taken from other methodological points that may entail the colonial inclination and demand the personal look of the members of the socio-cultural groups, the aforementioned controversial tension could end up being diluted more than resolving.

These authors consider that it is also important to continue investigating and exploring where we carry out the legitimations of the thoughts that surround this field of research. Although manifesting the perceptions of knowledge and scientificity in the traditionally conservative academic fields was an important first step, but also in other spaces and moments, essentially in those where societies, assemblies, rituals, mingas, other ancestral places of communication are implemented and reflection, and those that are achieved for the same purpose.

This space has to do with how we observe and do research, from the conception of who, of the community's inhabitants, from collective views, although not only coincide, the alternative is to implement research collectively in which each person in the community The group assumes the conception from which the common and different interests are situated and thought. In this way, it is thought that it is possible to leave the negative attempt to abandon subjectivities, and remove the conceptual qualities that accompany us, trying to achieve an illusory achievement of the conception of the other.

In general, it is not believed that it is possible to take our eyes off, it is based on arriving at a state where we are aware of what those unique filters are and through dialogue between beings of different life forms, it is possible to approach the other, understanding that The achievement of research work will be the result of the different subjectivities that are related. Thus, in a practice of giving and receiving, they get out options to develop specific proposals that address problems that have followed seem very difficult to solve to be faced in purely individual terms of each student in the classroom or from a single perspective.

It is usual and characteristic in the educational field a search for a reconceptualization of the school itself, and of what is understood by educational curriculum, knowledge and mathematics. According to Mendes (2004) and Correa (2002) they show how the production and use of intercultural didactic materials for mathematical literacy in indigenous languages are an alternative to affirming ethnic identity, and are part of the search to help solve the needs of develop their own curricula, according to the specific situations. The act of naming as mathematics cultural practices that have historically been erased or neglected can be a negative act of premeditated and consistent cultural resistance on the part of some societies.

Ethnomathematics as an academic space has taken a position during the last decades as a proposal, among many others, to recapitulate the forms of teaching in the school and the educational curricula from a socio-cultural conception of mathematics education, where it is carried out. Incorporate interculturality as a political bet and be possible:

... a dialogue between cultures, which is not simply a contact between cultures, but an exchange that is established in conditions of equity. Interculturality, understood as a continuous process, does not exist yet. It is something to build. It is a process of enunciation, relationship, communication and learning between people, groups, knowledge, values and different traditions. Process aimed at generating, building and fostering respect and mutual recognition, above the cultural and social differences existing between cultures. This means, for us, that one culture does not overlap the other. (Walsh, 2008: 140).

CONCLUSIONS

To conclude, as a first consideration we can say that it is not enough to consider the separate challenges of the relevance of recapitulating the school from a new intercultural didactic perspective, which of many alternatives is linked to the ideological domain logics. Therefore, rather than mediate between ways of being, knowing, structuring and disciplining bodies, places and moments, we observe that the school, as it is still projected, is one of the immense entities related to the civilizing colonial conception, that is, in the evolution of people from savages into civilized ones.

As a second conclusion, we can assume the school as a space where beings become subject, makes it the field par excellence of the ideological struggle and cultural resistance, in the school environment where smaller groups may have the need for coexistence between different ways of life, from different cultural productions. In correspondence with different of the aforementioned thoughts, it is important to avoid that Ethnomathematics be petrified as a teaching-learning methodology, an intercultural didactic theory or even an educational policy. Finally, we hope to have expressed a conception about some tensions and important challenges in Ethnomathematics, starting from our analysis, although there are undoubtedly many more that face this situation in mathematics in the field of research. This manuscript is the result of an analysis of group reflection, which attempted to facilitate an integrative conception of the thoughts that are considered most relevant about the evolution, origin and excellence of Ethnomathematics, both in educational practice and in scientific research, as manifested this conception is not the one that is implemented individually in our elaborations.

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