ETHNOMATHEMATICS: A POLITICAL TOOL FOR LATIN AMERICA[1]

ETNOMATEMÁTICA: UMA FERRAMENTA POLÍTICA PARA A AMÉRICA LATINA

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ABSTRACT

We analyze how the political dimension of ethnomathematics can be an effective tool for eurocentrism. Our thesis is that ethnomathematics is a useful tool for defending the mathematical knowledge of the communities in Latin America that are facing globalization, the specialization of the sciences, colonization, official histories, and the existence of a single truth, and can be used to develop a more inclusive, pertinent, and meaningful mathematics education. To support this thesis, we present three experiences where ethnomathematics played a main role in creating awareness of and revaluing this knowledge. In addition we present a work proposal to be used in the classroom that shows how to go from using ethnomathematics like a motivating element to an element of cultural valorization. We conclude by showing how ethnomathematics, and its political dimension in particular, contributes to the search for a better education, in line with the educational goals established by the Organization of Iberoamerican States (OEI).

Keywords: Intercultural Curriculum; Cultural Valorization; African-Descendent Communities; Political Dimension; Ethnomathematics.

RESUMO

Analisamos como a dimensão política da Etnomatemática pode ser uma ferramenta eficaz para enfrentar o eurocentrismo. A nossa tese é que a Etnomatemática é uma ferramenta útil para a defesa dos conhecimentos matemáticos das comunidades da América Latina frente à globalização, à especialização das ciências, à colonização, às histórias oficiais, bem como à existência de uma única verdade, que podem ser utilizados para desenvolver uma educação matemática mais abrangente, pertinente e significativa. Para apoiarmos essa tese, apresentamos três experiências em que a etnomatemática desempenhou um papel importante para a conscientização e para a reavaliação desse conhecimento. Além disso, apresentamos uma proposta de trabalho

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para ser utilizada em sala de aula, que mostra como a etnomatemática pode ser modificada de um elemento motivador para um elemento de valorização cultural. Concluímos, mostrando como a Etnomatemática e, particularmente, a sua dimensão política, contribui para a busca de uma educação melhor, que está de acordo com as metas educacionais estabelecidas pela Organização dos Estados Ibero-Americanos (OEI).

Palavras chave: Currículo Intercultural; Valorização Cultural; Comunidades Afrodescendentes; Dimensão Política; Etnomatemática.

1. Introduction

It is well known that European conquest and then colonization imposed its system of knowledge and beliefs on the systems of autochthonous knowledge systems of the communities that inhabited the American territory. Even though the American communities achieved their political, economic, educational, and religious independence more than 200 years ago, Latin America continues to be subjugated now by Modernity, which we have termed the second conquest of America. This approach brings our communities to the massive, irrational consumerism of capitalism; globalization, and international standardization; the division between victors and victims, social exclusion, and recognition of the single normative history; pharmaceutical medicine, industrialization, exploitation of fellow man, man's irrational search to dominate nature, and the irrational exploitation of natural resources.

This modernity does not recognize that Latin America, dating back to pre-Hispanic eras, has had endogenous economic systems, communal work, languages rich in syntaxes and semantics, traditional ancestral medicines, a strong symbolic relationship to nature and territory, systems of endogenous education, and its own math knowledge. Thanks to the indigenous and afro struggles in Latin America, many countries have advanced in the recognition of the existence of local communities and the legal status of subjects of the national constitutions of various countries such as Brazil, Colombia, Ecuador, Peru, and Bolivia. It is also important to highlight the re-valorization of the knowledge of their communities and the autonomy of these to execute their own education systems: ethnoeducation in Colombia, intercultural education in Chile, bilingual intercultural education in Ecuador, Peru, and Venezuela, and indigenous education and education for ethnic and racial relations in Brazil, etc.

Below, we will analyze the role that ethnomathematics plays in these processes of struggle and re-valorization of math knowledge of Latin American communities and we will present a proposal about how these extracurricular insights can be integrated to the math classroom.

2. The political Dimension of Ethnomathematics

Ethnomathematics surges from a response to eurocentrism, which, from its political dimension, among other objectives, seeks to contribute to:

I. *Valuing and fortifying* the sociocultural patrimony of the towns, communities, and socio-cultural groups through the study of its practices;
II. Provide an alternative development of history and the philosophy of mathematics that makes the multiple forms of constitution of its objects and practices visible, highlighting its social, political, and economic character. This implies a displacement from an ontological plane towards an epistemological plane in the study of math concepts;
III. *Develop an [mathematics] education based on equity, and respect of differences and socio-cultural diversity*, in other words a sensibility for social, cultural, and political factors, whether in the context of national systems of education, intercultural education projects, or projects of self-education (Peña-Rincón, Tamayo-Osorio, & Parra, 2015, p. 138)[2].

In addition, ethnomathematics shares, together with other sociocultural and political approaches to mathematics education, the fact that mathematics is not culturally neutral, but rather that mathematics is a human and social construct, and we recognize the need to form critical students in mathematics in order to face social problems such as: racism, gender difference, elitism, democracy, power, etc. (Blanco-Álvarez, 2012), an emancipating, liberating mathematics education (Gerdes, 2012).

Ethnomathematics invites us to see mathematics from a historical, social, and human perspective. It also invites us to broaden the mathematic and cultural universe and if we understand mathematics from this position, it will be more possible to talk about *equity, self-derived curriculum, and diverse ways of legitimizing knowledge, social inclusion, cultural diversity, diversity of mathematic knowledge, and other histories of mathematics*. In addition, if a person is able to respect the diversity of genders, communities, and is able to respect cultural diversity, capable to understand that there are other histories of mathematics, and to place academic mathematics at the same epistemological level as extracurricular mathematics, this will all contribute to a great social change and ultimately to achieving peace, as previously signaled (D'Ambrosio, 2001).

Ethnomathematics is a tool that provides us with elements to revalorize local math knowledge as well as allow us to value and see the math knowledge of the colonized in contact with the math knowledge of the colonizer. Ethnomathematics allows us to create justice and give legitimacy to knowledge that is not recognized as mathematics, which is the main objective of ethnomathematics from its political dimension (D'Ambrosio, 2000, 2002).

Hereafter, we expose three examples of the use of ethnomathematics as a political tool. The first was a course of teacher education in the year 2012, in the municipality of Tumaco, Colombia; in this case, the participating teachers, in evaluations, manifest a recognition of the importance and the political needs to reaffirm the knowledge of the afro-descendent community of Tumaco. The second example shows some of the research carried out by Gelsa Knijnik with people from the *Movimento Sem Terra* [Landless Movement], movement from Brazil, and the third example, even though it is not an experience from Latin America but rather Mozambique (Africa), is one we would

[2]Emphasis added by the authors**.**

like to present because of its significant contributions to the political dimension of ethnomathematics. It also recognizes Paulus Gerdes and his extensive work in this research area.

Other research and reflections about the political dimension of ethnomathematics can be seen in (Bishop, 2005; Greer, Mukhopadhyay, Powell, & Nelson-Barber, 2009; Powell & Frankenstein, 1997), among others.

3. An Experience using Ethnomathematics Formation in the Political Sense in a Teacher Education Course of African-Descendent Teachers in Colombia

We present an experience of afro-descendent teachers in Tumaco, Colombia, in 2012, where Ethnomathematics was used as a political tool for forming the awareness of teachers in the importance of re-valuing community knowledge and that this merits a place in the classroom, but no longer as knowledge of a second degree.

3.1. The Issue

This course was motivated by a series of educational issues that were detected in the municipality of Tumaco, Colombia, by Jaramillo, Jurado Valencia & Collazos (2011, p. 93), that were presented in Table 1. The population of the said community is composed by 95% Afro-Colombians, 3% indigenous, and 2% *mestizos*.

Characteristic	Weakness
Scholarly curriculum related to culture	• It is necessary that self-recognition, valorization of black culture, our cultural identity and history are developed at school; this is very important and the first that must do so are professors. • Does not contribute to the fortification of community identity. • It's necessary to build a proposal from one's own education. An ethnoeducational (afro and indigenous) curriculum. • It does not respond to the contextual needs of the medium.

Table 1. Major educational difficulties perceived by the community of the Tumaco municipality

These weaknesses can be classified as political and curricular. Numbers 1 and 2 have to do with problems of a lack of identity and valorization of afro-Colombian culture, and weaknesses 3 and 4 are related to the fact that the school curriculum is not designed to respond the very necessities of the afro culture.

These are needs that are much felt by the afro-Colombian population of Tumaco, since, even though the ruling of Law 115 of 1994 (Colombia, 1994) in chapter 3 *Education for ethnic groups* states that educational institutions and teachers can incorporate cultural elements in the curriculum, this still is not a reality in the classrooms.

On the other hand, the Afro-Colombian Ethnoeducational Project, from here on out identified by PRETAN (Organizaciones de Comunidades Negras de Nariño, 2011), proposes to contribute elements that allow that the mathematics class keeps in mind the oral tradition of the afro community of Nariño and the cultural elements that circulate

on the level of daily practices and ancestral discourse, thus fortifying the axis of the learning of afro identity.

In this way, the PRETAN calls attention to the characteristics of the profile of the afro-Colombian teacher that must respond to: a) A major commitment of the teacher to his/her community and his/her identification with the afro community of Nariño, b) Being knowledgeable and respectful of the afro community of Nariño, c) Being a living example for students of someone that promotes and motivates in them the desire to complete their studies, d) A teacher that investigates and innovates in his/her own classroom practice based on current literature and the cultural, historical knowledge accumulated by the community, e) An ethical teacher with values such as tolerance, respect, solidarity, and gratitude (which from his/her teacher experience tends to strengthen the bond between student and identity, creating a culture of contributing in the construction of a communal horizon of development and f) A teacher that constantly seeks permanent progression of academic and cultural formation in order to ensure a competitive, contextual, critical, intercultural, and liberating education.

In the same way, the PRETAN calls attention to the construction and development of its own curriculum, that seeks a permanent reflection and action to transform the conditions of the communities. In addition, such a self-determined curriculum is a catalyzing agent in processes of identity, social interaction, and affirmation of autonomy in the community. It is a curriculum where the teacher plays the role of social agent, promoter of participative and organizational processes in which the student has a central role.

Other characteristics that are important to highlight are: a) It takes as a point of departure the social praxis as the context in which the reality of men and women of the afro community of Nariño is developed, b) It qualities the level of political awareness, giving continuity to its own liberating thinking, c) It promotes the communal leadership of teachers, students, parents of families, and other social actors as a strategy for guaranteeing the organization and cohesion of the Afro-Colombian community of Nariño, d) It recognizes the diversity of social codes, linguistics, and cultural constructions of the afro community of Nariño, and e) It is constituted by the following elements: objectives, principles, levels, grades, and cycles in its own education, axes of learning, study plans, pedagogical projects, teaching approaches, scholarly research, other educational scenarios, and forms of communal evaluation of the afro ethnoeducation in the department of Nariño (Organizaciones de Comunidades Negras de Nariño, 2011).

3.2. Development of a Course on Teacher Training from Ethnomathematics

Keeping in mind the problem presented, a professional development course for teachers was designed using an ethnomathematics perspective with the objective of training mathematics teachers from a cultural perspective that responds to the academic needs of the area as well as to the recovery of the autochthonous and ancestral mathematics thinking of the Afro-descendent communities of the pacific coast of Nariño. By integrating mathematics with community knowledge, the afro culture and the territory acquires greater significance for the students.

In this sense, the political dimension of ethnomathematics allows, through the course, to propose an educational environment that will stimulate the unfolding of creativity, leading to new forms of multicultural relations (Oliveras, 2006). These relations provide an adequate space for preserving diversity and eliminating discriminatory inequalities, giving origin to a new societal organization. This makes mathematics a discipline that preserves diversity and eliminates discriminatory inequality. Ethnomathematics has this main objective (D'Ambrosio, 2002) which reinforces the characteristics of the specific curriculum. In terms of the structure of the course, Table 2 summarizes the main aspects of this.

Phase	**Stage**	**Moments**	**Work form**
Planification	Cooperative design of the course	Meeting to elaborate a pre-design for the course and define: objects, contents, phases, teachers to which the course is oriented, duration, schedules, place	Group discussion
		Meeting to discuss course design	Group discussion
Implementation	Theoretical-Conceptual	Teacher conceptions about mathematics	Group discussion
		Relation between culture and curriculum	Reading of documents, group work and group discussion
		Investigation of extracurricular mathematics in cultural practices of the community	Group investigation and presentation of results
	Activity design	Activity design	Methodology of class study[3]
	Application	Trial of activities designed and autoevaluation and coevaluation of coursework	
Results	Evaluation	Course evaluation by participating teachers	Individual written reflection

Table 2. Phases, moments, and work structure of a course oriented from Ethnomathematics

In the execution of the course 28 teachers participated: 23 teachers of primary education and 5 of secondary education, whose academic formation was varied and only one of whom was licensed in mathematics. The teachers took the course voluntarily and without cost.

3.3. Final Reflections of the Teachers about the Teacher Education Course

Upon completing the course, an evaluation was made in relation to the quality of the program, in which one of the items was: *a reflection on the development process*. The teachers wrote their reflections. It was gratifying as a professor (first author) of the

[3]This methodology seeks, on the behalf of teachers, to achieve a permanent qualification, a reflexive and critical work about their practice and consists in four stages: 1. Group planning of the activities, 2. Implementation of activities and class observation, 3. Auto-evaluation and co-evaluation, and 4. the Re-design of activities (Hart, Alston, & Murata, 2011)

course and as researchers that such reflections directly responded to the educational weaknesses presented in Table 1, which were unknown to the teachers.

We have categorized and commented on their reflections according to the weaknesses we highlighted in Table 1.

Teacher 1 reflection	Weakness it relates to
"The formation process was very good because it brought us to recover all of our culture because we have been acculturated and we have lost our own identity as afro-descendants and because of that there is no appropriation of our territory"	• Self-recognition and valorization of black culture • Fortifying community identity

Approaching ethnomathematics allowed this teacher to be critical and reflective about the acculturation processes that the community of Tumaco experiences and the lack of appropriation and empowerment of the Afro-Colombian culture at the hand of the population, which creates a lack of belonging to their territory.

Teacher 2 reflection	Weakness it relates to
"It is of vital importance to attend to this capacitation because in carrying out the Institutional Educational Project importance has not been given to our culture, we have focused on accepting that which is imposed on us by editorials, unaware of our own culture. This allows us to value that which is ours so that the boys and girls of our region will love their studies and the place they live"	• Self-recognition and valorization of black culture • Fortifying community identity

This teacher recognizes that he/she has accepted what the editorials have told him/her for a long time, making the classroom simply what the school text says. In addition, he/she is aware that there are other ways of working in the math classroom that allows one to study the math knowledge of the community and that it is important to recover this thinking and incorporate it into the classroom.

Teacher 3 reflection	Weakness it relates to
"The Community Education Project must incorporate all the processes given in Ethnomathematics in order to appropriate one's own ancestral education in order to realize the ways that the ancestors thought, interacted, and lived in order to project all these processes on the educational community"	• African ethnoeducational curriculum

Without a doubt, this teacher is aware of the importance and need to incorporate African-Colombian community knowledge into the curriculum. In addition, this brings attention to the need to design one's own curriculum.

Teacher 4 reflection	Weakness it relates to

"My reflection highlights the importance of recovering the ancestral knowledge of this region, highlighting that the social or cultural context can be brought to the classroom in a significant way so that the lesson can have an impact on the student without abandoning the cultural or ancestral knowledge that is relevant to point out and highlight".	• Fortifying community identity • African ethnoeducational curriculum

This teacher, like the previous ones, reflects the spirit of the political dimension of ethnomathematics, by manifesting how convenient it would be, on the one hand, to recover and highlight cultural knowledge, and on the other hand, bring this to the curriculum to endow the contents with sense and significance.

4. Ethnomathematics and its Political Value in Brazil

Another example of how the political dimension of ethnomathematics plays an effective role when facing eurocentrism is the work carried out by Gelsa Knijnik, a Brazilian mathematics educator, along with people from the *Movimento Sem Terra*, which is composed of peasants that fight for agrarian reform in Brazil.

In her research, Knijnik (1997) calls to mind the importance of avoiding a glorification of popular math practices, because only working with these can leave a social group socially subordinate, which places them at a disadvantage. In this way, it is necessary to understand academic mathematics in order to participate in the agrarian reform processes of the country. In addition, she affirms that when a subordinate group is aware of the economic, social, and political disadvantages that are associated with their popular math knowledge, they will try to learn academic mathematics. This is the development of this kind of political awareness that ethnomathematics seeks to instill on the people.

In another one of her works, Knijnik (2007) discusses the tensions that exist between writing and orality in the school curriculum. As we mentioned in the introduction, modernity does not recognize the knowledge of the Latin-American communities, in this case the oral mathematics knowledge, since in modernity writing is the tool used to classify between primitive and civilized mentalities. In this regard, there is research such as that of Carraher, Carraher, & Schliemann (1995) which presents how the ability of the Brazilian children to do mental mathematics in the school setting does not produce good results because of the complexity of writing and mathematics formalities.

In this way, in works such as (Knijnik, Wanderer, & Oliveira, 2005; Knijnik, 1996, 2002, 2014), this research promotes and encourages the development and political awareness of ethnomathematics and math education.

5. Ethnomathematics as a Political Tool in Mozambique

The work of Professor Paulus Gerdes (1952-2014) is a major example of how ethnomathematics was used as a political tool on a large scale. He was an ethnomathematician that left us a great and important legacy of ethnomathematics. His research has its origin in the 1970s, working on the ethnomathematics knowledge of Mozambique and other African countries in a systematic and rigorous way. Mozambique is a country that achieved its independence from Portugal 40 years ago

after a ten-year war. Finally, since 1975, Mozambique has been an independent republic and Professor Gerdes, along with a series of scientists and educators, began to work on questions like: what education should be given to those of Mozambique? Now that Mozambique is an independent republic, an education distinct from that of the colonialist education imparted by Portugal is needed (Gerdes, 1998).

Professor Gerdes found the Mozambican population with problems of self-esteem, cultural identity, and cultural fortitude. He assured us then that "Africa needs an education oriented by culture, that can assure the survival of the African cultures, placing emphasis on the originality of thought and the encouragement of creative virtue" (Gerdes, 2012, p. 16). He also pointed out that "it is necessary to make the mathematics curriculum multicultural in order to improve the quality of education, in order to increase the social and cultural self-confidence of all the students" (Gerdes, 2012, p. 16).

The tool that Gerdes used to attend to these problems is ethnomathematics. He began to work systematically, in a rigorous way, and carried out a number of investigations and publications, for example he published the book *Mulheres, cultura e geometria na África Austral*, where he presented a re-valorization of the mathematical thought of the black woman (Gerdes, 2011a). If we observe the normative history of mathematics book, the African-descendent population does not appear much and the women even less, sending the message that the black communities do not produce mathematics. Such a revalorization of the mathematical thought of black women is the fruit of ethnomathematics as a political tool.

Another of his investigations had to do with the recovery of the histories of mathematics; that the official history negated the ethnohistories of cultural groups that, like the Greeks, were capable of developing mathematical thinking. In particular, his book *Pitágoras africano: Um estudo em cultura e educação matemática* (Gerdes, 2011b) showed through the geometric designs of Mozambican basket weaving that the Pythagoras Theorem is found in such artisan work. In addition, working closely with the community, he developed a methodology for the analysis of diverse artisanal objects from Mozambique and other countries, trying to *unthaw* the geometric thinking of these people, hidden in the African baskets; one example of this is his book *Geometry from Africa: Mathematical and educational explorations* (Gerdes, 1999).

In addition to his ethnomathematics research of African mathematical thought, he also left us with contributions in his *Ethnomathematics and Mathematics Education*, where he proposed a methodology of working with learning circles, designing textbooks with ethnomathematics activities and reflections on the formation of mathematics teachers. This is found in his book *On culture, geometrical thinking and mathematics education* (Gerdes, 1997), *On culture, mathematics and curriculum development in Mozambique* (Gerdes, 1986), and others.

6. A Look at the School as a Stage of Political Struggle

School is seen as one of the instruments for perpetuating the knowledge of the dominant culture, and working in it deals with only the hegemonic, monocultural knowledge (Peña-Rincón & Blanco-Álvarez, 2015). Authors such as Peña-Rincón, Tamayo-Osorio, & Parra suggest that:

> (…) it is especially necessary to contribute to the decolonization of school and education, recognizing and encouraging multiple epistemologies. Without a doubt it is necessary to redesign the curriculums taking into consideration the reality and interests of those that learn, but this does not only imply incorporating that [mathematics] knowledge that has been omitted, negated, and made invisible, but rather considering the diverse ways of producing and understanding the said knowledge (2015, p. 143).

In spite of hegemony in school and the academic curriculum, many teachers in the classroom carry out proposals of integration of ethnomathematics[4] into their mathematics classroom. Vilela (2007) presents us with at least three kinds of interest with which teachers carry out the said integration in their classroom. Each one of these kinds that we have exemplified with phrases taken from the group interview of teachers in the framework of the course described in part 3 of this article.

The first of these is the *cognitive interest* that has to do with the use of extracurricular knowledge in the classroom as a means of support for the student to progress towards an understanding of academic mathematics. Ethnomathematics is not an object of mathematics study. Teacher A expresses that "this will not leave aside **mathematics as such**, because that is the way in which they will evaluate us, **but it will facilitate the student's learning**, I have various experiences" (our emphasis).

The second of these is the *amplifying interest*, referring to when the teacher works with the children comparing academic mathematics and extracurricular mathematics for the resolution of problems, as mentioned by Teacher B:

> I believe that the key is working with the students and **the measurements of our territory that served our ancestors when there was no standard measurement**, and that in a given moment, we also can use them, more so in the isolated zones. If we do not have a meter stuck, we will not have problems, they are not as precise, but we will not have problems because of it. I believe that the key is here, what my companion says, go measure *with what? No! Measure it with the steps.* I believe that here is the key (our emphasis).

The third of these is the *political interest* that comes from the amplifying interest but places an additional value on the extracurricular mathematics knowledge in the classroom, valuing it, legitimizing it. Teacher C mentions that:

> It is important to bring many children to the practice, […], one makes an example and remains with the example that is how one practices with the metric stick and sends them off to measure, **so that in the same way one must practice our practices, do you understand me? In order to place importance on the ethno part** (our emphasis).

Such types of integration of ethnomathematics to the classroom have been used in various investigations of ethnomathematics, being the most used the cognitive interest;

[4]A broader reflection of the integration of ethnomathematics to the academic curriculum is found in Oliveras & Blanco-Álvarez (2016).

ethnomathematics is used only as a motivating element in order to introduce study of the mathematics theme.

In our proposal, we consider that it's necessary to pass to the amplifying interest where we also learn the academic mathematics parallel to work in the classroom on the community mathematics. One example of this is the book *La matemática como reflexión comunitaria* of the Tule de Antioquia community in Colombia by means of which the community tried to systematize its mathematics thinking. The book is structured in two parts: Tule mathematics and Western mathematics. It is important to note that both mathematical systems hold the same level of epistemology; this is the spirit of the amplifying interest.

Then the revalorization of the community knowledge is necessary and what we consider to be the ultimate goal of Ethnomathematics in the school setting: the need to study it, strengthen it, respect it, teach it, use it, and share it, even though said knowledge does not enjoy a formal or axiomatic structure. This corresponds with the political interest.

From this research, we have proposed that classroom teachers take the step from the cognitive interest to the amplifying interest and then the political interest, as shown in Figure 1.

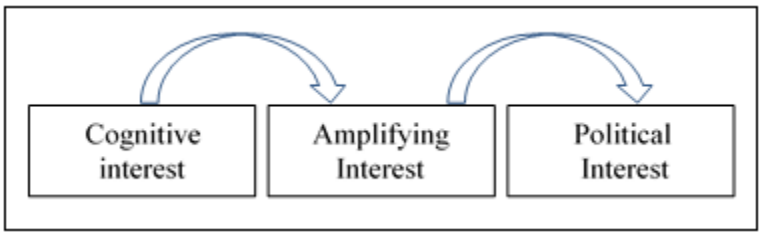

Figure 1. Steps from cognitive interest to political interest

7. Final Considerations

We have signaled three examples of how mathematics teaching, oriented from an ethnomathematics perspective, helps reinforce and revalue the culture of African-descendant communities and enrich the curriculum by having in mind cultural elements. In this way, we have proposed that our mathematics teachers go beyond only a cognitive interest in the classroom. We have invited them to advance to the amplifying interest in order to eventually achieve a political interest. This is congruent with the commitment of the Organization of Iberoamerican States (OEI) of:

> Promote a revalorization and re-establishment of the historical memory of the contribution of African-descendants to the construction of our nations in the educational systems. In a similar way, advance the review of the texts and education materials about country histories in order to make visible the contribution of the African-descendants to the development of nations (2008, paragraph 19).

Nonetheless, we are knowledgeable of the endless number of obstacles that this task entails, because of the lack of political recognition of the African-descendant groups in various Latin American countries, the lack of curricular flexibility, the lack of continual teacher formation, little or no participation of the African-descendant communities in

the educational institutions, and the lack of contextualized educational material. In addition, in regards to the geographic and curricular difficulties signaled by the OEI:

> The first is connected to residency in rural, geographically isolated zones and, because of this, distant from the main educational spaces to which the children cannot attend, whether because of the great distances that separate them or the lack of spaces. In some cases they attend, but they do so with other deprivations and inadequate conditions based on a lack of infrastructure, maintenance, didactic materials, and professors (CEPAL, 2008). The second factor relates to the lack of adequacy, relevance, and pertinence in the curriculum, that are obstacles to the entrance of these groups to the academic system because of the lack of connection between their culture and surrounding with the materials taught in schools (OEI, 2010, p. 93–94).

It is important to highlight that, in addition to working on the political dimension of ethnomathematics, it is necessary to pay attention to the historic dimension that provides us with much information about the processes of generation and transmission of math practices in Latin America; the cognitive dimension of ethnomathematics allows us to analyze the learning process, analyze the logics of production of the math knowledge; the conceptual and epistemological dimension that allows us to study the nature of mathematics profoundly and understand the existence of different language games, ways of life, and grammars that make sense of the math knowledge according to the social practice that surrounds it; and finally, the educational dimension that allows us to think of new curricular organizations and establishes new challenges in the formation of children, and initial and continuing formation of math teachers.

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8. References

Bishop, A. (2005). Las matemáticas occidentales: el arma secreta del imperialismo cultural. In A. J. Bishop (Ed.). *Aproximación sociocultural hacia la educación matemática* (pp. 27–41). Cali, Colombia: Instituto de Educación y Pedagogía, Universidad del Valle.

Blanco-Álvarez, H. (2012). Estudio de las actitudes hacia una postura sociocultural y política de la educación matemática en maestros en formación inicial. *REDIMAT: Journal of Research in Mathematics Education*, *1*(1), 57–78.

Carraher, T., Carraher, D., & Schliemann, A. (1995). *En la vida diez, en la escuela cero*. México D.F: Siglo XXI Editores.

Colombia (1994). *Ley General de Educación 115 de 1994*. Bogotá, Colombia: El

Congreso de la República de Colombia.

Comisión Económica para América Latina y el Caribe CEPAL. (2008). *Panorama social de América Latina, 2007*. Santiago, Chile: Naciones Unidas.

D'Ambrosio, U. (2000). Las dimensiones políticas y educacionales de la etnomatemática. In A. Martinón Cejas (Ed.). *Las matemáticas del siglo XX*: una mirada en 101 artículos (pp. 439–444). La Laguna, Tenerife, España: Números. Revista de Didáctica de las Matemáticas.

D'Ambrosio, U. (2001). Paz, educação matemática e etnomatemática. *Teoria e Prática da Educação, 8*(4), 15–33.

D'Ambrosio, U. (2002). *Etnomatemática*: elo entre as tradições e a modernidade. Belo Horizonte, MG: Autêntica Editora.

Gerdes, P. (1986). On culture, mathematics and curriculum development in Mozambique. In S. Mellin-Olsen & M. Johnsen Hoines (Eds.). *Mathematics and culture, a seminar report* (pp. 15–42). Radal, Norway: Caspar Forlag.

Gerdes, P. (1997). On culture, geometrical thinking and mathematics education. In A. Powell & M. Frankenstein (Eds.). *Ethnomathematics*: challenging Eurocentrism in mathematics education (pp. 223–247). Albany, NY: SUNY Press.

Gerdes, P. (1998). On culture and mathematics teacher education. *Journal of Mathematics Teacher Education*, *1*(1), 33–53.

Gerdes, P. (1999). *Geometry from Africa*: mathematical and educational explorations. Washington, D.C.: The Mathematical Association of America.

Gerdes, P. (2011a). *Mulheres, cultura e geometria na África Austral*. Maputo, Mozambique: Centro Moçambicano de Pesquisa Etnomatemática.

Gerdes, P. (2011b). *Pitágoras africano*: um estudo em cultura e educação matemática. Maputo, Mozambique: Centro Moçambicano de Pesquisa Etnomatemática.

Gerdes, P. (2012). *Etnomatemática, cultura, matemática, educação*. Morrisville, NC: Lulu.

Greer, B., Mukhopadhyay, S., Powell, A., & Nelson-Barber, S. (2009). *Culturally responsive mathematics education*. New York, NY: Routledge.

Hart, L. C., Alston, A. S., & Murata, A. (2011). *Lesson study research and practice in mathematics education*: learning together. New York, NY: Springer.

Jaramillo, J. B., Jurado Valencia, F., & Collazos, J. (2011). *Planes de vida para comunidades ancestrales*: hacia una plan decenal en educación para el municipio de Tumaco 2011-2021. Bogotá, Colombia: Universidad Nacional de Colombia.

Knijnik, G. (1996). *Exclusão e resistência*: educação matemática e legitimidade

cultural. Porto Alegre, RS: Artes Médicas.

Knijnik, G. (1997). An ethnomathematical approach in mathematical education: a matter of political power. In A. Powell & M. Frankenstein (Eds.). *Ethnomathematics*: challenging Eurocentrism in mathematics education (pp. 403–410). Albany, NY: State University of New York Press.

Knijnik, G. (2002). Curriculum, culture, and ethnomathematics: the practices of *cubagem of wood* in the Brazilian landless movement. *Journal of Intercultural Studies*, *23*(2), 149–165.

Knijnik, G. (2007). Diversidad cultural, matemáticas y exclusión: oralidad y escritura en la educación matemática campesina del sur del Brasil. In J. Giménez, J. Díez-Palomar, & M. Civil (Eds.). *Educación matemática y exclusión* (pp. 63–81). Barcelona, España: Graó.

Knijnik, G. (2014). Etnomatemáticas en movimiento: perspectiva etnomatemática, sus formulaciones teóricas y ejemplificaciones. *Revista Latinoamericana de Etnomatemática, 7*(2), 119–131.

Knijnik, G., Wanderer, F., & Oliveira, C. J. (2005). Cultural differences, oral mathematics and calculators in a teacher training course of the Brazilian Landless Movement. *ZDM*, *37*(2), 101–108.

Oliveras, M. L. (2006). Etnomatemáticas: de la multiculturalidad al mestizaje. In J. Gimenez, J. M. Goñi, & S. Guerrero (Eds.). *Matemáticas e interculturalidad* (pp. 117–149). Barcelona, España: Graó.

Oliveras, M. L., & Blanco-Álvarez, H. (2016). Integración de las etnomatemáticas en el aula de matemáticas: posibilidades y limitaciones. *BOLEMA*: in press.

OEI. (2008). Declaratoria de Cartagena. In *Memorias del Primer Encuentro Iberoamericano "Agenda Africandescendiente en las Américas."* Cartagena, Colombia: Organización de Estados Iberoamericanos - OEI.

OEI. (2010). *2021, Metas educativas*: la educación que queremos para la generación de los Bicentenarios. Madrid España: CEPAL Organización de Estados Iberoamericanos OEI Iberoamericana, Secretaría General.

Organizaciones de Comunidades Negras de Nariño. (2011). *Proyecto etnoeducativo Africannariñense*. Tumaco, Colombia: Secretaria Departamental de Educación de Nariño.

Peña-Rincón, P., & Blanco-Álvarez, H. (2015). Reflexiones sobre cultura, currículo y etnomatemáticas. In K. de la Garza & R. Cortina (Eds.). *Educación, pueblos indígenas e interculturalidad en América Latina* (pp. 213–246). Quito, Ecuador: Ediciones Abya-Yala.

Peña-Rincón, P., Tamayo-Osorio, C., & Parra, A. (2015). Una visión latinoamericana de la etnomatemática: tensiones y desafíos. *RELIME, 18*(2), 137–150.

Powell, A. B., & Frankenstein, M. (Eds.). (1997). *Ethnomathematics*: challenging eurocentrism in mathematics education. Albany, NY: SUNY Press.

Vilela, D. S. (2007). *Matemática nos usos e jogos de linguagem: ampliando concepções na educação matemática*. Tese de Doutorado. Campinas, SP: UNICAMP.