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## **Ethnomathematics in non-formal educational settings: the Urban Boundaries project**

### **Etnomatemáticas en contextos educativos no formales: el proyecto Límites Urbanos**

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#### **Abstract**

The push to marry off local and school knowledge has been a growing concern within educational sciences, particularly in mathematics education where a field of studies by the name of ethnomathematics has been producing research around the uses people do of mathematics outside school's walls. Notwithstanding the good will of educational agents in bringing to schools local knowledges, criticisms have been made on the sometimes naive way in which such a bridge is theorized and implemented. After a brief description of these criticisms, we present the Urban Boundaries Project as an attempt to avoid the inconsistencies of schooling, and the promotion of a non-scholarized ethnomathematics.

**Key words:** Ethnomathematics; Non-formal Education; Criticism.

#### **Resumen**

Las presiones para comprometerse con los conocimientos locales y la escuela ha sido una preocupación creciente dentro de las ciencias de la educación, particularmente en la educación matemática, donde el campo de estudios llamado Etnomatemáticas ha producido investigaciones en torno a los usos que hacen las personas de las matemáticas fuera de la escuela. A pesar de la buena voluntad de los agentes educativos en llevar a las escuelas los saberes locales, se han hecho críticas de la forma ingenua en el que se ha teorizado e implementado. Después de una breve descripción de esta crítica, nosotros presentamos el Proyecto de Límites Urbanos como un intento de evitar las inconsistencias de escolarizar y la promoción de una etnomatemática no escolarizada.

**Palabras clave:** Etnomatemáticas; Educación no formal, Críticas.

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## INTRODUCTION

A significant part of ethnomathematics research has educational aims (Borba, 1990; Gerdes, 1995; Barton, 1996; Powell & Frankenstein, 1997; Knijnik, 2004), seeking to bring to the schools or other formal educational environments (like indigenous schools) the knowledge and the mathematical practices of cultural groups of people. This makes ethnomathematics research part of a multicultural approach in education that during the last 30 years has aimed to open schools to the cultural diversity that characterizes our current societies. However, notwithstanding the good will of well intentioned agents, the ways in which the “bridge” between local knowledge and school knowledge is made has been the target of a strong criticism (e.g., Skovsmose & Renuka, 1997; Rowlands & Carson, 2002; Pais, 2011, 2012a), and some authors have called attention for the problems involved in bringing local knowledge into school settings (e.g., Dowling, 1998; Duarte, 2004; Pais, 2013). At stake in these criticisms is the ethnomathematical assumption that by bringing local knowledge into schools a multicultural education can be achieved. In this article we start by exploring these criticisms. They call our attention to the specific character of schooling, and how the ethnomathematical push to marry off local knowledge and schooling can very well ending up conveying an idea of culture where the Other is squeezed from its otherness (Pais, 2011, 2012a). Afterwards, we introduce the Urban Boundaries Project—a project based in Portugal and funded by the Fundação para a Ciência e Tecnologia—as an example of an ethnomathematical project that is not concerned with bringing local knowledge into schools, but rather to problematise within the local communities the knowledge and the competences they need it in situ. It is the wager of this article that our society needs to create alternative educational settings as a response for the increasing problem of exclusion faced by so-called minority populations. As long as schools are structured as credit systems (Baldino & Cabral, 1998; Vinner, 1997), only within non-scholarized settings can a genuine ethnomathematical approach be reached.

## **ETHNOMATHEMATICS AND SCHOOL**

By reading the six guiding questions of the Topic Study Group for which we first submitted this paper<sup>3</sup>, we easily notice how ethnomathematics is conceived in a strict relation with school. The spirit behind these questions is one that seeks to use research regarding mathematical thinking developed outside school to improve the understanding of mathematics and mathematics teaching and learning in school. This seems to be the most common approach to ethnomathematics within mathematics education research (Adam, Alangui & Barton, 2003): the use of students' ethnomathematical knowledge to construct a bridge for the learning of school mathematics. However, researchers such as Knijnik (2004) clearly state that "it is not a matter of establishing connections between school mathematics and mathematics as it is used by social groups, with the purpose of achieving a better learning of school mathematics" (p. 228). Where some see as unproblematic the "making of the bridge" between local and school knowledge, others criticize this learning strategy, claiming a place for a more serious understanding of the role of school and how local knowledge is inserted into it. As explored by Pais (2011, 2012a), the problem with the "bridge metaphor" is the reinforcement of the hegemony of school mathematics because the Other is valorised only as a way to achieve the true knowledge. Thus, it contradicts the critique that ethnomathematics makes to the hegemony of academic mathematics (e. g., Powell & Frankenstein, 1997).

At stake here is what ethnomathematicians such as Knijnik (2004), Monteiro (2004), and Duarte (2004) have been referring to as the folkloric way in which ethnomathematical ideas appear in the curriculum. According to them, the use of local knowledge as a curiosity to start the learning of school mathematics could be the cause of social inequalities. However, to truly include ethnomathematical ideas in the curriculum is no less problematic. If we focus on a regular school and take into account its role in preparing students for a globalized market-orientated society, with all the pressure to learn the mathematics of the standard curriculum that will be essential to students' approval in the high stakes tests, we can ask ourselves if there is a place for ethnomathematical knowledge (or other local,

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<sup>3</sup> Information about the group can be found in <http://www.icme12.org/sub/tsg/tsgload.asp?tsgNo=36>

nonscholarly knowledge)? As explored in Pais (2011), after a review of the current research being done in ethnomathematics, the educational implications of ethnomathematics (in a regular school) end up being co-opted by a school that is worried with the uniformization/globalization of knowledge—and not so much with issues of diversity. Monteiro (2004), a Brazilian ethnomathematician, poses the crucial question: “Is it possible to develop ethnomathematical work in the current school model?” (p. 437, our translation from Portuguese).

What is at stake here is the very often disavowed role of schools as places of economical production and ideological reproduction (Pais, 2012b). One of the main features of ethnomathematics research consists in developing a critique of what is accepted as being mathematical knowledge, by the confrontation of knowledge from different cultures. The existence of different ways of dealing with quantity, space, and patterns are now well documented, and it is not possible to deny them. But, to pass from this acknowledgement to the aim of inserting it in a school setting in order to be disseminated through school education is problematic because schools are not open spaces of shared knowledge. On the contrary, curricular changes, especially when the subject is mathematics, are very strict. Whether we choose to use this different knowledge as a curiosity, an illustration or a “starter” to the formal mathematics of the curriculum, or to develop a curriculum where one of the topics is local knowledge per se, the result may not be students' emancipation or the valorisation of different cultures. On the contrary, the process of bringing diversity and ethnomathematical ideas into the classroom may end up conveying practices opposed to the benevolent multicultural ideas these researchers want to enforce, by promoting a desubstantialized view of Other's culture (Pais, 2011, 2012a).

### **THE URBAN BOUNDARIES PROJECT**

This problem is connected with the educational aims of today's world. Together with globalization, the concern with diversity is currently considered to be one of the two main educational functions (Izquierdo & Mínguez, 2003). While globalization refers to the social need to respond to market globalization, which imposes a convergent education by training individuals to perform a role in the global society, diversity demands an integration of

different cultures in a model of divergent education, able to educate citizens in what has been called equity within diversity. To conciliate these two educational tasks could be a source of problems, as documented by recent research on the cultural dimension of education (e. g., Kincheloe & Steinberg, 2008); and as we previously addressed regarding the educational implications of ethnomathematics. This is especially the case in so-called developed countries where national cultural minorities and newer immigrant populations have been posing new challenges for education. In many cases, these populations rely more on non-formal educational sites, based in their everyday lives, than in the formal setting of school education, where they often experience problems of exclusion.

As a way to avoid the inconsistencies of school, a group of people from different backgrounds (among others, architects, biologists, physicists, teachers, and mathematics education researchers) decided to join efforts and built a project together with two communities from Costa da Caparica, a city located in the south margin of the Tejo river, facing the capital Lisbon. Populated since the 18th Century, Costa de Caparica presently constitutes one of the largest multicultural centres of Portugal, and it has been evolving around two majors base-communities: fishing and agricultural. The coastal zone of the Caparica municipality is known as Costa, and it was developed by two distinct fishermen crews from Ílhavo and Olhão – located to the north and south of Portugal, respectively. Contrastingly, the land zone located at the base of the Fossil Cliffs is known as Terras da Costa, and it was developed by the agricultural community, being presently occupied by immigrant populations from other Portuguese-speaking countries, gipsy community, and Portuguese migrants. The overall goal of the project is, on the one hand, to give political and academic visibility to the problems faced by these communities and, on the other hand, to theorize in terms of political economy the living conditions and the daily struggles of these communities. As such, we develop a critical ethnography (Carspecken, 1996; Thomas, 1993) in order to highlight the necessities of these communities as expressed by their members, the non-formal educational processes developed inside the two communities, and the political and legal recognition by society of such communities. Often marginalized by the “global” society, the members of these two local communities are within the project active researchers of their own educative practices, and constructors of

instruments and resources that compound the method of participatory observation that the project uses.

The structural plan of this critical ethnography encompasses six interactive, complementary, and usually parallel steps in a complex process. The first step, *project management*, constitutes the central axis of the research and is designed to efficiently and effectively sustain the project. Its importance concerns the systematization of the different encounters that are required to fundament the proposed methodology: documented, virtual, and physical encounters. From this first step, several deliverables are expected: a platform, scientific team meeting outlines, cost statements, auditing reports that will strengthen the theoretical and methodological procedures, critical field reports, and progress reports that are essential for an integrated vision of the practices proposed and will be developed as a set of video records throughout the whole investigation process. The second step, *community mediation*, will be developed alongside with the field work. Although this step could be horizontally diluted during data collection or presented as a data collection activity, due to the dual design of data collection here presented—which will take place in two distinct communities—it is our understanding that the mediation process must be extensively addressed in this project, in order to focus our investigation practice as an intra and intercommunities dialogue. In a third step, we seek to develop different *theorizations* based on the local praxis of investigation. It is our contention that more than “given voice” to these communities, it is our responsibility, as academics, to also create the spaces within scientific research where local and often invisible problems can be addressed. Individual and collective reports will be essential deliverables at this step, in order to propagate the theoretical movement to the scientific community. The *interactive data collection* constitutes the fourth step and equally encompasses the investigation and the interception traits in three activities: (1) *critical alphabetization*—which already occurs in one of the communities under the coordination of some members of the scientific team, and it is planned to be adequate to the different levels and understandings found in the distinct phases of the field work; (2) *multiple cartography*—which was requested by the local communities and is planned to be developed both separately in each community as collectively in community encounters, in order to strengthen the self comprehension of the

situationality<sup>4</sup> of community members through various perspectives: social, cultural, historical, geographical, and political; (3) *life-history portfolios*—which will gather studies of biographic nature from members of both communities, holistically approaching the concept of life-history. These three activities act as a complex, investigative and training triple-helix: feeding the analysis of the community educative action strategies; being an instrument for the participant observation of the contents revealed during the educational act; being a community transformation action where individual and collective knowledge will be explored and practiced in the process of community validation, recognition and visibility. This step is divided in three different phases along the research, thus allowing the dialogical solidification of both theoretical and analytical processes, constructively carrying the investigation. Deliverables in the form of individual and collective field notes and process outlines will constitute the sharing tools both for the local community (which will use this data for linking the theoretical framework with data analysis), as for the scientific community. In parallel with the field work, we plan to start the fifth step: *critical data analysis*, which will be extended until the end of the second step and is justified by the proposed dialogical process between steps two, three, and four. This step is required for achieving the addressed goals, in recognition of the communicative, analytical, and material instruments used in the development of the activities ongoing the previous step. Continuous and punctual processes outlines will be written, as well as an analysis report for each of the proposed activities. As a sixth step, we present the *dissemination plan*. This plan will be presented as the result of the ethnographic study in several forms: a website regarding critical ethnography, community education, and intercultural mediation; a national conference with the presence of all participants and consultants; publication of scientific articles; and, finally, a professional short-film. This step aims to publicly present and discuss the results of the Project at a national and international level. The entire process here presented allows to fulfil general goals such as:(i) make multicultural voices listenable;(ii) clarify educative processes regarding multicultural contexts; (iii) valuing knowledge that is centred in the organization and mediation of different interactive learning situations; (iv) promoting intra and intercultural encounters; (v) disseminate the importance

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<sup>4</sup> In Paulo Freire' sense

of self acknowledgement and acknowledgement of acting spaces; and (vi) stimulate the development of local projects. In this process, we aim to identify the educative action strategies within multicultural communities, to organize parameters for the establishment of an intercultural education curriculum, to feed the process of self-management and the autonomy of multicultural communities, and to develop the recognition of the relation between knowledge systems and human values.

### **FINAL REMARKS**

The two communities have been experiencing throughout half a century diverse problems of inclusion—from the inexistence of piped water to the silencing of their voices in the political arena—, particularly concerning schooling. Through the development of project's activities we seek to address the educational needs of these populations in situ, that is, in the midst of their everyday lives where survival with dignity is often the first and foremost important daily struggle. Therefore, it is the everyday problems felt by these two communities that guide the organization of parameters that support a multicultural education curriculum based on the socio-cultural and economic reality of these communities. This way, we seek to address the tension between globalization and diversity by means of submitting these two educational aims to the needs of the communities, which have been systematically excluded both from globalization and from the social recognition of their differences.

It is our contention that this approach reduces the risk of desubstancialization, since we are working in the basis of communities' local knowledge, and focusing on their communicative, analytic and material resources; and from the real problems they felt in their daily struggles in the midst of a society that does not recognize them as citizen on their own right. In such an environment, ethnomathematics (as defined by D'Ambrosio (2002), who partly substantiates our approach to mathematics and education) acquires its full meaning: not some kind of pre-school mathematics ready to be used in the teaching and learning of school mathematics, but an all-encompassing societal program based on the idea that there are several ways, techniques, skills (*tics*) to explain, understand, deal with and live with (*mathema*) distinct natural and socioeconomic realities (*ethnos*). Against this

background, ethnomathematics appears not so much as the study of “different mathematics”, but as a way to deal with different forms of “knowing” (Mesquita, Restivo & D’Ambrosio, 2011). In the Urban Boundaries Project ethnomathematics is not to be confused with a subfield of mathematics education, designed to improve school mathematics, but as a political space where new forms of emancipation can be thought and practiced.

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