

CONCEITOS DE DESVIO POSITIVO NA AÇÃO PEDAGÓGICA DO PROGRAMA ETNOMATEMÁTICA

CONCEPTS OF POSITIVE DEVIANCE IN PEDAGOGICAL ACTION IN AN ETHNOMATHEMATICS PROGRAM

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Abstract

An important dilemma in mathematics education is its overwhelming bias against a local orientation in its research paradigm. Thus, a search for innovative methodologies such as ethnomathematics is useful for recording historical forms of mathematical ideas, procedures, and practices developed in diverse cultural contexts. It is important to highlight that an ethnomathematics program is not an attempt to replace academic mathematics. At the same time, it is necessary to acknowledge the existence of, and important contributions of local mathematical knowledge for inclusion in the mathematics curriculum. In this context, the *insubordination* triggered by much work in ethnomathematics is *creative* and often evokes a disturbance that causes a review of rules and regulations in many mathematics curriculum contexts. This process enables educators to use *positive deviance* to develop actions in order to deal with such norms. Thus, positive deviance involves an intentional act of breaking the rules in order to serve the greater good. This process increases the potential for continual growth in the debate about the nature of mathematics as it relates to culture since it proposes a dialogue between local and global approaches to the construction of mathematical knowledge.

Keywords: Creative Insubordination. Ethnomathematics. Pedagogical Action. Positive Deviance. Responsible Subversion.

Resumo

Um importante dilema em educação matemática é o seu contundente viés contra uma orientação local em seu paradigma de pesquisa. Assim, a busca por metodologias inovadoras como a etnomatemática é necessária para registrar formas históricas de ideias, procedimentos e práticas matemáticas desenvolvidas em contextos culturais

diversos. É importante ressaltar que o programa etnomatemática não é uma tentativa de substituir a matemática acadêmica, mas, ao mesmo tempo, é necessário reconhecer a existência de conhecimentos matemáticos locais no currículo de matemática. Nesse contexto, a insubordinação desencadeada pela etnomatemática é criativa, pois evoca um distúrbio que desencadeia uma revisão das regras e regulamentos do currículo matemático. Esse contexto permite que os professores utilizem o desvio positivo para desenvolverem ações para lidar com essas normas. Assim, o desvio positivo envolve um ato intencional de quebrar as regras para servir um bem maior. Esse potencializa crescimento contínuo do debate sobre a natureza da matemática em relação à cultura uma vez que propõe um diálogo entre as abordagens locais e globais para a construção do conhecimento matemático.

Palavras-chave: Insubordinação Criativa. Etnomatemática. Ação Pedagógica. Desvio Positivo. Subversão Responsável.

Initial considerations

Ethnomathematics as a program and as a powerful research paradigm arose in opposition to dominant eurocentric discourse in mathematics education. A discourse which emphasizes a school curricula originally developed by colonizing countries and imposed upon local communities during the process of colonization and conquest. Traditional academic views of mathematics and curriculum are highly valued in educational institutions worldwide. This context has allowed for the emergence of ethnomathematics that contrasts the overwhelming Eurocentric discourse in mathematics because this program challenges the view that members of local and distinct cultural groups only develop simplistic techniques for solving problems they face in their daily lives.

For example, Rosa and Orey (2015) have argued previously that ethnomathematics emerges as a program that can be interpreted to some extent as a reaction to this *cultural imperialism*¹, which spread around the world along with the expansion of empires and the great navigations in the fifteenth century. This can be connected to concepts² of *creative insubordination* (CROWSON; MORRIS 1982), *responsible subversion* (HUTCHINSON, 1990), or *positive deviance* (ZEITLIN, GHASSEMI; MANSOUR, 1990), which are equivalent as they relate to the adaptability of rules and regulations in order to achieve the welfare of the members of distinct cultural groups.

¹ Cultural imperialism can be considered as the economic, technological, and cultural hegemony of developed nations that has come to determine the direction of both economic and social progress, many cultural values and standardizes civilization and cultural environments throughout the world (SANDBACKA, 1977).

² Acts of *responsible subversion* in the nursing literature are related to breaking the rules for the benefits of the nurses' patients (HUTCHINSON, 1990). In the first studies related to the schools administrators, in the educational literature, the terminology used was creative insubordination (HAYNES; LICATA, 1995).

In the field of mathematics education, according to D'Ambrosio and Lopes (2015a), *subversion* refers to teachers' practices that in an insubordinate way, but with discernment, are opposed to prescriptions with no pedagogical sense, of the educational bureaucracy and of public policy. This concept refers as well to actions that are assumed in relation to many often unchallenged norms and institutional rules, which aim at a better commitment to the needs of school populations. A central objective of ethnomathematics is related to helping educators and learners to become responsible yet subversive collaborators in their educational contexts. It is important here to note that ethnomathematics recognizes and includes diverse forms of learning found outside of formal educational environments.

In so doing, in educational institutions, the "collaborative nature of the course [ethnomathematics], along with the reflection on practice, the group deliberations about implementing alternative teaching strategies, and the documentation of student learning, provided teachers with the confidence and self-efficacy necessary to defend the multiple dimensions of their practice and their acts of *creative insubordination*" (LOPES; D'AMBROSIO, 2016).

This approach in education is the antithesis of the development "most models of mathematics (...) that aim to develop effective teachers of marginalized students (e.g., low performers, (...), students of color, working class students), rely on strategies that underscore the need for a mainly white, middleclass female population to understand the schooling experiences of *others*" (GUTIÉRREZ, 2012, p. 32).

Thus, educators, and this includes school administrators and teachers together can be considered responsible subversives if they design alternatives that can achieve better results for the common good of the community and are constituted by active input by colleagues, students and parents. This action is in opposition and, generally, a challenge to established authority when it opposes the good of others, even, if it unintentionally excludes and/or uses discriminatory policies.

Responsible subversion means that people mindfully gain awareness about when, how, and why to act against established procedures or guidelines that are unjust, or do not positively serve their population. Being *subversively responsible* requires assuming oneself as an unfinished being that makes use of curiosity as the foundation of knowledge production and makes it a permanent search tool (D'AMBROSIO; LOPES, 2015a).

In this context, ethnomathematics can be considered both a subversive and responsive program because it often causes a disruption in the existing order in academic mathematics by encouraging and developing the study of local ideas, procedures, and unique mathematical practices found in various specific and diverse cultural contexts that are in accordance to the emic perceptions of its members (ROSA; OREY, 2016). In this regard, this program has broken the rules and bureaucratic expectations of academic mathematics in order to recognize divergent ways and value the diverse modes of the mathematics produced in other cultures.

The authors regard this subversion as triggered by an ethnomathematics program as a responsible form of subversion because it initiated a disturbance caused by a review of both traditional or western academic mathematical knowledge systems. And by

increasing the potential for growth and the emergence of new opportunities for the discussion of the nature of the mathematics curriculum, the subversion triggered by this program is responsible. In this regard, responsible subversion contributes to the confrontation of taboos suggesting mathematics as a universal field of study without traditions and cultural roots and documents alternative forms of mathematical thinking possibly useful in future research (ROSA; OREY, 2015).

In the specific area of mathematics education, Gutiérrez (2013a) describes the acts of creative insubordination developed by the teachers as necessary tools to set political actions in school environments. This context enables teachers and students to develop their own voices, which results in political acts of creative insubordination and responsible subversion.

The ongoing, indeed universal, challenges educators face in mathematics education can develop methodological procedures that help teachers to understand culturally bound mathematical ideas, procedures, and practices developed by members of distinct cultural groups without letting their own culture interfere with the cultural background of others. In this regard, Orey and Rosa (2014) affirm that many members of distinct cultural groups developed their own interpretation of the *local* culture (*emic* approach) opposed to the outsiders' *global* interpretation (*etic* approach) of that culture.

Even though we are discussing here some aspects of creative insubordination and responsible subversion, it is important to highlight that in this article we use the concept of *positive deviance*, whose amplitude embraces innovative solutions in the ethnomathematics research and its pedagogical action because this program also relates to the flexibility of norms in the educational institutions.

Positive deviance in the context of ethnomathematics

Decision-making in teaching contains multiple conditions of certainty, uncertainty, and risk. For example, many diverse pedagogical settings contain an infinite assortment of situations that require teachers to use technical skills, a professional code of conduct, and situation-specific knowledge. Globalized - one size fits all - mathematical standards may not be realistic for implementation of curricular activities at a local level.

Therefore, teachers may be forced to deviate, react creatively, responsible, subversively in meeting the educational needs of their students. Thus, we propose that teachers use *positive deviance* to develop actions in order to deal with such situations because it "involves an intentional act of breaking the rules in order to serve the greater good" (GARY, 2013, p. 26).

The term deviance can be emotionally charged, evoking a wide range of images and interruptions, most of them likely to be aberrant or elicit disapproval (GARY, 2013). However, deviations can be described as a normal part of the process of any work (POLET, VANDERAEGEN; AMALBERTI; 2003). The concept of positive deviance first appeared in nutrition research in the 1970s.

Investigators observed that despite the poverty in certain communities, some poor families had well-nourished children (ZEITLIN, GHASSEMI; MANSOUR, 1990). The researchers suggested using information gathered from these families to plan alternative nutritional programs (WISHIK; VAN DER VYNCKT, 1976). The term *positive deviance* has also been used in broadening the discipline of organizational behavior (DODGE, 1985).

Positive deviance is a term which is widely used throughout business, management, sociology, criminology, healthcare, and nursing. As concepts are a basis for theory building, an understanding of the notion of positive deviance may contribute to development of innovative knowledge in teaching that is linked to the cultural context of the students. Yet, there is no uniform or consistent definition of this concept for educational contexts.

Consequently, we view positive deviance as the unprescribed practices or strategies that produce better outcomes than traditional standard practices (FIELDING, HOGG; ANNANDALE, 2006, PASCALE, STERNIN; STERNIN, 2010). Hence, this idea can be related to the teaching and learning process in regards to the use of local techniques in solving problems faced by members of distinct cultural groups in their daily lives.

Presmeg (1998) argued that an “important step in using cultural practices in the affirmation of diversity in mathematics classrooms is that teachers (...) become aware of these issues through courses (...) in teacher education programs (p. 336). These programs enable the development of active, critical, reflective, and responsible educators, willing to collaborate with their peers in order to collectively seek solutions to the educational problems that emerge in their pedagogical practices (D’AMBROSIO; LOPES, 2015b). Thence, mathematics education provides opportunities for teachers to:

- 1) broaden and add complexity to their understandings about teaching, learning, mathematics, and marginalized youth; 2) notice and develop multiple interpretations on situations they would not normally see (e.g., about mathematics, about students, about issues of social justice, about the profession of teaching); 3) develop an advocacy stance on teaching, learning, mathematics, and marginalized students; and 4) become adept at creatively responding to subtractive discourses that position marginalized students as incompetent and/or narrowly define mathematics as a predetermined knowledge base to learn, (i.e., be able to use creative insubordination) (GUTIÉRREZ, 2015, p. 6).

According to this assertion, it is necessary, in these programs, to deconstruct the notion that mathematical ideas, procedures, and practices are uniquely *western, modern* or *European* in their origin as they are based on certain philosophical assumptions and values strongly endorsed by the powers that capitalist western civilization. On the one side are strongly held beliefs that these mathematical procedures are unique/superior and that the sociocultural unit of operation is the individual; on the other side are beliefs that mathematical practices are the same for everyone and that its goals and techniques are equally applicable across all cultural groups.

An important goal here is to both challenge and strengthen existing theoretical models, both in their assumptions of mathematical universality and their claims of descriptive, predictive and explanatory adequacy. A second goal is to better understand and explain both existing and historical variations of mathematical ideas, procedures, and practices that vary across time, culture of origin, race, ethnicity, gender, sexual orientation, and other sociocultural characteristics. In this regard, it is recommended that mathematics teachers become:

(...) concerned with interrogating oppression or promoting more social justice focus on teaching and curriculum — in particular, the ways in which teacher beliefs, teacher practices, and school policies like tracking can be viewed as forms of racism. At a practical classroom level, it is important for teachers and teacher candidates to recognize how popular educational reforms in mathematics can have different affects on students who historically have been marginalized (GUTIÉRREZ, 2015, p. 13).

In relation to this assertion, Gutiérrez (2013b), political action or creative deviance by mathematics educators includes taking a position in opposition to standard curriculum and instructional practices, forms of evaluation and assessment, and the rules, and guidelines that enforce them. When these elements seem to be unfavourable to the development of students' learning, according to Tarantino (2005), an act of positive deviance becomes both intentional and honorable behavior that differs from the established norms because it contains elements of innovation, creativity, and adaptability.

For example, Rosa and Orey (2017) affirm that ethnomathematics, ethnomodelling, ethnocomputing, and the trivium curriculum are innovative approaches to mathematics education that provoke discussion around how educators and learners attempt to make sense of and integrate underlying social, cultural, economic, environmental, and political frameworks within which diverse mathematical ideas, procedures, and practices are embedded.

An important dilemma in mathematics education in relation to the curriculum is an overwhelming bias against local orientations in the traditional research paradigm. Acknowledging local mathematical knowledge as well as its implications for social justice, cultural empowerment, and political transformation of a society triggers creative and responsible subversion, and encourages debate about the true nature of mathematics as it relates to culture and society.

These are the main objectives of the ethnomathematics program in regards to its positive deviance in preparing teachers to their teaching environments. Therefore, when working with ethnomathematics, it is possible to identify three approaches that have assisted us in investigating, studying, and coming to understand the mathematical ideas, procedures, and practices developed by the members of any given cultural group:

1. *Global (etic-outsider)* forms the outsiders' view on beliefs, customs, and scientific and mathematical knowledge of the members of distinct cultural groups. Globalization has reinforced the utilitarian approach to school mathematics and the Western bias in the prevailing mathematics curricula, as

well as helped to globalize pervasive mathematical ideologies. In particular, school mathematics is criticized as a cultural homogenizing force, a critical filter for status, a perpetuator of mistaken illusions of certainty, and an instrument of power. The mathematics curriculum is central to cultivating values as well as fostering *conscientization* in learners. In this approach, comparativist educators attempt to describe differences among cultures. These individuals are *culturally universal* (SUE; SUE, 2003).

2. *Local (emic-insider)* forms the insiders' view on their own cultural practices, customs, religion, sexuality, beliefs, and scientific and mathematical knowledge. Local knowledge is important because it has been tested and validated within the local context. Local knowledge creates a framework from which members of distinct cultural groups are able to understand and interpret the world around them. Currently, there is a recognition of the importance of the unique local perspectives and contributions to the development of scientific and mathematical knowledge. In this approach, the members of distinct cultural groups describe their culture in its own terms. These individuals are *culturally specific* (SUE; SUE, 2003).
3. *Glocalization (emic-etic)* represents a continuous interaction between globalization and localization, which offers a perspective that both approaches are elements of the same phenomenon (KLOOS, 2000). It involves blending, mixing, and adapting two processes in which one component must address the local culture, system of values and practices (KHONDKER, 2004). In a glocalized society, members of distinct cultural groups must be "empowered to act globally in its local environment" (D'AMBROSIO, 2006, p. 76). In this context, it is "necessary to work with different cultural environments and, acting as ethnographers, to describe mathematical ideas and practices of other peoples, it is fundamental to give meaning to these findings" (D'AMBROSIO, 2006, p. 79).

Through focusing on local knowledge first and then building on it to integrate global influences, we can create learning rooted in local cultural traditions and contexts but are also equipped with a global knowledge creating a sort of localized globalization (CHENG, 2005).

According to this context, two questions seem to arise: 1) should educators tacitly agree with the imposed cultural universality (global) of mathematical knowledge or take on techniques, procedures, and practices of its cultural relativism? Thus, educators seeking to link universal (global) and community specific (local) approaches face the classic dilemma of scientific goals conflicting with investigations in ethnomathematics.

Aspects of positive deviance in ethnomathematics

Both the local and global approaches are often perceived as incommensurable paradigms. While they are thought of as creating a conflicting dichotomy, instead, we believe that they can be considered as complementary viewpoints, rather than posing a

dilemma, the use of both approaches deepens and can clarify understanding of important issues in scientific investigations about ethnomathematics (ROSA; OREY, 2013).

Since these two approaches are complementary, it is possible to delineate forms of synergy between the local and global aspects of mathematical knowledge. A suggestion is to use a combined local-global approach rather than simply applying one dimension. This combined local-global approach requires educators to first attain local knowledge developed by the members of distinct cultural groups. This approach allows us to become familiar with relevant cultural differences in diverse sociocultural contexts (ROSA; OREY, 2015).

Similarly, ongoing debates regarding the importance of cultural diversity in the mathematics curriculum has also renewed the classic global-local debate. This discussions demonstrates why we need to better comprehend how to build scientific generalizations while at the same time try to understand and make use of sociocultural diversity. Yet, attending to unique mathematical interpretations developed in each cultural group can challenge the traditional goals of mathematics in which the main objective is to build theories that describe the development of mathematical practices in academia.

Local observations connect with; indeed seek to understand mathematics and culture from the perspective of the internal dynamics and relationships as influenced within a group. A global approach often takes on a cross-cultural or comparative perspective, which seeks to comprehend or explain different cultures from the outside worldview. Local worldviews clarify intrinsic cultural distinctions while the global worldview seeks objectivity as an outside observer across cultures (ANDERSON, 1997). These approaches are complementary.

This local approach seeks to examine the principles of classification and conceptualization from within the group. When the distinctions made by members of a particular culture are emphasized, a local analysis can be culturally specific in the context of the insider's beliefs, thoughts and attitudes. Local knowledge and interpretations are essential to an emic analysis, it says, *this is how we do this*. It is the viewpoint of the participant that conveys messages about mental and behavioral dimensions for the understanding of cultural contexts. Therefore, "what is emphasized in this approach is human self-determination and self-reflection" (HELFRICH, 1999, p. 133).

A global analysis gives us a cross-cultural approach. Etic-oriented researchers examine the question from a more cross-cultural perception so that their observations are taken according to externally derived criteria. This context allows for the comparison of multiple cultures where "both the objects and the standards of comparison must be equivalent across cultures" (HELFRICH, 1999, p. 132). Accordingly, in the conduction of ethnomathematics research, cultural, gender, social, linguistic, political, religious, and ethnic affiliations are researched and integrated into a unified holistic solution. In this manner, the intended mathematical practice is given a stake in the overall process and not just the mere ending result.

Ethnomathematics-based investigations have revealed the cultural influence in the evolution of world-wide mathematical knowledge through the study of historical accounts,

which helped the analyses of ideas, procedures and mathematical practices developed locally, which are aimed at deconstructing the dominant mathematical discourse by offering innovative views about the nature of this knowledge (ASCHER, 2002; OREY, 2000). In this sense, responsible subversion was used in this process when the norms and rules used in academic mathematics in these programs are inconsistent with the mathematical knowledge developed in terms of the local reality of the students.

It is necessary to emphasize the pedagogical action developed in many mathematics curriculum ignores this important connection between academic knowledge and practices developed by community members. Thus, to reduce the gap between theoretical and practical knowledge in mathematics curriculum, there is a need for teachers to query possible connections between the mathematical knowledge developed in local, community contexts and that which are practiced and supported by the academy.

Consequently, François (2010) argued that “there has to be a translation of this study to mathematics education where the teacher is challenged to introduce the cultural diversity of pupil’s mathematical practices in the curriculum since pupils also use mathematical practices in their everyday life” (p. 1518). It is also important that the results of these investigations show that mathematical knowledge developed locally is worthy of recognition and appreciation by the members of the academic community (ROSA; OREY, 2015). Similarly, it is recommended that mathematics curriculum:

Teacher education programs have incorporated study of multicultural classrooms into the pre-service preparation of teachers. Teachers must learn special instructional skills to accommodate different backgrounds and different learning strategies. It has now been recognized that culture can determine the student’s feeling toward participation in class discussion, initiating questions, acceptance of authority, memorization of facts, seeking innovative ways of understanding, and many other aspects of classroom education. Misreading the cultural signs can cause teachers to misunderstand the student’s learning process or even mistake a natural response for unwillingness to learn (SHIRLEY, 2001, p. 86).

In this perspective, positive deviance can be considered as an approach to social change based on the observation that in any cultural group there are people whose successful strategies have enabled them to create and find solutions to solve problems. These individuals are referred to as positive deviants (TUHUS-DUBROW, 2009; STERNIN; CHOO, 2000). Thus, Bloch (2001) describes positive deviants as individuals who are focused, persistent, and optimistic in their pursuit. Similarly, teachers can be considered as positive deviants; and one of the solutions to many educational problems may be that the school community members start listening to their positive deviants.

Positive deviant teachers apply ethnomathematics as pedagogical action and recognize the uniqueness and can incorporate alternative perspectives from the community as well as members of distinct cultural groups by emphasizing emic knowledge systems. Showing these perspectives in a dynamic way, and valuing them on their own terms and contexts (ROSA; OREY, 2016) allows learners to see a context for the

mathematics they are learning. Positive deviants practice differently and more effectively (CLANCY, 2010).

It is important that ongoing investigations in ethnomathematics describe the ideas and procedures implicit in mathematical practices locally developed by community groups. In this sense, the research on these practices can be regarded as a form of resistance towards the imposition of academic mathematical knowledge as they may suggest actions in search of creative and innovative solutions to these challenges (LLOYD, 2011).

For example, in his study, Cortes (2017) found that ethnomodelling provided an integrative approach to the school mathematics curriculum that considers both local (emic) and global (etic) mathematical knowledge origins so that teachers and students come to understand, in a more realistic, holistic, and comprehensive way, the mathematical procedures and practices developed by the members of distinct cultural groups. Data collection from this study came from 38 students in the second year of high school during their interaction with a farmer and his labor practices in a local market.

The results of a study conducted in Brazil investigated the specificity of mathematical ideas, procedures, and practices produced by adolescent and adult construction workers who were also students in an evening adult education course. The results showed that mathematical knowledge produced, developed, and transmitted in construction sites had important curricular implications. It also studied the connections of the local knowledge with academic knowledge legitimized by the school in order to determine curricular modifications. The researchers found that these connections had positive results in the development of a more positive and relevant mathematics curriculum (DUARTE, 2004).

Responsibly subversive teachers contribute to the generation of new and a respect for diverse forms of mathematical knowledge and assists in resolving ethical dilemmas involved in investigations in this area of study. During investigations seeking to understand and comprehend local mathematical knowledge, educators may be faced with a set of specific characteristics related to ideas, procedures, and mathematical practices that are different from those studied in the academy (ROSA; OREY, 2013).

They are individuals who accomplish the objectives and goals of the organizations such as schools and are crucial to the success of change efforts. Similarly, Fielding, Hogg, and Annandale (2006) affirm that positive deviants are exceptional and high achieving individuals who exceed normal or average levels of performance in a group. They are “extremely resourceful, knowledgeable, and adaptable” (CLANCY, 2010, p. 54).

This above discussion demonstrates that there is a need for educators to break the greater western-Eurocentric perspective of mathematical knowledge (ANDERSON, 1997). Hence, mathematical knowledge must be interpreted in the broader sense given that the term *ethno* is associated with members of identifiable cultural groups, such as national and tribal societies, working groups, children of a given age, individuals belonging to distinct professional classes, and marginalized and minority cultural groups (D’AMBROSIO, 1985). This approach may assist this ongoing reconstruction process, which seeks to relate academic mathematics with sociocultural activities through the use of:

- Artifacts as observational objects created and developed by the members of distinct cultural groups. These instruments provide clues and information about its creators and users.
- Mentifacts as analytical tools such as thoughts, reflections, concepts and theories that represent the ideas and beliefs of the members of a particular cultural group, for example, religion, language, and laws.
- Sociofacts that represent the social structure of distinct cultural groups such as family and tribal structures. They can be considered as the patterns of interpersonal relations expected and accepted among the members of these groups.

This perspective aims to reduce the prejudice, inequity, and harm due to ongoing disconnections between knowledge as practiced in the academy (etic) and its practical use in everyday life (emic) (ROSA; OREY, 2016). Responsible subversion in mathematics curriculum can be seen as a responsible form of subversion that uses the theoretical and methodological apparatus of these investigations to reveal and combat the privilege and the authority that was granted to the academic mathematical discourse. This approach enables understanding and comprehension of how privilege and authority, stemming from colonization, have influenced the distribution of power in modern society (FITZSIMONS, 2003).

This context allows for the analogous use of responsible subversion to conduct research in ethnomathematics in order to start a changing process in mathematics education. However, it is necessary that professionals are willing to take the risks associated with that decision. This decision-making process is one of the most important components of responsible subversion, which can be understood as a fight against dehumanizing effects of bureaucratic authority (HAYNES; LICATA, 1995) that may occur during the conceptions of investigations related to the ethnomathematics program.

It is necessary to outline new and ongoing research related to cultural perspectives in ethnomathematics in mathematics education. Chiefly, this work acknowledges that contemporary academic mathematics is predominantly Eurocentric. Eurocentrism has its positive elements in relation to dramatic scientific accomplishments over the last 500 years. Yet, at the same time, it has hindered local mathematics ideas, specifically those once practiced by vanquished societies. Accordingly, one of the ways in which ethnomathematics may influence mathematics curriculum is by making this subject a living and humanistic knowledge field.

For example, the results of the study conducted by Rosa (2010) showed that traditional mathematics education aims at transmitting a certain amount of techniques and uses them in artificial situations, which are presented to students as problems. These problems are artificially formulated in such a way that they only help the memorization of skills and techniques, which are usually boring, uninteresting, obsolete, and unrelated to reality or the modern world. These characteristics of traditional mathematics education are responsible for a downgrading of school satisfaction and students' achievement.

It has supported a scientific paradigm that has allowed us to develop destructive military power and created financial chaos and environmental ruin for the planet. Many

procedures and practices coming from local traditions, have been lost, many are considered inferior, and therefore unimportant. Yet, there is growing evidence that the current academic paradigm needs to consider the moral implications of its uses. Thus, the main objective of mathematics education is to situate educational activity in the real life and experiences of individuals in their own socio-cultural-economical contexts. According to Freire (1993), this methodological approach opens up a series of possibilities for the way many educators can approach educational practices.

A systematic ethnomathematics-based study, as called for here, and includes one that aims at developing skills to observe phenomena rooted in distinct cultural settings. The results will lead to new viewpoints into mathematics education and, eventually, new forms of mathematics its self, in order to improve cultural sensitivity in the teaching of mathematics. Ethnomathematics is defined as the study of mathematical phenomena within a culture, thus, it differs from traditional conceptions that consider mathematics as the foundations of science and as constant and applicable everywhere. Therefore, in an ethnomathematics process, mathematics is a social construction and is often culturally bound.

Hence, it is important to highlight, once more, that the pedagogical action of this program helps learners to overcome the use of disassociated techniques and formulas often blindly memorized. As well, it allows them to develop strategies in order to give access to diverse mathematical representations in new formative dimensions of a mathematical nature. And most importantly, it helps them connect to their prior experience and community through the learning of mathematics.

Mathematics curriculum based on an ethnomathematics perspective emphasizes the importance of community to the school because it allows educators to construct knowledge and experienced based on valuing what and how mathematical thinking occurs in the community first. It is necessary that the school curriculum is designed to value and promote local knowledge (emic) and practices developed by members of communities who integrate school contexts and then connect it to the outside environment. This perspective provides a necessary balance to school curriculum because the integration of these components in the mathematics curriculum enables the conception of ethnomathematics as a program that aims at the humanization of mathematics through contextualized approaches to curriculum development.

Because pedagogical practices often transcend physical environments in order to welcome knowledge and practices present in diverse sociocultural contexts, it is important to emphasize that these pedagogical actions allow for comprehensive analysis of the school contexts or the educational institutions (ROSA; OREY, 2015). In this approach, one important pedagogical proposal is to develop mathematics curricula that transforms mathematics into a living knowledge and integrates real situations through questionings, analysis, and critical reflection of phenomena that occur in everyday life.

This process in positive deviance can be understood as an approach to organizational change as well as a theoretical basis for: a) understanding institutional behaviors (LINDBERG; CLANCY, 2010), b) as an alternative method of identifying best practices (TARANTINO, 2005), c) and as a problem-solving techniques (LLOYD, 2011).

Thus, positive deviance can be considered as a valuable tool for teachers to identify innovative pedagogical actions for their teaching practices such as inquiry methods and ethnomathematics. Despite of the typical top-down hierarchy of the educational system, there seem to be individuals who figure out solutions to problems and solve them on their own by using local techniques found in the school community.

Following this discussion, Tarantino (2005) suggests that instead of relying on outside parties to determine best practices and solutions, institutions or organizations should identify and use the existing knowledge and procedures that are already practiced in their local context. Similarly, in our opinion, the most efficient way to improve education is to use locally available sustainable and effective approaches. In so doing, Sternin and Choo (2000) argue that it is important to identify the relevant positive deviancies within each local community and then adopt that behavior.

Because the positive deviance approach values and studies local ways to solve problems, it offers important advantages over traditional approaches that try to impose solutions from outside. These advantages are related to: a) the progress that is made rapidly without requiring an outside analysis or resources, b) the resulting benefits that can be sustained since the solution to the problems resides within the community, and c) the approach can be broadly applied because positive deviants exist in every cultural group (STERNIN; CHOO, 2000).

Thereafter, it is in the school community itself that educators find the didactic elements of the mathematical content necessary in the development of mathematics curriculum (D'AMBROSIO, 2006). There is a need to diversify teaching strategies used in the mathematics curriculum, in this case an *ethnomathematics* perspective. It must be acknowledged here that there is no single recipe that will help educators everywhere to acquire all the necessary pedagogical tools for improving the performance of students in mathematics. In this sense, both teachers and educators need to commit to innovative educational pedagogies in order to help students and communities reach their potential.

Final considerations

In education, positive deviance is exemplified by teachers' intentional bending of rules to accomplish specific goals for students or to promote work efficiency for teachers. In this way, the subversion occurs when experienced, knowledgeable, idealistic teachers feel professional conflict and frustration over certain aspects of students' performance and consequently *work around* the rules so they can adequately meet their educational needs. The (re)examination of education in *disadvantaged* communities enables the transformative engagement of students in empowering and collaborative experiences that link curriculum, pedagogy and assessment to identity, politics, and social justice (ZYNGIER, 2009).

Positive deviance can be conceptualized from a behavioral approach highlighting the significance of reference groups and normative standard as the basis for categorizing deviant behavior. The criteria for defining positive deviant behaviors include those that

break or depart from reference group rules and norms that are socially or organizationally beneficial (WARREN, 2003). In this context, especially in regards to ethnomathematics, positive deviance can be considered as a tool to combat against the dehumanizing effects of curricular bureaucratic authority and as a tool for peace. Thus, the objective of positive deviance is to ensure that curricular bureaucracies do not disservice students because, often, public policies and institutional procedures have no real connections with the school community, which means:

(...) helping teachers develop not just knowledge of mathematics, pedagogy, and learners, but also the political knowledge and experiences necessary to negotiate the system (e.g., learning how to use creative insubordination to buffer themselves from mandates that are not in the best interest of their students) and develop working networks with other educators who share their emancipatory visions (GUTIÉRREZ, 2013a, p. 62).

According to this assertion, Zyngier (2009) argues that it is necessary to enable teachers to become responsible subversives or positive deviants through enabling a sense of collective effort. If educators are connected and engaged with student sociocultural backgrounds while affirming the different strengths that their knowledge adds to the development of pedagogical action in the classrooms, then, student knowledge, history, and their unique experiences are validated and accounted for in the schools and allows them to construct bridges of understanding to academic forms of mathematics and science. Such students' engagement is empowering because it develops a sense of entitlement, belonging, and identification. They soon see why they have to learn it.

Finally, we conclude that the concept of *positive deviance* is useful because it offers teachers a basis for decision making when the normal, expected actions collide with their view of the right thing they have to develop in the schools for the benefit of their students. This concept is extremely necessary in the development of a mathematics curriculum based on ethnomathematics in order to assist teachers to serve student learning and growth. This should be the main concern of any educational system in order for educators to address student's cognitive, cultural, and pedagogical needs. Surely, this demonstrates the need for a cultural perspective into the mathematics curriculum for the 21st century.

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